Appendix 11

Whale Tail 2022 Annual Open Pit Geomechanical Inspection

Knight Piésold CONSULTING

Management System Certified by: bsi ISO 9001 ISO 14001 ISO 45001 CERTIFIED

March 17, 2023

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Dear Christian,

RE: Meadowbank Complex - Amaruq Site - 2022 Annual Open Pit Geomechanical Inspection

1.0 INTRODUCTION

Agnico Eagle Mines Limited (AEM) operates the Meadowbank Complex in Nunavut, Canada. The complex consists of the Meadowbank and Amaruq Sites. The Amaruq Site consists of several open pits at the Whale Tail and IVR deposits, and an underground mine at the Whale Tail deposit. Knight Piésold Ltd. (KP) has been providing geomechanical support for the Amaruq Site since 2015, including developing the open pit slope geometry recommendations and completing the annual third-party inspections of the open pits required under the water license for the mine.

The 2022 annual inspection of the open pits at the Amaruq Site is summarized in Appendix A of this letter.

2.0 OPEN PIT INSPECTIONS

The inspection was completed by Mr. Ben Peacock, P.Eng., of KP from August 14 to 19, 2022. The open pits and surface excavations in rock that were included in the inspection and their current status is summarized in Table 1.

Table 1 Open Pits Inspected and their Status

Open Pit	Current Status
Whale Tail Open Pit	Active mining
IVR V1 Open Pit	Active mining
IVR V1 Open Pit	Active mining
IVR West 1 Open Pit	Inactive, backfilling with waste rock in progress
IVR West 2 Open Pit	Active mining, expected completion in August, 2022
Attenuation Pond 5 (AP5)	Inactive, partially flooded

Several AEM staff participated in the inspection, with different staff taking part on different days. Those involved included:

- Christian Tremblay (Rock Mechanics Coordinator)
- Amadou Traore (Rock Mechanics Engineer)
- Vincent Duranleau (Rock Mechanics Technician)

Adam Jackson of Tetra Tech Canada Inc. was seconded to the mine at the time and also participated in the inspection.

The results of the inspection are detailed in Appendix A. Key comments are included below:

- No Priority 1 recommendations were made
- 14 Priority 2 recommendations were made
- 17 Priority 3 recommendations were made
- 9 Priority 4 recommendations (opportunities for improvement) were made

3.0 CLOSING

We trust this inspection summary meets your present needs. Please do not hesitate to contact us should you require anything further.

Yours truly,
Knight Piésold Ltd.

REGISTERED PROFESSIONAL ENGINEER
B.D. PEACOCK
LICENSEE
2023-03-17
NT/NU

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2023-03-17
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

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Reviewed:
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Principal Engineer

Approval that this document adheres to the Knight Piésold Quality System:

Attachments:
Appendix A Meadowbank Complex - Amaruq Site - 2022 Annual Open Pit Geomechanical Inspection

/bdp

APPENDIX A

Meadowbank Complex - Amaruq Site - 2022 Annual Open Pit Geomechanical Inspection

(Pages A-1 to A-90)

Meadowbank Complex - Amaruq Site

2022 Annual Open Pit Geomechanical Inspection

August 14 to 29, 2022

Outline

Introduction

Whale Tail Open Pit

IVR V1 & V2 Open Pits

IVR West Open Pits

AP5

Monitoring and Inspections

Ground Control Program

Recommendations

Introduction

Introduction

General

- Agnico Eagle Mines (AEM) operates the Meadowbank Complex in Nunavut. The complex consists of the Meadowbank and Amaruq Sites.
- The Amaruq Site consists of the Whale Tail and IVR deposits. The Whale Tail Open Pit entered commercial production in 2019 and the IVR V1 Open Pit entered production in 2020. Preparations for underground mining at the Whale Tail deposit are also underway.
- Knight Piésold (KP) has been providing geomechanical support for the Amaruq Site since 2016, including a 2018 feasibility design for the Whale Tail Open Pit, a 2019 feasibility design for the IVR V1 and V2 Open Pits, and several design studies for the underground mine. A detailed review of the Whale Tail Open Pit slope performance was completed in 2021 and 2022.
- KP has completed the annual inspections for the open pits at the Amaruq Site since 2019. The 2022 annual inspection was completed by Ben Peacock, P.Eng., during a site visit from August 14 to 19, 2022. The inspection is summarized in this presentation, along with a summary of other related discussion topics.

Introduction

Inspection

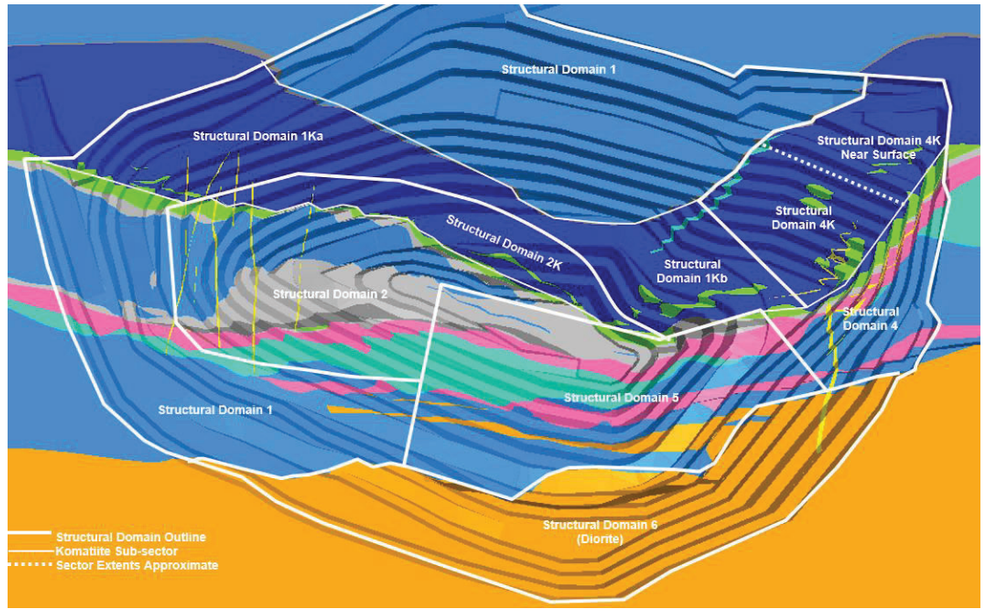
- The following open pits and surface excavations at the Amaruq Site were reviewed on August 14 and 15, 2022 (shown at right):
  - Whale Tail (WHL) Open Pit
  - IVR V1 Open Pit
  - IVR V2 Open Pit
  - IVR West 1 Open Pit
  - IVR West 2 Open Pit
  - AP5
- The participants included Christian Tremblay (AEM), Amadou Traore (AEM) and Adam Jackson (Tetra Tech).

Whale Tail Open Pit

Whale Tail Open Pit

Overview

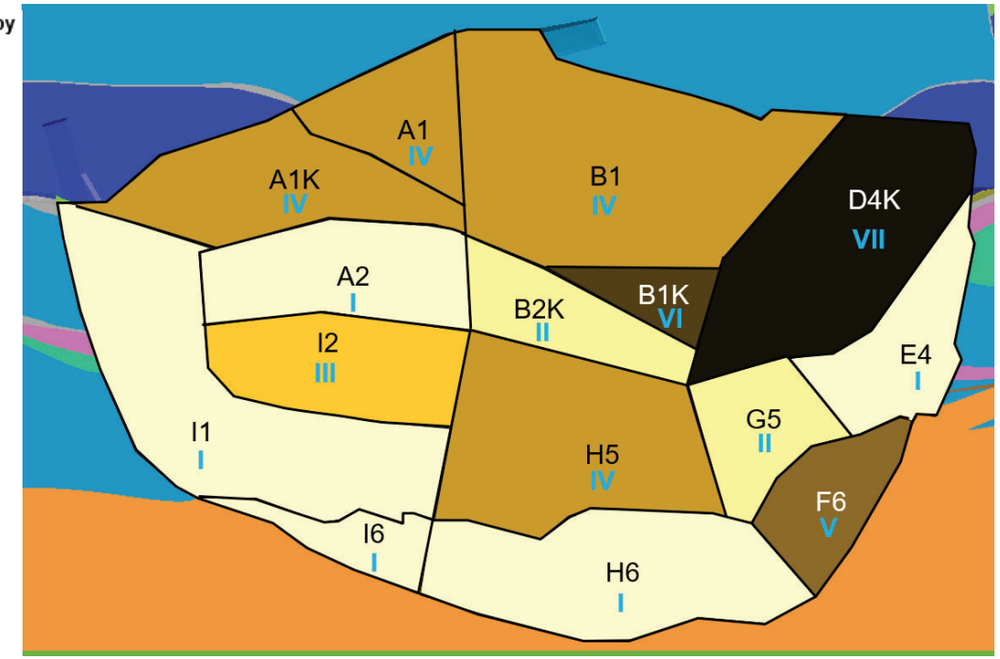
- The WHL-13A open pit is the current design pit for the Whale Tail deposit. The current structural domains (which control the achievable slope geometry in many cases) are shown at upper right along with the lithologies expected in the final open pit walls.
- The current design sectors and slope geometry recommendations are shown at lower right. These are based on the WHL-PH3-V11F open pit design.
- A detailed study of Design Sector D4K is in progress and could result in chances to these recommendations.



	Base Bench Geometry		Bench Geometry Controlled by Bench-Scale Failures
I	BASE CASE BFA: 75° Bench Width: 10 m Bench Height: 21 m IRA: 53°	III	BFA: 65° Bench Width: 10 m Bench Height: 21 m IRA: 47°
II	KOMATIITE BFA: 75° Bench Width: 10.5 m Bench Height: 21 m IRA: 52°	IV	BFA: 65° Bench Width: 10.5 m Bench Height: 21 m IRA: 46°
		V	BFA: 75° Bench Width: 16 m Bench Height: 21 m IRA: 44°
		VI	BFA: 55° Bench Width: 10.5 m Bench Height: 21 m IRA: 40°
		VII	BFA: 55° Bench Width: 11 m Bench Height: 14 m IRA: 34°

LITHOLOGY LEGEND:

- GREYWACKE
- CHERT
- KOMATIITE - NORTH LIMB
- KOMATIITE - SOUTH LIMB
- IRON FORMATION
- MAFIC VOLCANICS
- DIORITE
- RAMP FAULT



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Whale Tail Open Pit

Inspection

- The Whale Tail open pit was inspected on August 14 and 15, 2022. Observations made during the inspection are summarized on the following slides.
- The approximate open pit geometry at the time of the visit is shown at right. The approximate final crest position (Phase 3) is marked by the dashed yellow line, and the walls inspected are labelled relative to mine north.

Whale Tail Open Pit

Observations - Northwest Wall

BFA: 65°
Bench Width: 10 m
Bench Height: 21 m
IRA: 47°

- Final wall in Design Sector A1/A1K.
- No mining has occurred in this area and there have been no slope failures since the last annual inspection.
- The benches are generally performing well.
- The Oxidized Greywacke is thought to be associated with a talik zone below what was the western end of Whale Tail Lake. It is of lower rock mass quality than the Greywacke and prone to ravelling. The exposures along the ramp are limited in height and rockfall has not been a concern to date. If ravelling increases, a rockfall berm could be constructed along the inside of the ramp through this unit.

Whale Tail Open Pit

Observations - North Wall

BFA: 65°
Bench Width: 10 m
Bench Height: 21 m
IRA: 47°

- Final wall in Design Sector B1.
- Limited mining has occurred in this area and there have been no slope failures since the last annual inspection.
- The benches are performing better than expected, with the bench face often standing steeper than the foliation.
- The 2021/2022 design review found that many of the pre-shear drillholes have been drilled at an angle shallower than the planned 60°, reducing the effective bench width. Comments on drill and blast quality control are provided later in this presentation.

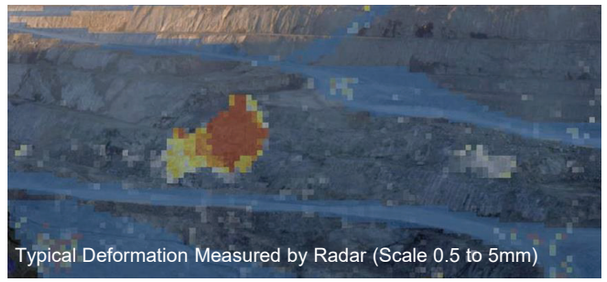
Whale Tail Open Pit

Observations - Phase 1 North Wall

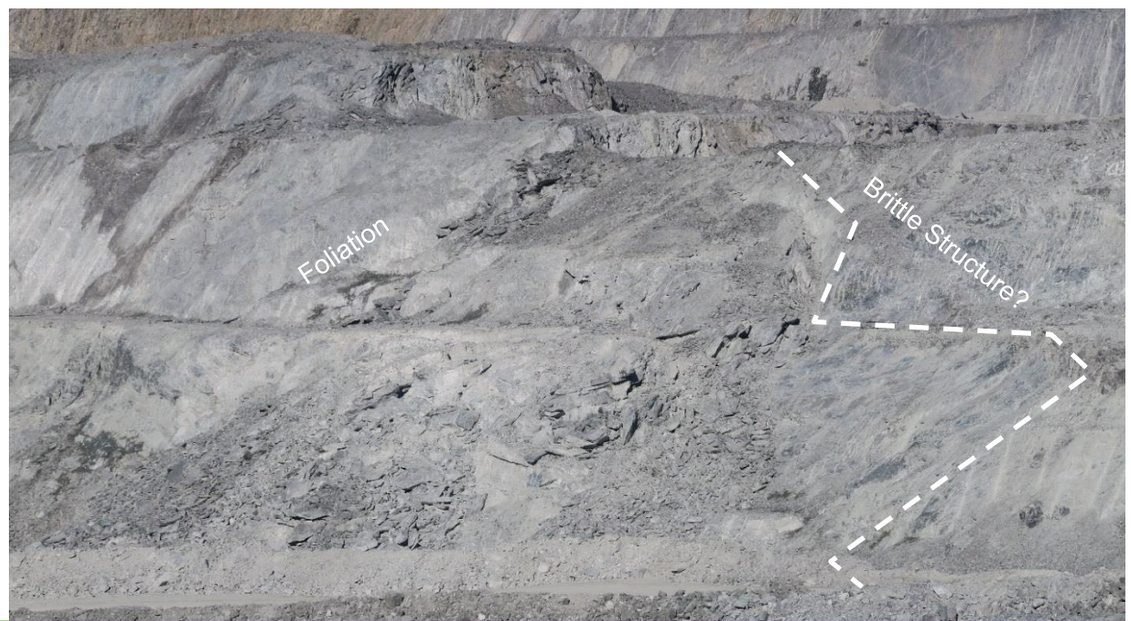
- Interim wall in Phase 1. Phase 1 has been the focus of production over the past year.
- The wall was established in the Komatiite, parallel to the foliation. As expected, a series of bench-scale failures have occurred in areas where the foliation locally dips at a shallower angle than the bench face.
- The implementation of a 55° pre-shear has improved slope performance and half barrels are visible in many areas. Bench-scale failures have and will continue to occur. AEM continues to complete extensive scaling in this sector in order to remove potential hazards and reduce the likelihood of a failure. This is endorsed.
- The bench failures almost always occur during freshet or the summer months.
- As a result, the development of the ramp along the this wall was prioritized during the 2021-2022 winter in order to minimize the rockfall risk to personnel. A berm was installed along the inside of the ramp prior to freshet.
- Two areas of instability have developed along this wall in 2022 (outlined in the image at right) and are described on the following slides.

Whale Tail Open Pit

Observations - Phase 1 North Wall (2)


Typical Deformation Measured by Radar (Scale 0.5 to 5mm)

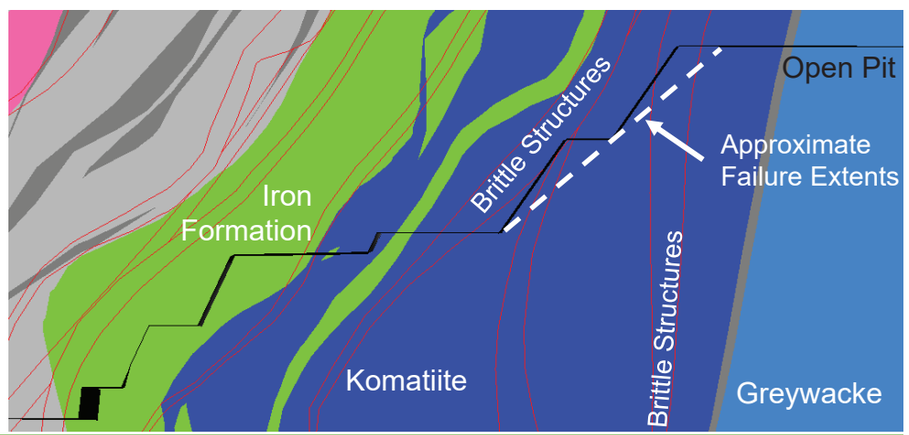
- A multi-bench failure has occurred progressively within the Komatiite over multiple events between May 14 and July 16, 2022.
- The area was identified as a potential instability during development and a berm constructed below the wall prior to freshet.
- The failure appears to be bounded by persistent structures. This could represent an undulation in the foliation, as similar geometries have resulted in bench scale failures in the past. The eastern contact appears to be more linear and may be a Brittle Structure.
- The failure mass continues to exhibit steady, gradual deformation in the radar data, in the order of 5 to 6 mm/day.



Whale Tail Open Pit

Observations - Phase 1 North Wall (3)

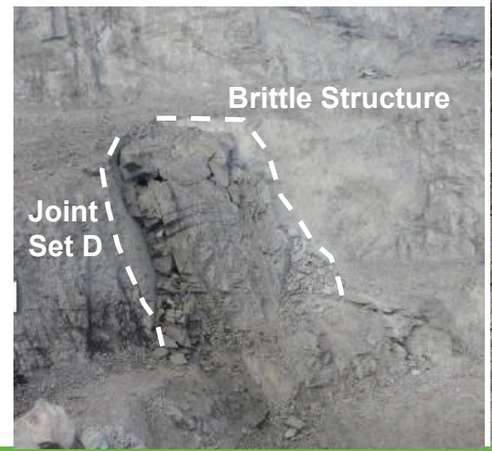
- A review of the lithology model suggests that the failure is unlikely to propagate significantly further back behind the crest due to the presence of the Greywacke.
- The potential for the failure to continue to propagate with depth was discussed as the structure defining the eastern boundary of the failure daylights below the ramp. The failure is larger than others along the Phase 1 North Wall and should be reviewed in greater detail to better understand the failure mechanism, likely contributing factors, and the potential for the failure to continue below the ramp. It may be possible to use the radar data to better understand the possible structural controls on the failure. A Maptek scan is recommended to document the failure geometry in detail.
- The Phase 1 pit will be used as a sump for managing water into 2024. Personnel will be travelling on the ramp below this failure during that time.
- Options for reducing the risk to personnel if the failure continues to progress were discussed. These include:
  - Buttressing the failure. This would limit the ramp to single lane traffic but that is expected to be manageable.
  - Allowing the water level to rise a point on the ramp above the failure. This would allow the pumps to be located above the failure, removing the requirement for personnel to travel below the failure. However, the infiltration of water into the toe of the failure mass would like adversely influence the performance of the failure. The potential risks associated with storing this much water above the underground workings would also need to be reviewed.
- The failure should continue to be monitored with the radar and the berm maintained.
- Once mining of Phase 1 is complete, the risks associated with on-going access below the failure should be reviewed and mitigation measures implemented as appropriate.

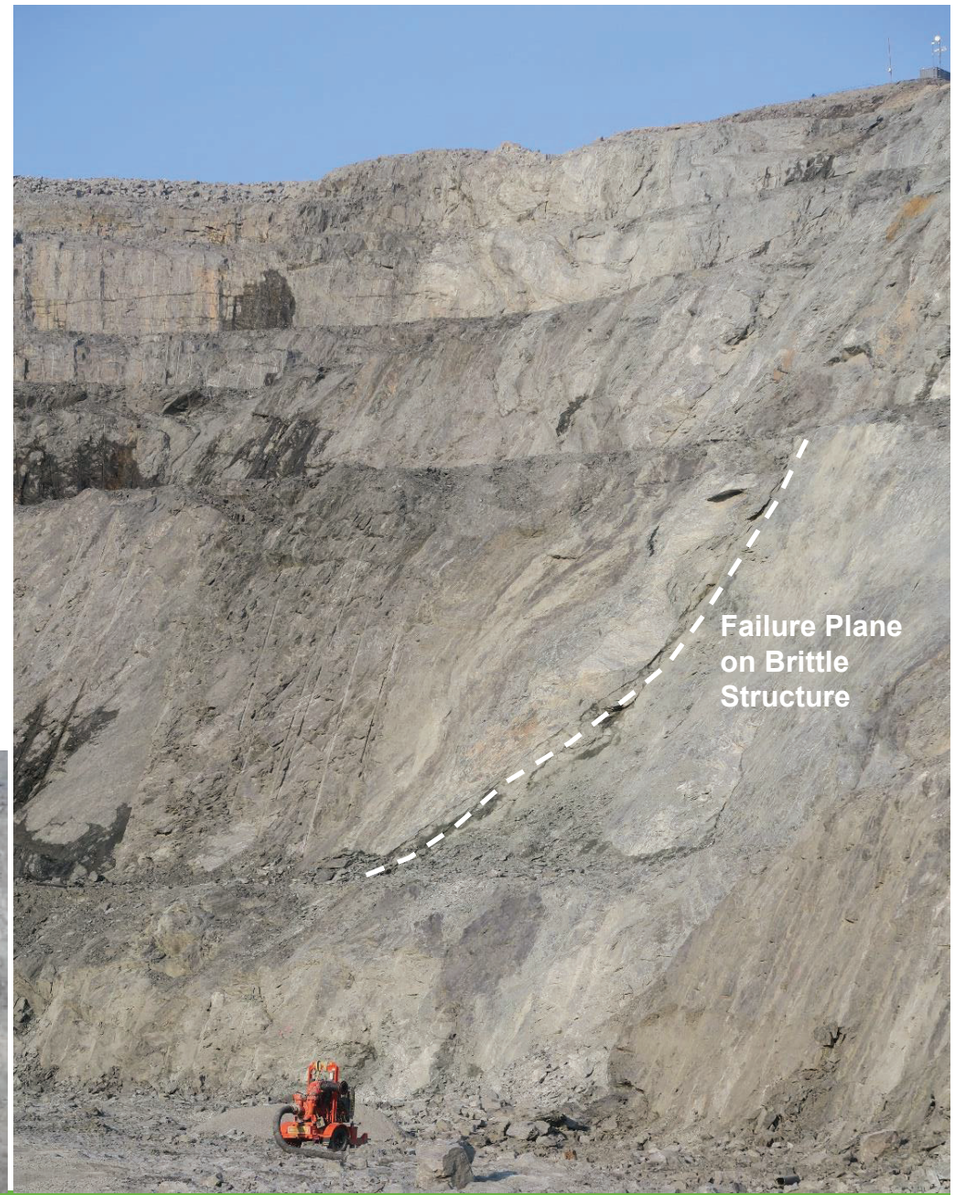


Whale Tail Open Pit

Observations - Phase 1 North Wall (4)

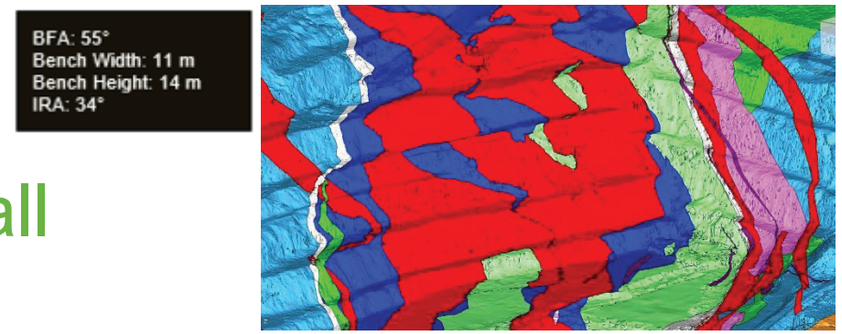
- During the site visit, a possible instability at the western end of the wall was identified based on trends in the radar monitoring data.
- A wedge is present on the wall, formed by a brittle structure and a cross-cutting structure (likely Joint Set D). The rock mass below the brittle structure is Komatiite but it is not clear if the wedge itself is Komatiite.
- The area was barricaded and access prevented. Due to the timing of the event, the pump shown in the photo was left within the barricaded area.
- After the site visit, a portion of the wedge failed in place on August 16 (see inset below). A small step-in with a berm has been left below the failure to allow mining to continue in the area.
  The area should continue to be monitored.
- The failure will be mined out when Phase 1 is pushed back to the final pit configuration.



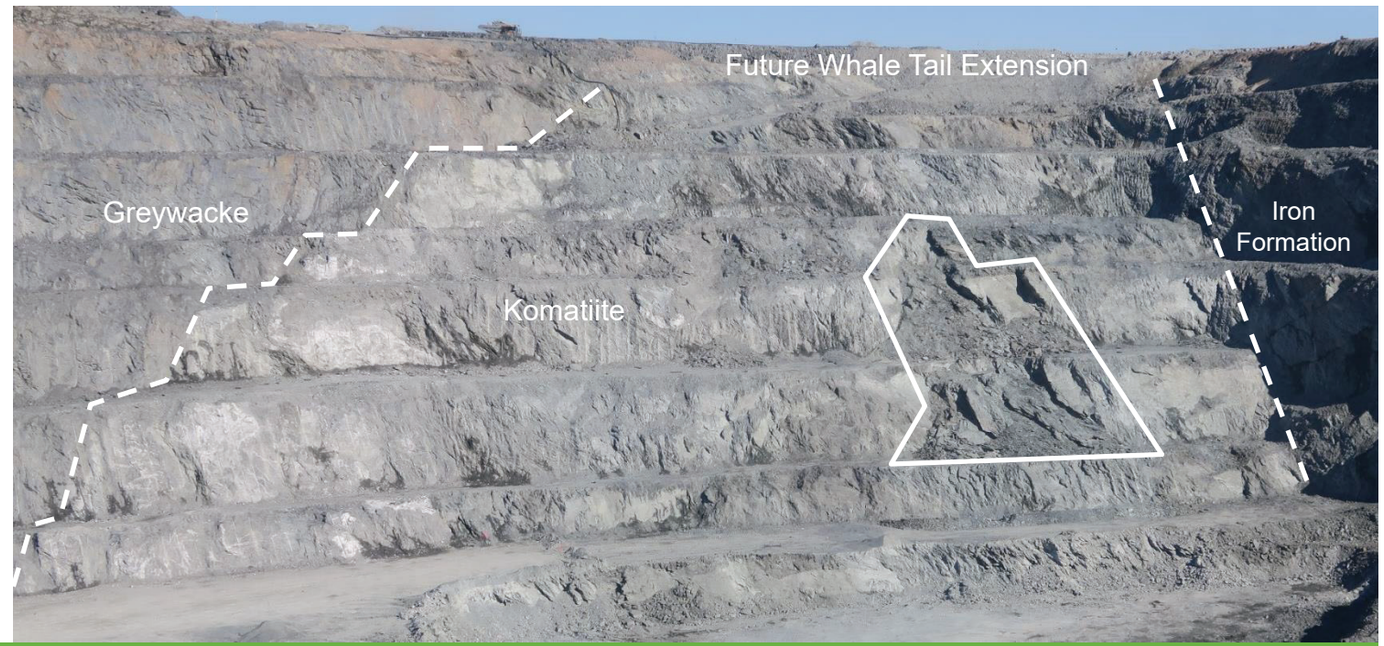


Whale Tail Open Pit

Observations - Northeast Wall

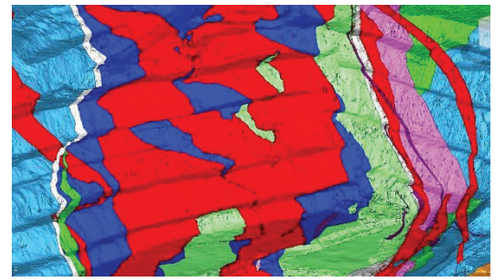


- Final wall in Design Sector D4K.
- This sector is within the Komatiite and has been characterized by a series of bench scale failures. The failures are currently understood to be a hybrid of failure on the foliation and failure of the weak rock mass, influenced by water (i.e., a combination of seepage within the talik and surface runoff) and the Brittle Structures.
- A revised slope design was developed in December 2021 and a pushback of the upper two benches completed to re-establish the slope. The pushback will eventually form part of the planned Whale Tail Extension to the northeast.
- The wall continues to be a focus for the Rock Mechanics team. Assessments of the overall slope stability using a numerical model and of the planned lower wall using kinematics are in progress.
- The performance of the benches has improved with the revised slope design. Several bench-scale failures have occurred and will continue to occur.
- A series of bench-scale failures have occurred at the eastern end of the sector (outlined at right). The failures have almost, but not yet, linked up. This area is discussed on the following slide.

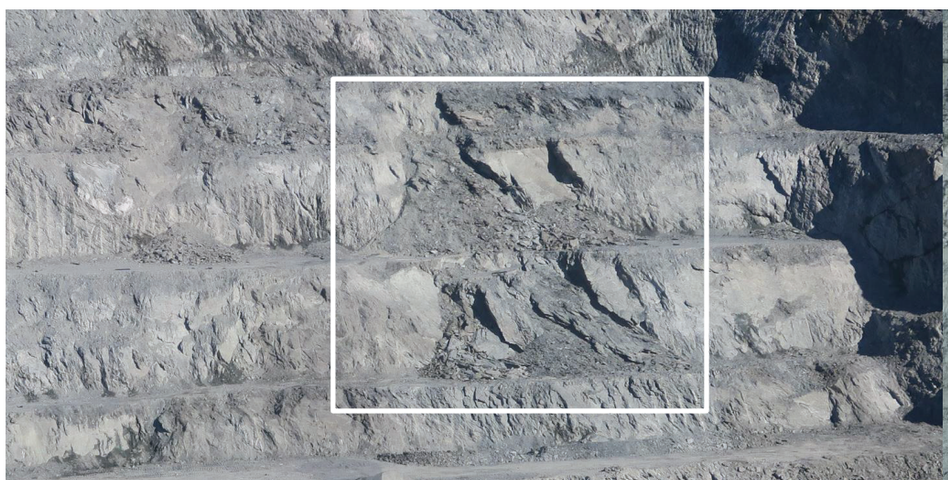


Whale Tail Open Pit

Observations - Northeast Wall (2)



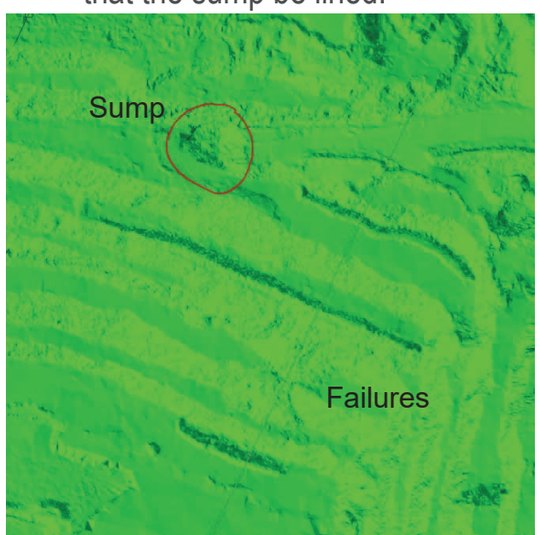
- Seven rockfalls and bench scale failures have been reported in this sector in 2022, ranging in tonnage between approx. 150 and 1500 tonnes. All but one are associated with a series of progressive failures associated with the area outlined in the left photo.
- The failures occurred during freshet, between May 28 and July 17, with most occurring in June. Failures were expected and a rockfall berm was constructed below this area prior to freshet.
- The middle photo shows the outlined area at the time of many of the initial failures in June. These failures were relatively small and several appear to be associated with surface water or erosion of the face (see next slide). The rock mass quality was noted to reduce as the rock mass thawed and these failures progressed over time. The failures on the two benches have almost linked up.
- The western limit of the failures appears to be defined by the foliation. The eastern limit of the failures appears to have a structural control (see right photo). This may be one of the brittle structures (see image at upper right, with brittle structures in red).

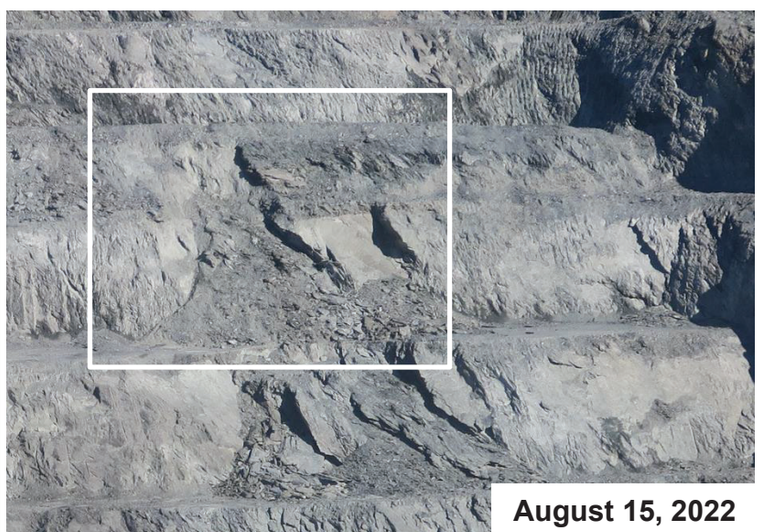


Whale Tail Open Pit

Observations - Northeast Wall (3)

- The site team believes that the infiltration of surface water and the erosion of brittle structures in the bench face likely contributed to the initial failure in May.
- The pushback is located within the drainage for what was the northeastern lobe of Whale Tail lake and water reports to the area. An unlined sump has been established at the base of the pushback at the top of the slope (left photo). The sump is on the Komatiite-Greywacke contact, which is likely promoting infiltration.
- Photos prior to the failures show surface water running across the bench face and eroding the weak rock mass (right photo). The water appears to be concentrated along the potential structure bounding the western edge of the failures.
- It seems reasonable that water is contributing to the failures. It is recommended that surface water be diverted away from the area to the extent possible and that the sump be lined.





August 15, 2022

Area Outlined in Middle Photo on June 13, 2022

Whale Tail Open Pit

NE Wall - Mitigation Measures

- Different strategies for reducing the exposure of personnel to rockfalls and bench-scale failures during mining in this sector were discussed:
  - Adjusting the sequence so that mining in this sector is completed during the winter when the wall is frozen (or at least is not completed during freshet). A high-level review suggests that this could likely be accommodated until mid-2025 without undue disruption. It is recommended that this approach be evaluated by the mine planners as it is likely the most effective.
  - Implementing single benching. A height of up to 10 or 11 m is achievable with the existing equipment, but does require scaling from a muck pad. The requirement for an 8 m minimum catch bench width results in a shallow IRA; as a result, this approach may not be viable.
- The ramp will pass through this sector, approximately 4.5 benches below the current toe of the slope. The current open pit design incorporates an increase in the width of the ramp in this area (from 28 to 36 m) as well as a step-out above a portion of the ramp in order to accommodate rockfall berms. This is endorsed.
- As noted, an assessment of the slope design for the lower Northeast wall is in progress. Several aspects of the slope design were discussed during the visit, notably:
  - The current design for the lower wall incorporates triple-benching rather than double-benching, which increases the exposure of personnel to rockfall. Recommend continuing with double-benching in the lower wall, at least where the wall is sub-parallel to the foliation.
  - The brittle structural model suggests the potential for a bench or multi-bench planar failure on one of the modelled structures directly below the planned ramp. This is being considered as part of the assessment. Modifications to the slope design or the use of ground support (e.g., dowels or cable bolts) may be required to reduce the potential for a failure impacting access along the ramp.

Whale Tail Open Pit

Observations - East Wall

BASE CASE
BFA: 75°
Bench Width: 10 m
Bench Height: 21 m
IRA: 53°

- Final wall in Design Sector E4.
- Limited mining has occurred along this wall since the 2021 review. Specific areas of note are listed below and outlined on the photo.

1. Material from a former in-pit dump remains on the face of the upper bench. A rockfall berm was constructed to retain ravelling material. No significant changes have been observed.
2. The Greywacke near the Diorite has experienced crest loss and previous rockfall events. A temporary step-out has been left below the area to reduce the exposure to personnel. The intention is to scale the area, clean the catch benches and recover the step-out as part of the Phase 3 pushback. This is endorsed. Several potentially unstable blocks were previously identified and should continue be monitored as part of the visual inspections. The drone should be used to supplement these inspections.
3. A joint set cross-cutting the foliation and dipping to the north is prominent in the Iron Formation near the Komatiite contact. It has locally resulted in increased crest loss.

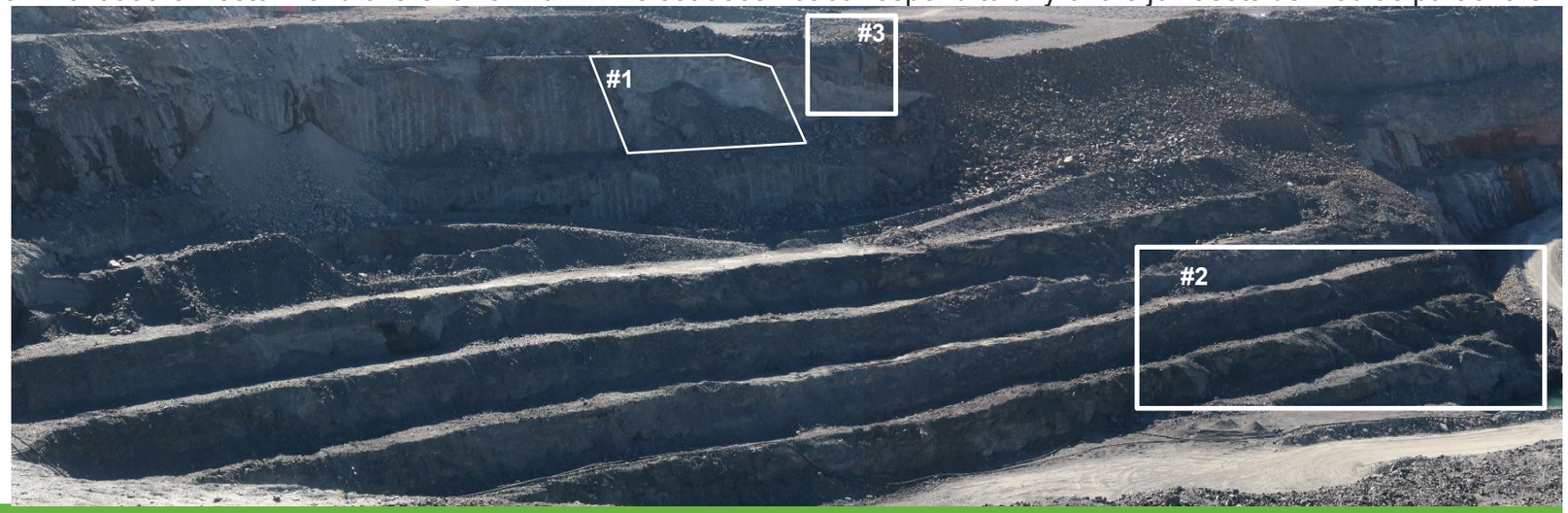
Whale Tail Open Pit

Observations - Phase 2 Southeast Wall

KOMATIITE
BFA: 75°
Bench Width: 10.5 m
Bench Height: 21 m
IRA: 52°

- Interim wall approximately within Design Sector G5. Also referred to as Phase 2 South (G5).
- The lower portion of the wall has been developed with single benches. This was initiated due to the rockfall hazard at the transition with the East Wall.
- The wall is in the process of being mined out as part of the Phase 3 pushback. Spillover from the pushback is accumulating on the uppermost catch benches. The single benches have been effective and material has not yet reached the lower benches or the pit floor. This should continue to be monitored.
- Specific areas of note are listed below and outlined on the photo.

1. A bench-scale failure occurred along a sub-vertical contact between the Komatiite and the Greywacke in 2021. The failure will be mined out by the pushback. It is likely that localized bench-scale failures will occur on adversely oriented contacts as mining progresses.
2. A joint set dipping to the northwest is prominent at the western end of the lower wall . This set does not correspond to any of the joint sets defined as part of the structural domains for the open pit, but may correspond to Joint Set F identified in the underground mine. These structures are locally forming wedges and should be mapped. If joints with this orientation occur more regularly, the bench design in this area should be reviewed.
3. A potentially unstable block is present at the edge of the pushback. See comments on next slide.



Whale Tail Open Pit

Observations - Phase 2 Southeast Wall (2)

- A potentially unstable block is present along one of the curvilinear structures present in the south wall of the open pit.
- The western edge of the block has been unconfined by the pushback and it appears that fractures within the block have started to dilate.
- The area was previously used to anchor one of the dewatering lines (using the 3 vertical posts at the crest) but was recently decommissioned for operational reasons.
- Access above the block should be restricted until it is mined out. Consider leaving some muck against the block to buttress it during drilling and blasting. The area should be monitored when crews are working in the area.

Whale Tail Open Pit

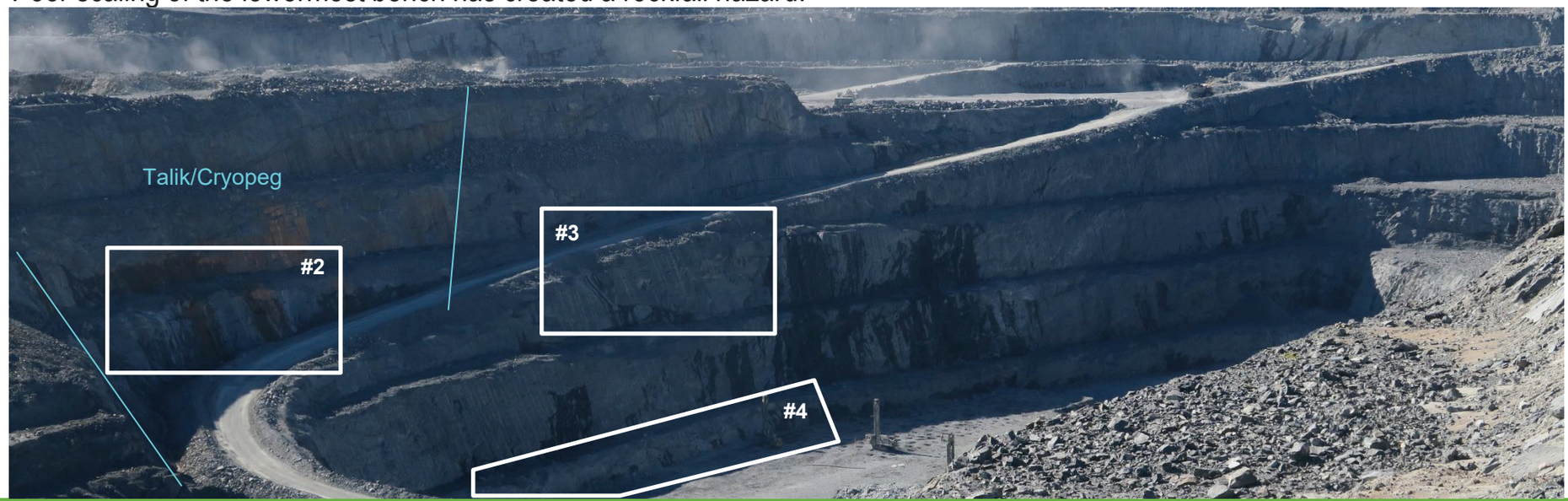
Observations - Phase 2 Southeast Wall (3)

- A Brittle Structure was observed at the western end of the wall, adjacent the Phase 2 ramp.
- This structure (#3) is modelled along the northern contact of the South Limb Komatiite. The observed position, orientation, and thickness of the structure agree well with the 3D structural model.
- No particular stability concerns were noted.
- In general, the 3D structural model has not been validated against the exposures in the open pit. Recommend doing so to build confidence in the model as it is being used to inform key design decisions.

Whale Tail Open Pit

Observations - Phase 2 South Wall

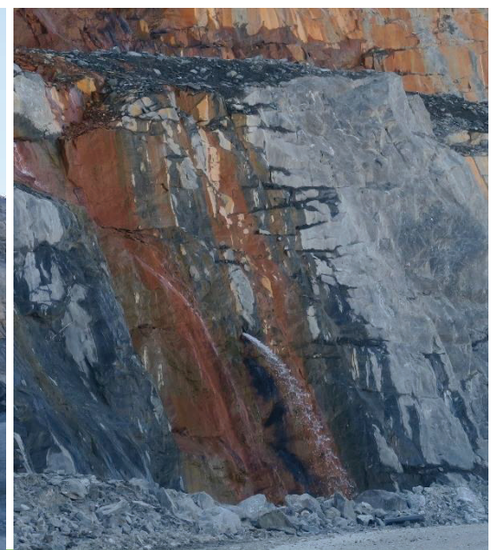
- Interim wall approximately within Design Sector H5. Also referred to as Phase 2 South (H5).
- The wall is generally performing well. Specific areas of note are listed below and discussed on the following slides.
  1. Spillover from the Phase 3 pushback has created a rockfall hazard along the Phase 1 ramp (not numbered below as it occurs throughout).
  2. Seepage within the talik associated with Whale Tail Lake.
  3. A possible unstable block was previously identified below the ramp.
  4. Poor scaling of the lowermost bench has created a rockfall hazard.



Whale Tail Open Pit

Observations - Phase 2 South Wall (2)

1. Spillover from the Phase 3 pushback has accumulated on the catch benches above the Phase 1 ramp and has previously blocked the ramp. The mine has limited the ramp to light vehicles and has partially constructed a rockfall berm along the inside of the ramp. The berm needs to be extended along the full length of the ramp and built up to ensure a consistent 2 m height (left photo). Some rockfall has accumulated behind the berm and it will need to be regularly inspected and maintained.
2. Prominent seeps are present in the lower South Wall, concentrated along sub-horizontal structures (centre photo). The seepage resulted in an ice wall but no significant ice falls occurred and the mine was able to manage this successfully. A water-management pushback has been planned to help mitigate this risk, which is endorsed. A test horizontal drain hole was completed (right photo) and has both consistently made water (including over the winter) and influenced the seeps on the wall. This suggests that horizontal drains may be viable in intercepting and managing seepage.



Whale Tail Open Pit

Observations - Phase 2 South Wall (3)

3. A potentially unstable daylighting wedge was identified below the Phase 1 ramp during the 2021 inspection. A preliminary assessment completed at the time by the mine suggested that the wedge was displacing in response to blasting and had a FoS < 1 if the structures are cohesionless and persistent. This is likely conservative for a wedge of this size but still indicates that the wedge may not be stable. The area will be mined out by the Phase 3 pushback.

- It is understood that the wedge is no longer responding to blasting; however, there have been no large blasts below the south wall recently. One is planned in the near-future and the response of the wedge should be carefully monitored.
- As the wedge undercuts the ramp, it was recommended that instrumentation be installed to monitor any displacement. This has not been done. The fracture defining the eastern end of the wedge appears to have dilated (photo at lower right). Given the size and position of the block, the installation of instrumentation (e.g., wireline extensometer) to supplement the radar coverage continues to be recommended.

Whale Tail Open Pit

Observations - Phase 2 South Wall (4)

4. Loose and overhangs are present along the crest of the lowermost bench on the south wall (photo at lower right). This flitch was approved by Rock Mechanics (student) and drilling of the pattern for the next flitch was in progress. The flitch should not have been approved with these hazards present. None of the personnel working in the area reported the hazard.

- While the crest needs to be scaled, the blastholes make scaling challenging. One possibility would be to carefully monitor the area during loading and then scale the flitch after the blast. The area should be noted on the hazard map.
- The circumstances should be reviewed with both Rock Mechanics and operations personnel, as several opportunities to identify and correct the hazard were missed. Did the person signing off on the bench have sufficient experience to complete the Bench Approval?

Evidence of the north dipping structures that form the basis for Structural Domain 5 was observed at the eastern end of the lower wall, north of the Komatiite contact. Mapping is recommended to better define the extents of this structural domain.

Whale Tail Open Pit

Observations - Phase 3 South Wall

BASE CASE
BFA: 75°
Bench Width: 10 m
Bench Height: 21 m
IRA: 53°

- Final wall within the Phase 3 Pushback (Design Sectors H6 and I6). The wall is predominantly Diorite.
- The area is a focus of current mining activity.
- Curvilinear structures are prominent in the wall and have locally contributed to crest loss (see left photo).
- Seepage from the lower bench face and floor was observed in the active mining area (see right photo). It is understood that this is a relatively recent development and is thought to be linked to a change in the blast pattern design, which now leaves a rock ridge between the pushback and the Phase 2 crest; the ridge may be retaining water that was previously draining into Phase 2.

Whale Tail Open Pit

Observations - Phase 3 South Wall (2)

- The rock mass characteristics of the Diorite exposed in the upper benches is variable. Some areas are characterized by few discontinuities forming large blocks (photo at right). In other areas, more discontinuities and and numerous small blocks are present (example on previous slide). The areas of lowest rock mass quality (photo at left) appear to be concentrated below the footprint of Whale Tail lake.
- In general, this variation in rock mass quality has not strongly influenced bench performance but has resulted in increased scaling or local rockfall hazards. Rockfall berms have been constructed below some of the blocky areas thought to represent the greatest hazard. This is endorsed.

Whale Tail Open Pit

Observations - Phase 3 South Wall (3)

- The mine has recently switched to double-benching using 10.5 m flitches in the Diorite instead of triple-benching using 7 m flitches.
- This reduces the overall exposure of personnel working near the face but makes scaling more difficult as the excavator must work from a muck pad to reach the crest. As part of this transition, carefully monitoring the scaling and placing additional emphasis on the Bench Approval process is recommended to ensure that hazards are managed.

Whale Tail Open Pit

Observations - Phase 3 South Wall (4)

- A prominent fault, believed to be the Ramp Fault, has been exposed in the southeast wall of the Phase 3 Pushback.
- The fault is associated with a zone of reduced rock mass quality 1 to 2 m thick and 10 to 20 cm of gouge.
- A considerable amount of loose was present on the wall. It is understood that the wall had not yet been approved and that additional scaling will be recommended. This is endorsed.

Whale Tail Open Pit

Observations - Phase 3 Southeast Wall

BFA: 75°
Bench Width: 16 m
Bench Height: 21 m
IRA: 44°

- Final wall in Design Sector F6.
- The slope geometry recommendations for this sector were adjusted in late 2021 as the strike of the sector had changed, increasing the potential for planar failure on Joint Set C.
- The achievable bench geometry is sensitive to both the persistence of Joint Set C and blasting and scaling practices. With careful blasting and scaling, a BFA of 75° and IRA of 44° could be achievable if the persistence is limited to 10 m or less, though with backbreak in the order of 8 m. However, if these practices are not used or are not effective, a BFA of 50° and IRA of 39° will be required.
- Geotechnical inspections and Bench Approvals were identified as a critical control for managing potential crest loss, rockfall and bench-scale failures.
- These are the first benches established in this sector and it is important to validate the bench design and implementation.

Whale Tail Open Pit

Observations - Phase 3 Southeast Wall (2)

- The first two benches were established as single 7m high benches without pre-shear. The reason for this is not clear.
- The bench faces have broken back to Joint Set C. The resulting catch bench width appears to be less than the 8 m minimum in at least some areas.
- It is understood that the benches were heavily scaled. Some of this material has been left on the catch benches compromising their capacity to retain rockfall. To the extent possible, this material should be cleaned up and removed.
- Several discontinuities defining the bench faces appear to be persistent over both benches (i.e., a persistence > 10 m).
- It is not clear whether the Bench Approval process was followed for these two benches. If it was, it did not achieve the desired outcome.
- The design bench geometry will not be achievable if the approach used for these two benches is continued. Mining practices have improved for the third bench, which is discussed on the next slide.

Whale Tail Open Pit

Observations - Phase 3 Southeast Wall (3)

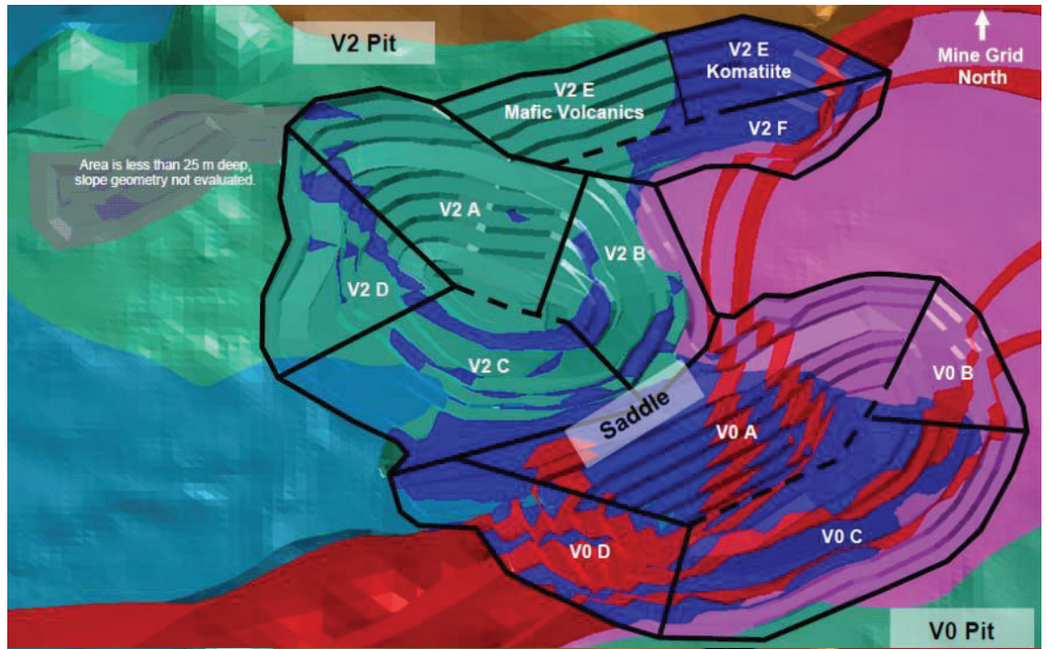
- The first flitch of the third bench had been established and drilling of the second flitch was in progress at the time of the visit. The bench is planned to be triple-benched. Pre-shear was used.
- The central portion of the bench has performed reasonably well (photo at right). Some crest loss, but half barrels visible over most of the face.
- The eastern portion of the bench has failed back to Joint Set C over almost the full height of the bench (photo at left). It is understood that this portion of the bench was scaled heavily, however some loose slabs were observed on the face that should be removed.
- It is understood that the Rock Mechanics student was tasked to do the Bench Approvals for this sector. Given the importance and challenging nature of this sector, it is recommended that the Bench Approvals for this area only be done by experienced personnel.
- It is not clear if the design BFA of 75° will be achievable for this sector. The remaining flitches of this bench need to be monitored and their performance documented. Once the bench is complete, a review should be completed to assess if the bench design is achievable or if it needs to revert to the shallower geometry (i.e., BFA of 50°).

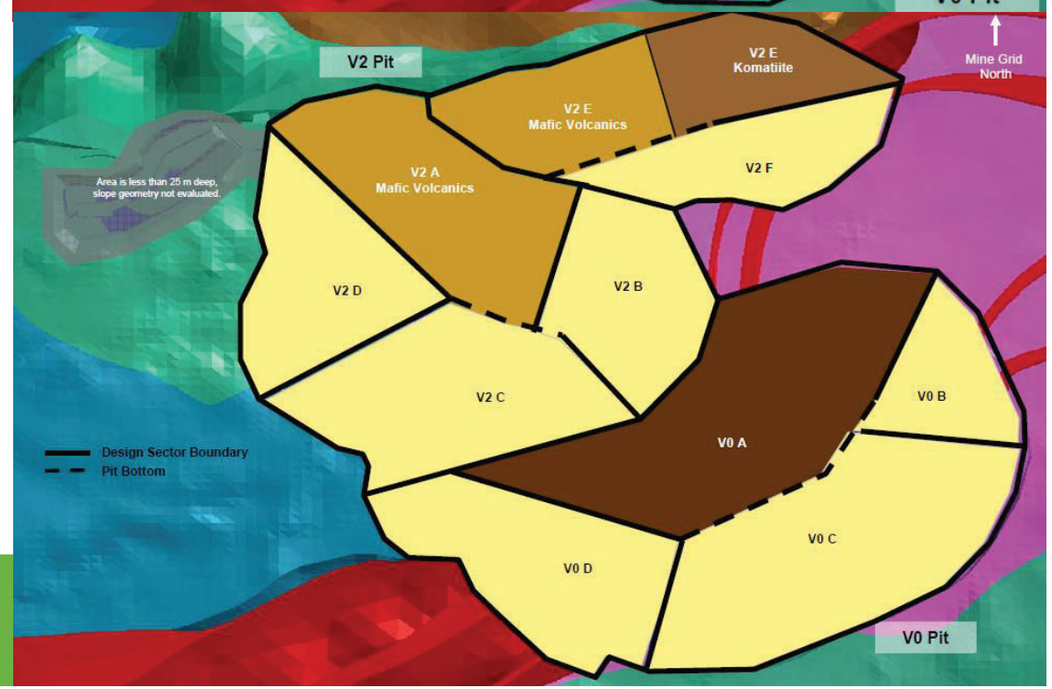
IVR V1 & V2 OPEN PITS

IVR V1 & V2 Open Pits

Overview

- The design recommendations for the IVR West 1, IVR West 2 and IVR V2 Extension open pits are shown at right for reference.
- The design sectors are shown at upper right along with the lithologies expected in the final open pit walls. The slope geometry recommendations are shown at lower right.
- Note that the V1 open pit was previously referred to as the V0 open pit and most design documents issued by KP refer to it as such.
- The design recommendations were developed based on the IVR-001-004C design. Updated designs, IVR-001-006C, have been developed for both open pits.





LEGEND:

- GREYWACKE (S3)
- CHERT (S10, S10E, S10mSi & S10sSi)
- KOMATIITE-0a - NORTH LIMB (V4-0a & V4Bio)
- KOMATIITE-0b - SOUTH LIMB (V4-0b & V4Bio)
- MAFIC VOLCANICS (V3 & I3A)
- BRITTLE STRUCTURES

Base Bench Geometry

BFA: 75°
Bench Width: 10.5 m
Bench Height: 21 m
IRA: 52°

Bench Geometry Controlled by Bench-Scale Failures

V2 A & V2 E
BFA: 75°
Bench Width: 10 m
Bench Height: 14 m
IRA: 46°

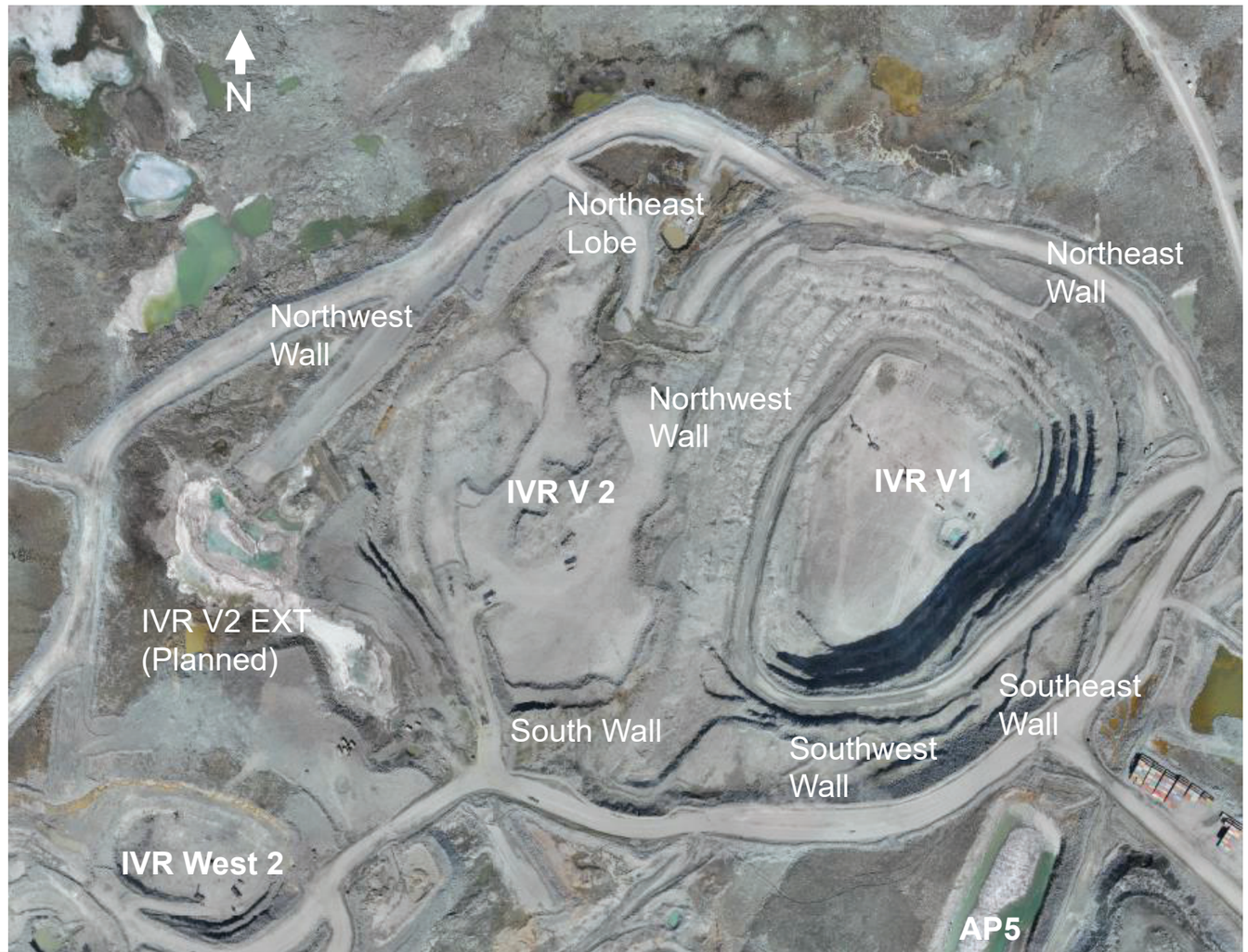
V2 E
BFA: 50°
Bench Width: 8 m
Bench Height: 14 m
IRA: 35°

V0 A
BFA: 45°
Bench Width: 8 m
Bench Height: 14 m
IRA: 32°

IVR V1 & V2 Open Pits

General

- The IVR V1 and IVR V2 open pits were inspected on August 14 and 15, 2022. Observations made during the inspection are summarized on the following slides.
- The approximate current pit geometry is shown at right. The walls inspected are labelled relative to mine north.
- Note that the IVR V2 Extension is planned as an expansion of the IVR V2 open pit towards the west, approaching the IVR West 2 open pit.



IVR V1 Open Pit

Observations - Northwest Wall

- Final wall in Design Sector V0A. This sector encompasses the footwall of the deposit.
- The slope geometry was expected to be controlled by the potential for bench and inter-ramp scale planar failures on the foliation (Joint Set A).
- Specific comments are provided on the following slides.

IVR V1 Open Pit

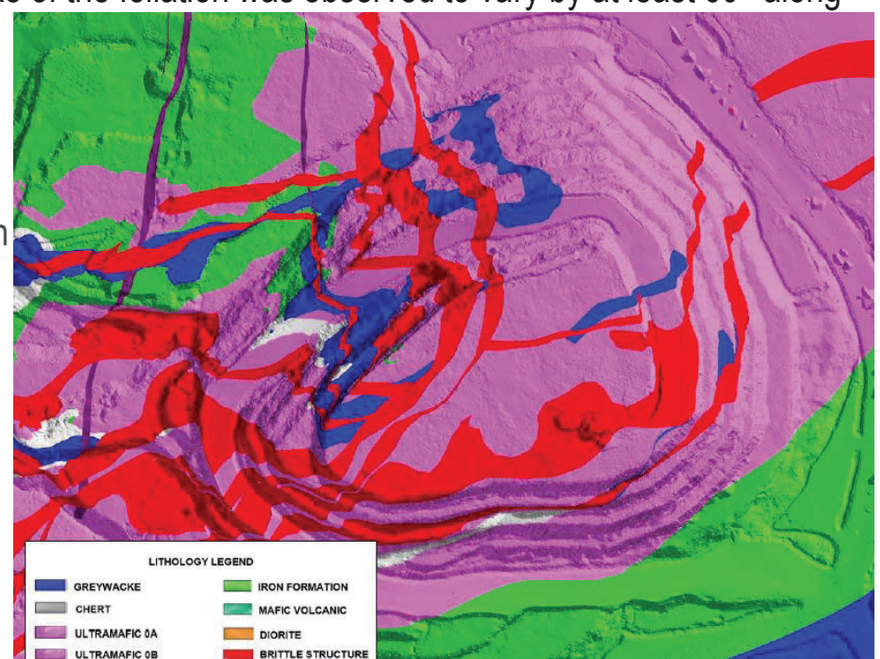
Observations - Northwest Wall

- The benches at the southern end of the upper wall failed back to the foliation during development. In some cases, there is effectively no catch bench width remaining.
- Mining of the IVR V2 open pit has resulted in spillover onto the northwest wall. The mine has adjusted the blasting practices to reduce this, but spillover is expected to continue.
- A rockfall berm has been established along the inside of the ramp and has capacity. The rockfall berm will need to be monitored and cleaned out as required as mining of IVR V2 continues.
- Mining of IVR V2 will ultimately remove the upper two to three benches of this wall, which will reduce the rockfall hazard in the long term.

IVR V1 Open Pit

Observations - Northwest Wall

- The performance of the Northwest Wall varies significantly along the wall. Observations suggests that this is linked to:
  - **Lithology:** Bench faces steeper than the dip of the foliation have been achieved in an interval of Greywacke at the western end of the wall. The Greywacke is more competent than the Komatiite and has increased discontinuity shear strength.
  - **Foliation Orientation:** The foliation was expected to be parallel to the wall. Where this has occurred (e.g., the upper benches at the eastern end of the wall), the foliation has typically defined the bench face. However, the strike of the foliation was observed to vary by at least 60° along the wall and this has contributed to variable bench performance.
  - **Bench Design and Implementation:** The original design was for a 45° BFA established using staggered blast holes. This proved impractical to implement, at least partially due to poor control of the blast hole depth resulting in over-drilling. The mine has trialled pre-shear blasting of 55° and 65° BFAs, which is discussed in greater detail on the next slide. In both cases the catch bench width was increased to maintain the design IRA.
- Recommend documenting the lithology, rock mass structure, and bench performance at regular intervals along the Northeast Wall in order to better understand the controls on the wall performance. While relatively few benches remain in the IVR V2 pit, the results are relevant to the footwall of the IVR V1 pit.



IVR V1 Open Pit

Observations - Northwest Wall (2)

- The mine has trialled the use of a 55° and 65° pre-shear to define the bench face rather than using staggered blastholes. The 55° pre-shear trial was done at the east end of the wall, above the ramp (shown at lower left). It performed well. As a result, the mine tried 65°.
- The 65° pre-shear trial was done for the full length of the current bench. It performed well to the west of the brittle structure in the middle of the wall, with the bench face standing steeper than the dip of the foliation. This may be because the slope appears to be in the Mafic Volcanics in this area. East of the brittle structure (shown at lower right), the bench performance was marginal, with two bench-scale failures and increased crest loss. Subsequent to the site visit it is understood that additional bench-scale failure occurred in this area.
- The mine intends to use the 65° pre-shear for the remaining two to three benches. The bench performance suggests that this is aggressive, particularly to the east of the brittle structure. Based on the observed performance, it is recommended that the 55° pre-shear be used for future benches on this wall.

IVR V1 Open Pit

Observations - Northwest Wall (3)

- In May, a 100 tonne wedge failure occurred directly below the ramp on the foliation and a cross-cutting structure (outlined in white). This was part of the 65° BFA trial.
- Several hazards were observed on the eastern end where the 65° BFA was used:

1. The foliation has formed two slabs on the bench face of the second lowest bench (Photos 1A and 1B below), separated by what appears to be a brittle structure. These slabs are potential instabilities and should be a focus of future monitoring. It is understood that several rockfalls occurred in this area after the annual inspection.
2. There is a local overhang on the lowest bench (Photo 2 below). Recommend scaling it down.