TECHNICAL REPORT

Identification of Potential Inrush and Inundations Pathways from present and future TSF Facilities into Rasp Mine Underground Workings (with a focus on Kintore Pit proposed TSF3).

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TABLE OF FIGURES

GLOSSARY

Barricades- A barricade is used to restrict access and not used as an inundation or inrush risk control device.

Barrier – A structure between the inundation and inrush hazard (an area where people may be) designed to prevent the release of the hazard into the working area.

Dip- The angle at which a bed, stratum, or vein is inclined from the horizontal, measured perpendicular to the strike and in the vertical plane.

Impoundment Areas / Impoundments – Areas containing or confining water or materials that may flow when wet.

Inrush – A sudden and often overwhelming flow of water or waste rock including historical sand fill into mine workings

Inrush Control Zone – (ICZ) This zone is the zone required around an inrush hazard that is a principal mining hazard under cl 46 of the WHS Regulations, in which additional controls are required to be implemented.

Pentice – A barrier constructed / installed at the base of a vertical opening (e.g. raise) to prevent falling material making contact with persons or machinery.

Plugs – An engineered bulkhead that is specifically designed to protect workers from an inrush / inundation event.

Risk- the chance of something happening that will have an impact on objectives

Risk assessment – the overall process of risk identification, risk analysis and risk evaluation.

Workings – The entire systems of openings in a mine. Typical usage restricts the term to the area where the ore or waste is being mined.

Naming Convention - All historical Main Lode (ML) workings are referred to in feet. Shafts levels were named from the top of the collar. All modern workings in the Western Mine are named by Relative Level (RL). 1000 ft level is equivalent to 7sub level in the mine.

1. CONTEXT

1.1. GENERAL

Rasp Mine is proposing to utilise the Kintore Pit as a Tailings Storage Facility (TSF3) once the capacity of the current facility (TSF2) is reached. The Kintore Pit is currently used as the main access portal into the Rasp underground mine. A new mine access portal and decline will be established via a proposed boxcut to the North of the current portal location.

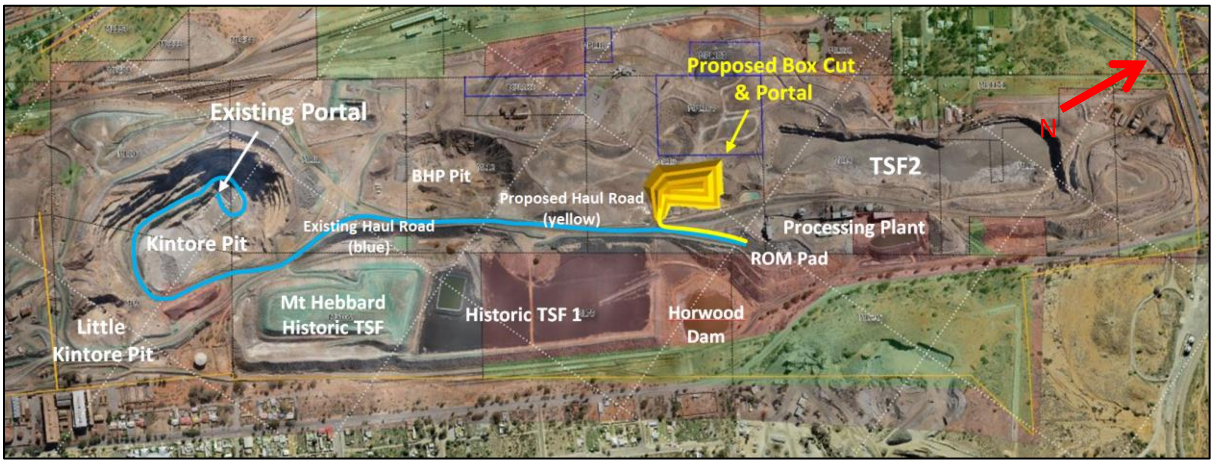


Figure 1 – Site Plan showing proposed box cut location

The Kintore Pit has previously intersected historical mine workings within the Main Lode and as such is potentially connected to current and future active mine workings via a series of historical rises, stopes and level development. Historical survey records and mine plans have been used to determine the properties of many of these openings, however the properties and exact nature of some areas are unknown.

The critical controls proposed to manage the risk of tailings or water entering historic and active workings within the proposed TSF3 include:

1. Filling of the MLD drive with waste to remove access beneath the Kintore Pit.
2. Dewatered tailings co-disposed with waste rock, compacted and placed in the Pit as engineered fill.
3. Installation of a drainage layer in the Pit with a seepage collection system managed as part of current mine dewatering system.
4. Rockfill (waste rock) layer placed over and against historical workings in the bottom and walls of the Pit.
5. Installation of an engineered plug at the underground portal entrance.
6. Filling voids in Pit walls as they become known and accessible.
7. Monitoring of placed tailings to monitor liquefaction potential of tailings; And as required additional barriers will be installed at specified locations if liquefaction potential is identified from monitoring.

These additional barriers at specified locations to isolate active areas from the risk of inrush are only required if the tailings have the potential to liquefy, for this to occur three conditions must be satisfied:

1. Tailings at near saturation
2. Tailings void above the critical void ratio
3. Change in stress condition, such as a breach of the rock surrounds into historic mine workings or a rise in the water levels within the tailings.

It is proposed to periodically assess the potential liquefaction risk of the placed tailings in the Pit by conducting in situ testing of the entire depth of tailings. According to Golder, this will enable an assessment to be made whether the tailings are dry or wet and approaching conditions, (identified above) , conducive to liquefaction. Only then will the additional barriers be installed, (Golder, 2020 (1896230-047-Rev1)).

This report details the potential pathways between Rasp Mine's underground workings and Kintore Pit. Also detailed are the locations of the additional barriers required to effectively isolate these pathways from current or future active mine working, if required (Figure 2).

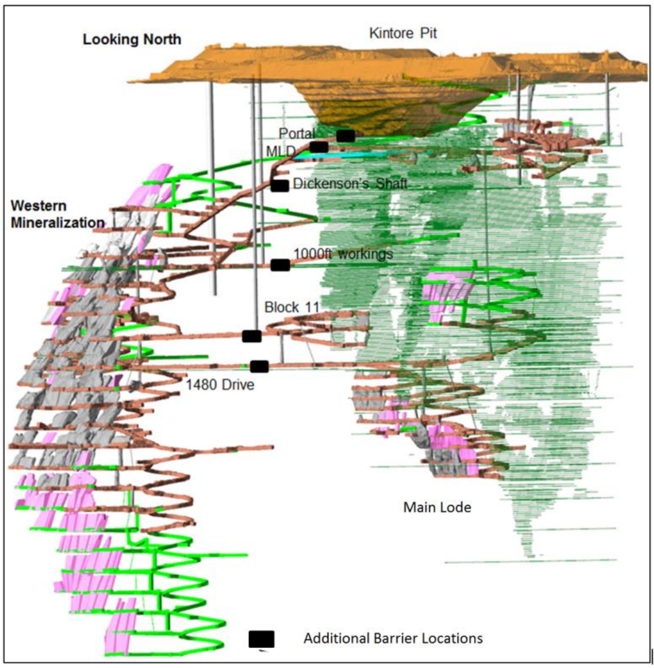


Figure 2- Additional Barrier Locations

This report will be distributed to Golder Associates Pty Ltd and Ground Control Engineering Pty Ltd for their information and recommendations on barrier design and specifications for each of the identified locations. Also to provide any additional recommendations identified to manage the risks associated with inrush or inundation due to placing dewatered and compacted tailings into Kintore Pit.

This report additionally details the potential pathways for ingress into historic workings below the current tailings storage facility in Blackwoods Pit (TSF2) and surrounding shafts which could be impacted by an inrush or inundation event. The secondary aim of this report is to provide key information that will be incorporated into the Principle Hazard Management Plan (PHMP) - Inrush and Inundation and also contribute to the PHMP Subsidence.

The following table provides a summary of the pathways and recommended controls to be implemented to minimise the risk associated with inrush and inundation.

Item	PHMP Risk Type	Assessed Infrastructure	Pathway Summarised	Section in Report	Current Control	Proposed Control	Comments
1	Inrush and Inundation	Intact Hangingwall Shafts (Block 9 and Block 10 Shafts) including the Harvey Shaft and No. 2 Main Shaft	Water diverted to Kintore Shaft via the open footwall sills within the Central Mine Block. Continued connection path to No.6 Shaft from the 1070 ft and the No.2 Shaft. From here the water would then traverse down the BD Pillar Incline into the 1480 ft drive and drain to No.7 Shaft and pumped out to surface. (Fig. 6)	2.1.1	Shafts collapsed and backfilled (not open), Kintore pentice (Shaft open) (disrupt velocity and momentum of any event), sand filled stopes, current porous Kintore Pit floor, current pumping infrastructure PS1 (decline to surface) and No.7 Shaft Pump	Engineered barrier at 1480 drive, and the Portal (if liquefaction potential identified in Kintore tailings), reduced water content of tailings, engineered designed seepage collection system at base of Pit, drainage and pumping of excess tailings water, filling of voids in Pit walls as they become known and accessible, stormwater management, tailings compaction to reduce permeability and construction of a waste rock fill barrier in the base of the Kintore Pit	Related to large scale event.
2	Inrush and Inundation	Intact Footwall Shafts including the North Vent Shaft, South Vent Shaft and Kintore Shaft	1. Above Kintore pentice the 400 and 600 ft open workings allow connection between the Blocks 9, 8 and 7 historical workings and again to the No.6 Shaft to 1070 ft level and No.2 Shaft. (Fig. 6) 2. Fluid pathway between 1480 ft and 1615 ft level with connection to the Harvey Shaft and direct connection to the Lower Harvey Shaft East (LHSE) workings. (Fig. 7)	2.1.1	As above.	As above.	Flow pathway 2 would result in the inundation of the LHSE, with water levels eventually rising through accumulation onto the 1480 ft drive and then water reporting to the No.7 Shaft. Related to Large Scale Event
3	Inrush and Inundation	Filled Shafts (Harvey Shaft, Campbell Shaft, Old Kintore Shaft, Kintore Shaft, Weatherly and numerous others Macgregor etc. Old Main Vent Shaft, South Vent Shaft, North Vent Shaft and Kelly Shaft) within the Kintore Pit.	As above. (Figs. 5, 6, 7, 15 and 16)	2.1.2	As above.	As above	Related to Large Scale Event
4	Inrush and Inundation	435 ft workings and above mined out in existing Kintore Pit	Down Main Decline, and entering from above MLD Drive, down 1270 Vent Raise and or down Harvey Shaft and Kintore Shaft to the 1480 ft drive and then pumped to No.7 Shaft. NB connection and description for LHSE above. (Fig.7 and Fig.9)	2.1.3	As above.	As above.	Pathway would involve water travelling through waste fill, sand filled stopes and natural Vughs and in known Subsidence zone. Related to Large Scale Event
5	Inrush and Inundation	Backfilled Pit identified linking BHP Pit (SE Corner) with north wall of Kintore Pit, depth of subsidence zone unknown.	1. Seepage of water ingress after heavy rain event from BHP Pit connected to Kintore Tailing in SW High Wall via a subsided zone (depth unknown). (Fig 12,15 and 16) 2. Potential Subsidence of side Pit wall into Pit. (Fig. 13)	2.2.1	As above with additional controls - geotechnical inspections after rain, Kintore Pit TARP, Storm Water Management Plan, current underground mine pumping infrastructure. Previous Historical Drilling indicates presence of fill in this area.	Observation and risk assessment.	No seepage observed after rain events at base of tailing in SW High Wall of Kintore Pit. Related to minor or localised event.

Item	PHMP Risk Type	Assessed Infrastructure	Pathway Summarised	Section in Report	Current Control	Proposed Control	Comments
6	Inrush and Inundation	Intact Weatherly Shaft (north of Kintore Pit within Pit boundary)	Tailing entering the Shaft into intact footwall drives within Block 11 through McBrydes Shaft and entering the 400, 500, 600 and 1000 ft levels into the WM 7 sub and 1200 ft levels. The fluid could then enter the Delpratts and Stewart Shafts (open), then make its way to the 1480 ft and then to No.7 Shaft. (Figs. 15 and 16)	2.2.2	Current water pumping infrastructure.	Engineered barriers (if liquefaction potential identified in Kintore tailings), at Portal, MLD and 1480 ft drives effectively sealing Main Lode workings from WM, filling of the 1270 Vent Raise.	No observed water from Delpratts or Stewart Shaft. Related to Large Scale Event
7	Inrush and Inundation	Dickensons Shaft (collapsed and backfilled), Stewart Shaft (open), Delpratts (open) and interactions with 200, 300, 500 and 1000 ft levels.	Water accumulated within Shafts and underground workings making its way suddenly to 1000 ft 7Sub level.	2.2.3	Current water pumping infrastructure.	As above.	As above, unrelated to MOD6 but applicable to PHMP (Inrush and Inundation). Related to large scale event.
8	Inrush and Inundation	Block 11 - 9Sub level, 19L WM, 1480 ft drive, No.7 Shaft.	Potential water pathway from sand filled workings above 9sub level which connect with the historical 1315 ft drive. This area was effectively abandoned due to the unexpected breakthrough and subsequent failure of the stoping crown. In the event that water build up is contained above the 1315 ft drives there is some potential for the water to travel into the WM10L and then down air rises onto the 1480 ft drive reporting to No.7 Shaft. The water may also fill the LHSE area via the LHSE Decline. (Fig 18)	2.2.4	Current water pumping infrastructure.	Engineered barriers (if liquefaction potential identified in Kintore tailings), at Portal, Block 11, MLD and 1480 ft drives effectively sealing Main Lode workings from WM.	Related to minor or localised event, no water being observed arising from the Block 11 area as at April 2020, unrelated to MOD6.
9	Inrush and Inundation / Ground and Strata Failure	1480 ft drive stopes, 1480 ft drive	Water reported to the 1480 ft drive after mining was abandoned in this area, the water would move down the MLD Decline and inundate the 1615, 1630, 1715 and 1715 Sub levels. If there was a large amount of water the fluid pathway would then inundate the LHSE. (Figs. 19 and 20)	2.3.1	Current water pumping infrastructure	Engineered barriers (if liquefaction potential identified in Kintore tailings), at Portal, MLD and 1480 ft drives effectively sealing Main Lode workings from WM.	Related to minor or localised event, unrelated to MOD6.
10	Inrush and Inundation / Ground and Strata Failure	Unfilled 10Sub level Stopes, 10Sub level access, 1480 ft drive.	The mining sequence changes as a result of the scenario described at Item 9 resulted in these stopes not being filled and were abandoned. If water from the historical workings above were to ingress into the 10Sub level stopes it may pool (if not addressed) and eventually rise to the 10Sub level drive, down a nearby open airway reporting to the 1480 ft drive and then down the usual route to No.7 Shaft. This pathway would have the potential to inundate the LHSE and LHS orebodies. (Fig. 21)	2.3.2	As above.	As above.	Related to minor or localised event, unrelated to MOD6.

Item	PHMP Risk Type	Assessed Infrastructure	Pathway Summarised	Section in Report	Current Control	Proposed Control	Comments
11	Inrush and Inundation / Ground and Strata Failure	West Pillar Stope, MLD Drive.	The mining sequence changes as a result of the scenario described at Item 9 resulted in these stopes not being filled and were abandoned. If water from the historical workings above were to ingress into the 10Sub level stopes it may pool (if not addressed) and eventually rise to the 10Sub level drive, down a nearby open airway reporting to the 1480 ft drive and then down the usual route to No.7 Shaft. This pathway would have the potential to inundate the LHSE and LHS orebodies. (Fig. 22)	2.3.3	Current water pump infrastructure	Engineered barriers (if liquefaction potential identified in Kintore tailings), at Portal, MLD and 1480 ft drives effectively sealing Main Lode workings from WM, filling of the 1270 Vent Raise.	Related to minor or localised event, unrelated to MOD6.
12	Inrush and Inundation / Ground and Strata Failure	525-1 Stope, MLD Drive.	As above. (Figs. 10, 22 and 23) See Related Section 2.1.3	2.3.4	As above.	As above	Related to minor or localised event, unrelated to MOD6.
13	Inrush and Inundation	Thompsons Shaft, Unknown Capped Shaft (Possibly Eyre Shaft), Blackwood Pit TSF2, Howell Shaft.	In the unlikely situation where TSF2 Embankment2 failed during a H6 the water would flow from Embankment2 and potentially damage the concrete plug of the Unknown Capped Shaft. The water could inundate the lower working levels of the Thompson Shaft and saturate all of the levels up to an including the 800 ft level. It is assumed that the water would then fill the 800 ft level and form a connection with the Browne Shaft. (Fig. 26)	2.3.5	Shaft is capped, engineered Embankment2 design, current water pumping infrastructure.	Engineered barrier (if liquefaction potential identified in Kintore tailings), at the 1480 ft drive. Potential second barrier at 1480 drive.	Related to large scale event, unrelated to MOD6.

2. POTENTIAL FLUID AND INRUSH PATHWAYS / IMPOUNDMENTS

Two potential impoundment zones have been identified, referred to as the Southern Impoundment (zone directly impacted by placement of compacted, dewatered tailings / waste rock into Kintore Pit) and the Northern Impoundment which covers the BHP Pit (no tailings are expected to be placed into this zone), as shown in Figure 3.

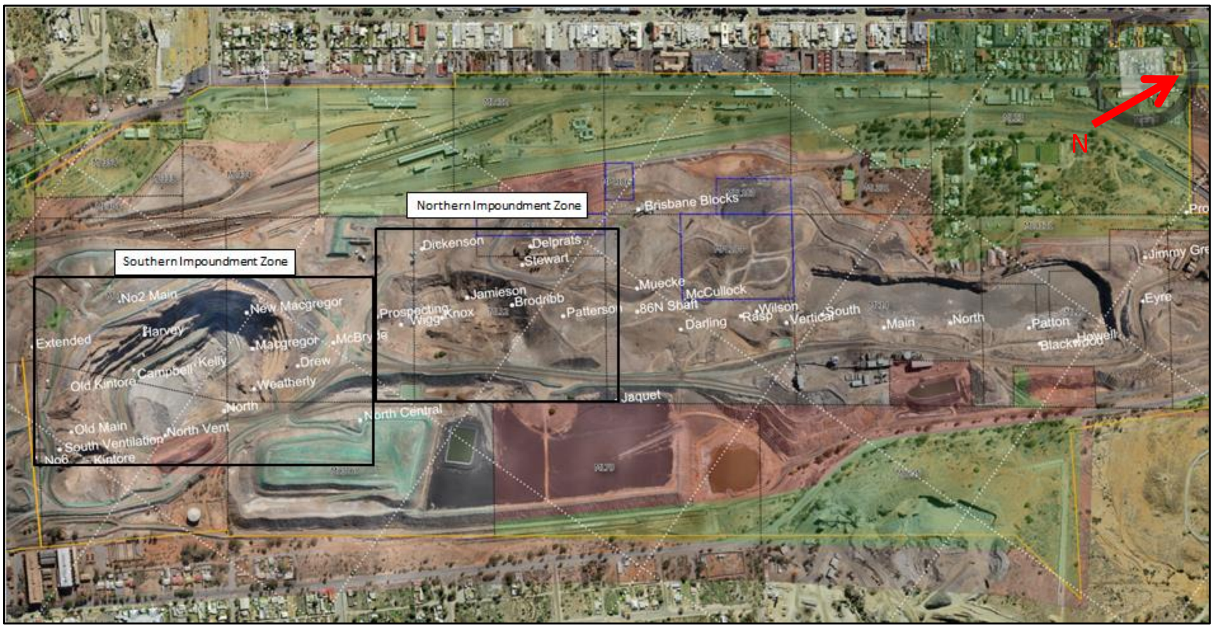


Figure 3- CML7 Impoundment Locations

2.1. SOUTHERN IMPOUNDMENT

There are three potential pathways via the Southern Impoundment;

1. Intact footwall and hanging wall shafts (outside of the Kintore Pit Footprint),
2. Filled shafts within the Kintore Pit footprint,
3. Historic and current mine workings (e.g. lateral development).

2.1.1. Intact Footwall and Hanging Wall Shafts

The main pathway routes for water to drain directly down are shafts that are connected (via historical workings) to the Pit and are on the footwall side and/or hanging wall outside of the stoped area. These shafts are outside of the subsidence zone and therefore have a greater chance to be intact.

Primarily these shafts exist within the Central Mine Block (Mining Lease 9 and 10), and are Harvey Shaft and No 2 Main Shaft, New Macgregor (Hanging Wall) and the Footwall Shafts: North Vent Shaft, South Vent Shaft, Old Main Shaft and Kintore Shaft , see Figure 4 and Figure 5.

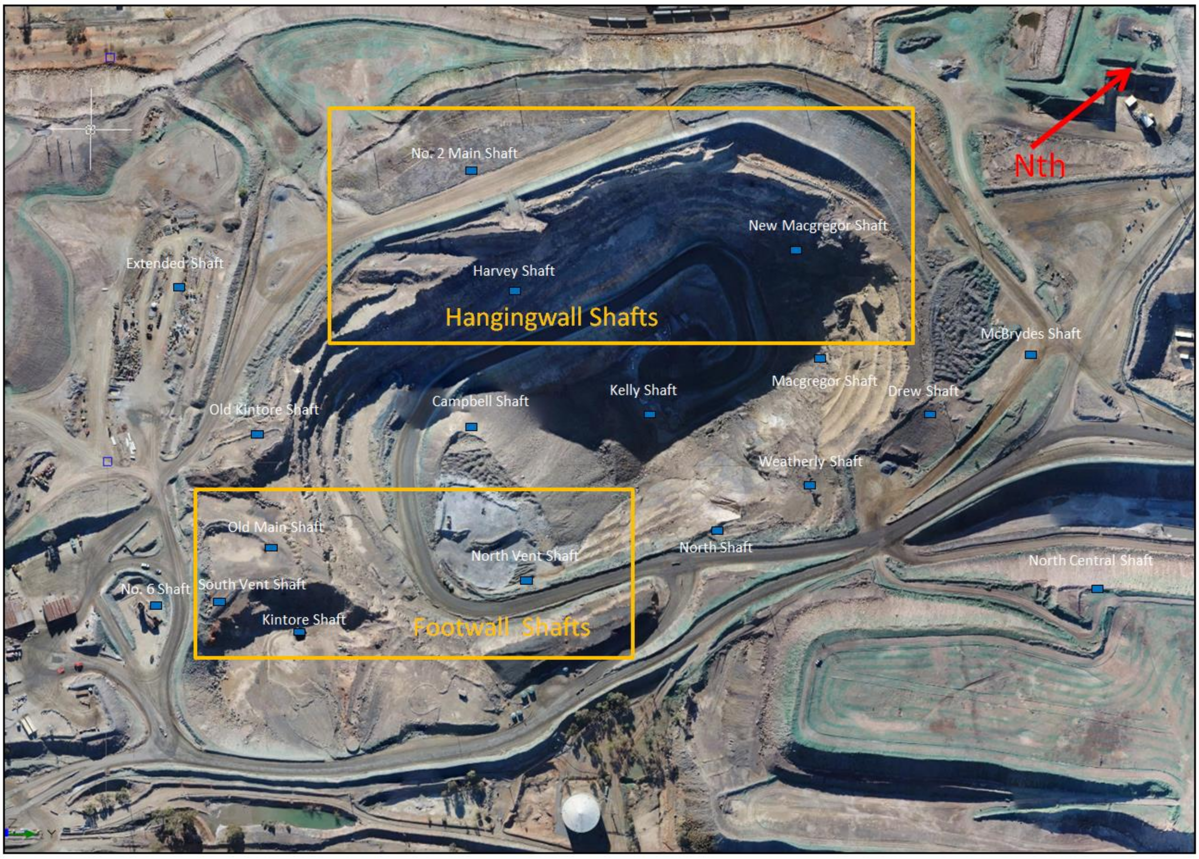


Figure 4- Intact hangingwall and Footwall surface shaft collar Locations

Figure 5- Section View, Intact hangingwall and Footwall surface shaft collar Locations (looking W)

The North Vent Shaft and the No 2 Main Shaft may be primary paths located on the south eastern side of the Kintore Pit. These can feed the open footwall sills of the Central Mine Block (ML 9 and 10) with water which could divert south to the Kintore Shaft. As the Kintore Shaft has a historical pentice installed on the 600ft, (confirmed by CMS), it is unlikely that this will block the continued trend of the open diversion of water vertically down, (see Figure 6), however the presence of the pentice, would likely impede the travel, momentum and speed of a substantial inrush of sand and water event.

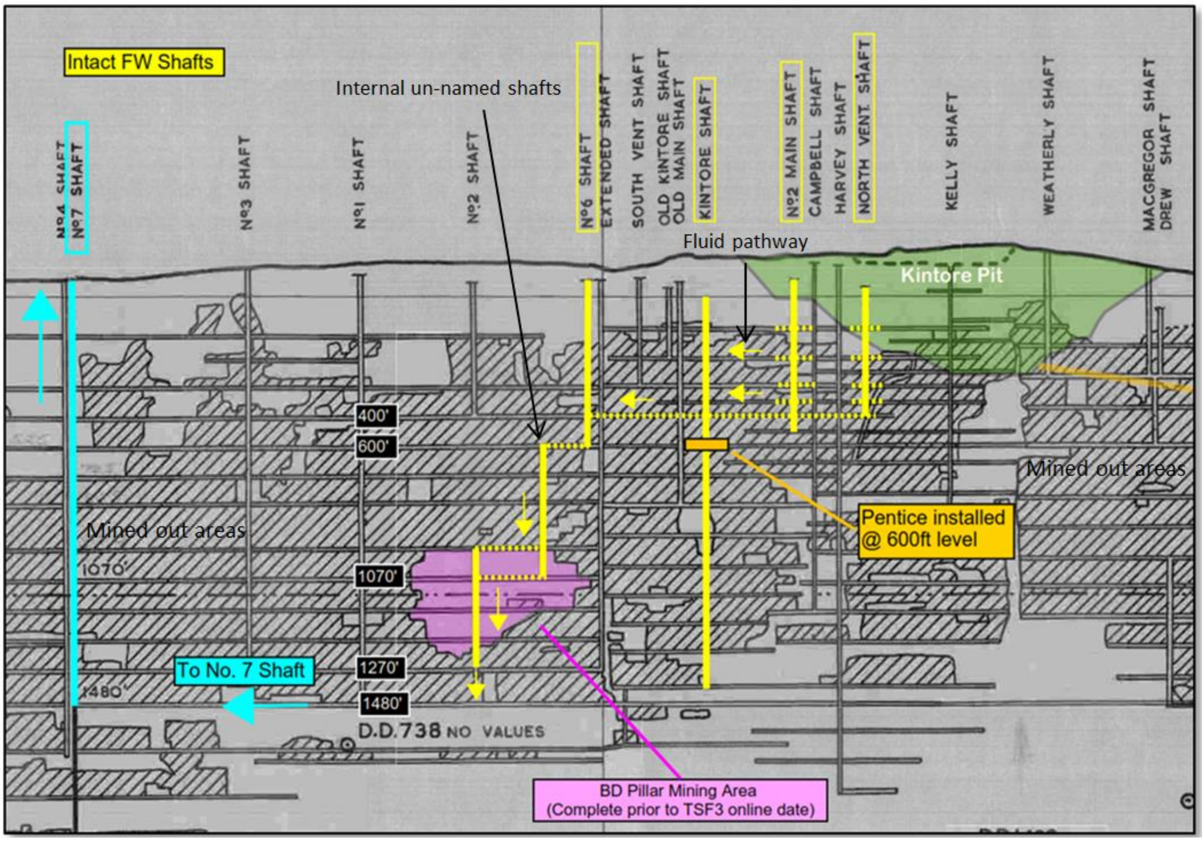


Figure 6- Cross section looking West – "Southern Impoundment" pathways

There are two remaining open pathways that will allow flow above the pentice, the 400 ft and the 600 ft Kintore levels. These openings connect the Block 9 workings to the Block 8 and 7 historical workings (425 ft /625 ft). These provide secondary pathways to No 6 Shaft and thus a vertical pathway to the 1070 ft level and the No 2 Shaft.

The BD Pillar incline is in this pathway, and the water may then traverse down the incline into the 1480 level along the concrete drains laid on a grade of 1 in 400 and drain to No 7 Shaft as shown in Figure 6.

Some of the water would drain to No 7 Shaft through the historical workings. The incline is connected at the 1070 ft, 1170 ft, 1270 ft and 1370 ft.

The Harvey Shaft is a vertical shaft existing on the hanging wall side of the Main Lode. The Shaft provides water pathways directly down to nearly all lower levels in the Block 10 region. However, in most cases the immediate open drive to the workings has been stoped and filled preventing further diversion to any open sill drive. Attempts were made to fill the Harvey Shaft, however it is unknown if the Shaft has been completely filled.

The primary levels where no fill or the drives contain partial fill are the 1480 ft and 1615 ft levels. These are regions in which the crosscut to the Harvey Shaft may still act as an open water channel, see Figure 7. These provide immediate drainage to the Lower Harvey Shaft East (LHSE) decline levels. Water will report to the area due to its lower elevation. Once the LHSE area reaches full inundation water will rise to the 1480 ft drive and drain to No 7 Shaft.

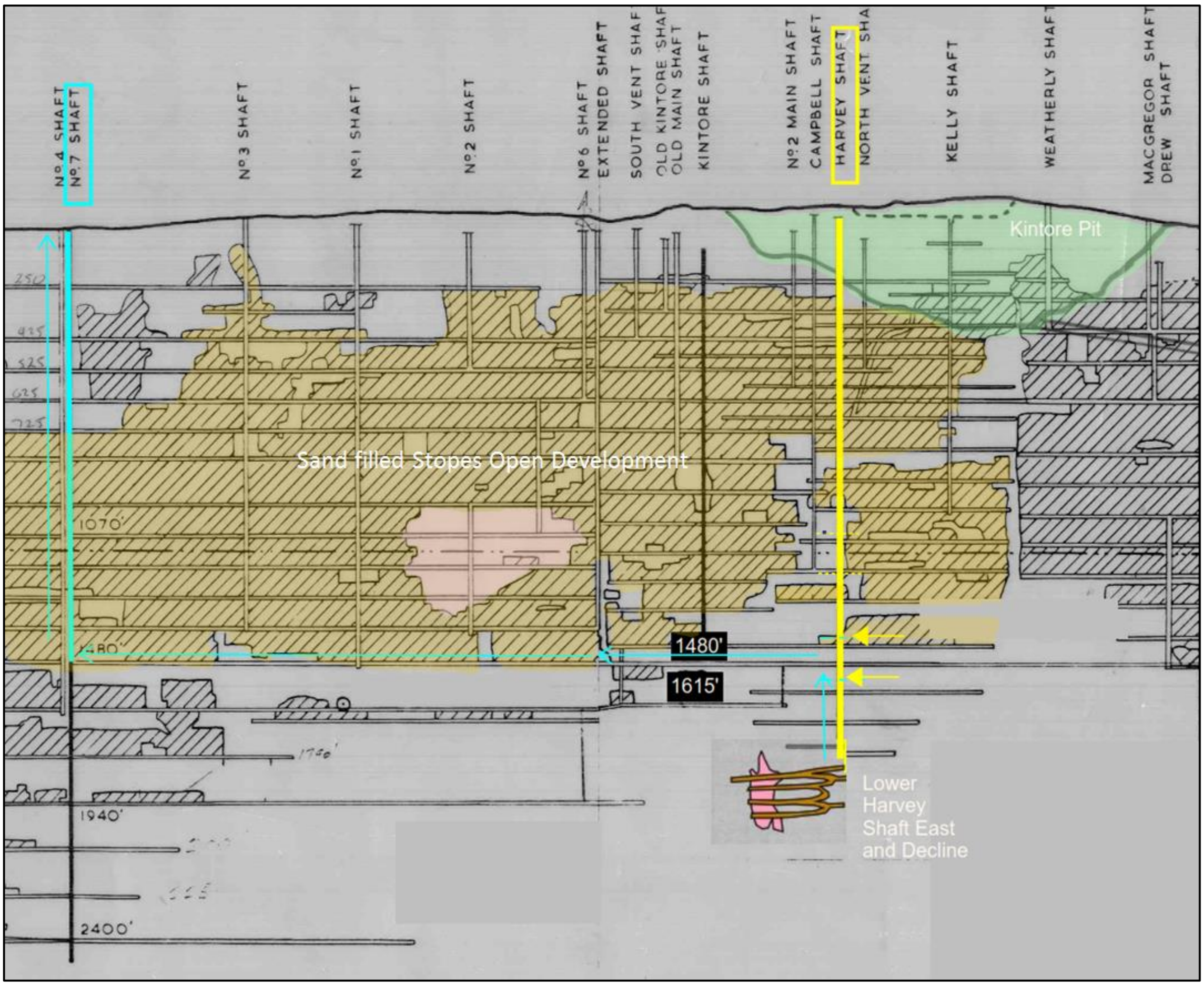


Figure 7- Harvey shaft cross section potential fluid pathway

2.1.2. Filled shafts within the Kintore Pit footprint:

The filled shafts within the Kintore pit are: Harvey Shaft, Campbell Shaft, Old Kintore Shaft, Kintore Shaft, Weatherly Shaft and the numerous Central Mine Shafts, Old Main Shaft, South Vent Shaft and North Vent Shaft (Eastern Footwall) and Kelly Shaft (Figure 8). There is no record of these shafts being filled, however anecdotal evidence (including some shafts with no current surface expression) suggests that all are partially filled.

Figure 8- Kintore Pit shafts and surrounds (shaft collar locations approximate)

An abundance of workings were intersected during the original mining of the Kintore Pit (see Figure 9). To prepare the original Kintore Pit for the portal an unknown quantity of waste rock was used to level the Pit. Any subsequent workings exposed in the floor were filled with waste material. Evidence of workings in the Pit walls suggests that these 3 x 3m drives have collapsed. The introduction of the planned rock fill layer placed into the bottom of the Pit and against the Pit walls will seal the workings. It is important to note that the pit floor does not hold casual water and that increased seepage rates have been reportedly observed after rainfall in the MLD drive indicating that at present there is some connectivity.

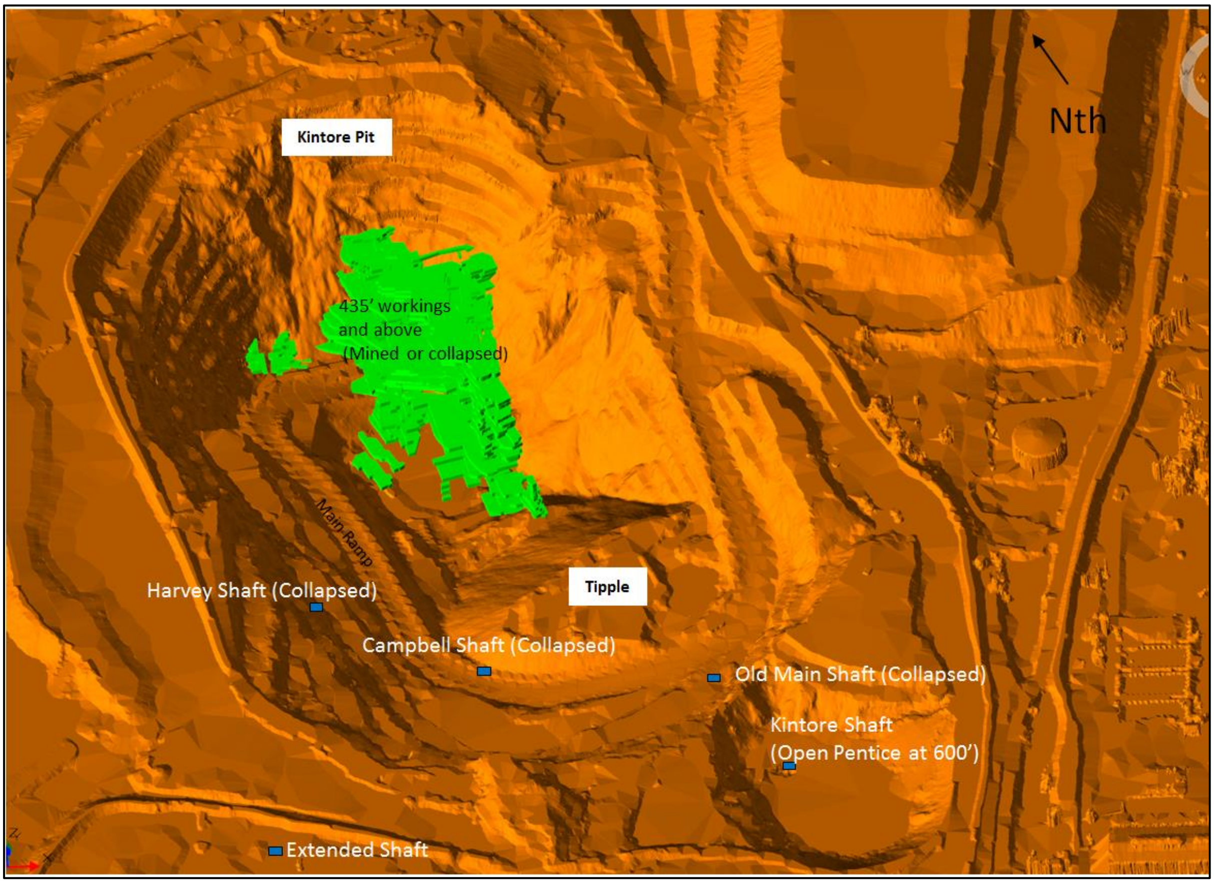


Figure 9- Historical workings mined out in the Kintore pit

NB As the shafts in the ramps do not daylight into the pit and no subsidence has been observed the shafts are assumed to have collapsed and been backfilled.

2.1.3. Historic and current mine workings (lateral development).

A potential pathway for ingress of water involves the area immediately underneath Kintore Pit down to the 525 ft level.

These pathways are linked to the mined excavations in Kintore Pit, shown in Figure 9 denoted as 435' workings and above. These historical filled stopes and crowns, include known and unknown natural voids and potentially large vughs (Beech. G, 1895) which are thought to have suffered significant relaxation, resulting in subsidence, (see Figure 10). In September 2012 it was reported that development into the Crown (of a stope called ML-4S Crown 1) encountered a fall zone (i.e. presumed a zone of rockfall) which had not been recorded on the historical plans. Diamond drilling prior to commencing the development did not highlight the fall area.

This known fall zone identified in the 1920's at the southern end of Block 9 (zone of yellow shading in , Figure 10) appears to have propagated further north than shown in the records.

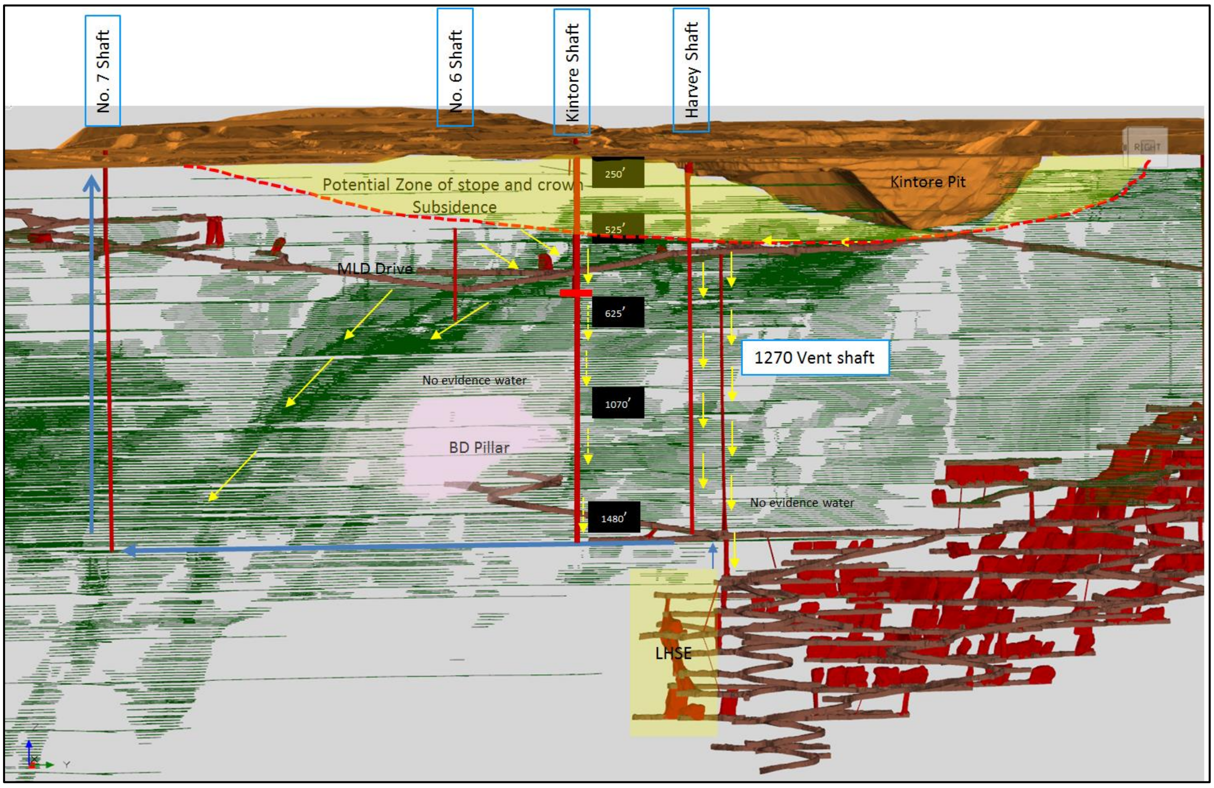


Figure 10- Zone of potential subsidence down to 525' level underneath Kintore Pit (looking west)

The subsided sand filled stopes and crown zones have the potential to hold water or leak water over time. The flow path of this water would be typically down the Main decline, captured by current mine pump infrastructure and / or down the 1270 vent raise and or / down the Harvey Shaft and / or Kintore Shaft (it is not thought that the pentice in place at 600 ft level was designed as a water holding barrier). Kintore Shaft is connected to the 1,480 ft level haul drive by a 600 ft long cross cut and a vertical ladderway, (Newton, 1962). It should be noted that no water is seen or observed at the 1270 ft level at present. If this pathway does make water then the water would lead to Shaft 7 via the 1480 ft level and then be pumped out of the mine. If the fluids made it below to the LHSE without being intercepted then the LHSE would fill over time due to its lower elevation and eventually making its way to the 1480 ft level.

2.2. NORTHERN IMPOUNDMENT

2.2.1. BHP Open Cut Stormwater Seepage

There exists a potential pathway for stormwater seepage through the original BHP open cut workings to the workings in the upper north east wall of Kintore Pit. Currently surface rainfall is diverted around both pits and channelled to on site drains as per the Rasp Stormwater Management Plan. Since mining resumed in 2012 at Rasp there has been no visual evidence for water pooling in the BHP Pit. Historic plans indicate that there is a ~38m distance between the historical open cut intersected in the northern end of Kintore Pit and the southerly open cut that continues into BHP Pit, see Figure 11. The plans indicate that the extent and depth of the Pit is approximate only. The nature of the ground conditions and the presence of fill that could aid in water transfer into BHP Pit or the Kintore Pit indicate this pathway may require further clarification and definition see Figure 12. In the event that water is seen at the base of the existing tailings in the north east wall of the Kintore Pit (through regular and documented geotechnical inspections) then an action plan based upon the Risk Assessment framework, would be developed to address the issue. It is considered that any seepage would be collected by the proposed sump collection system and returned to underground to be pumped out using the existing pumping infrastructure.

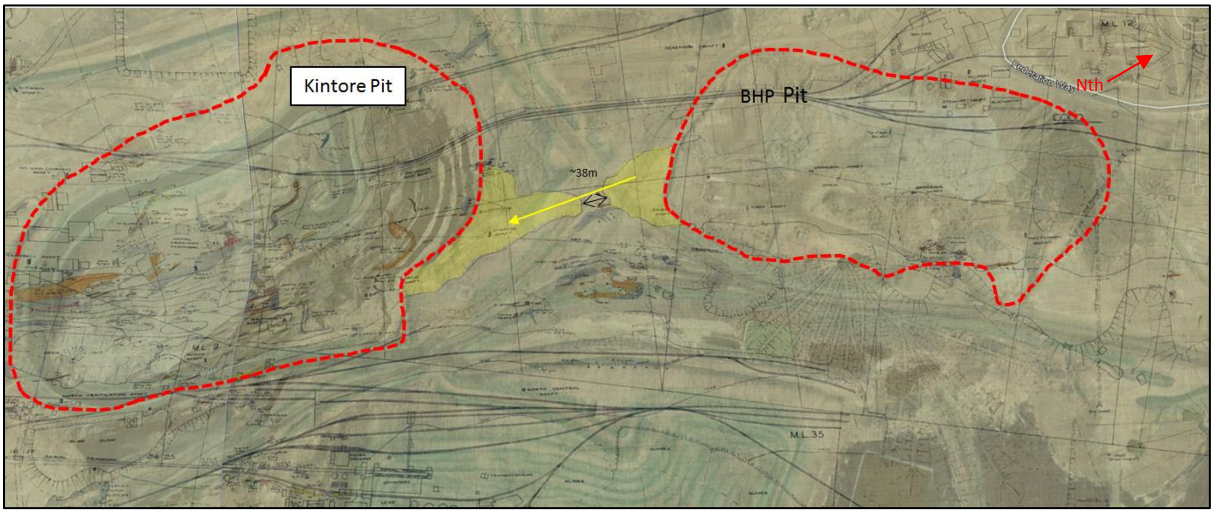


Figure 11- BHP Surface CGS Plan (circa 1930) overlaid with modern site image

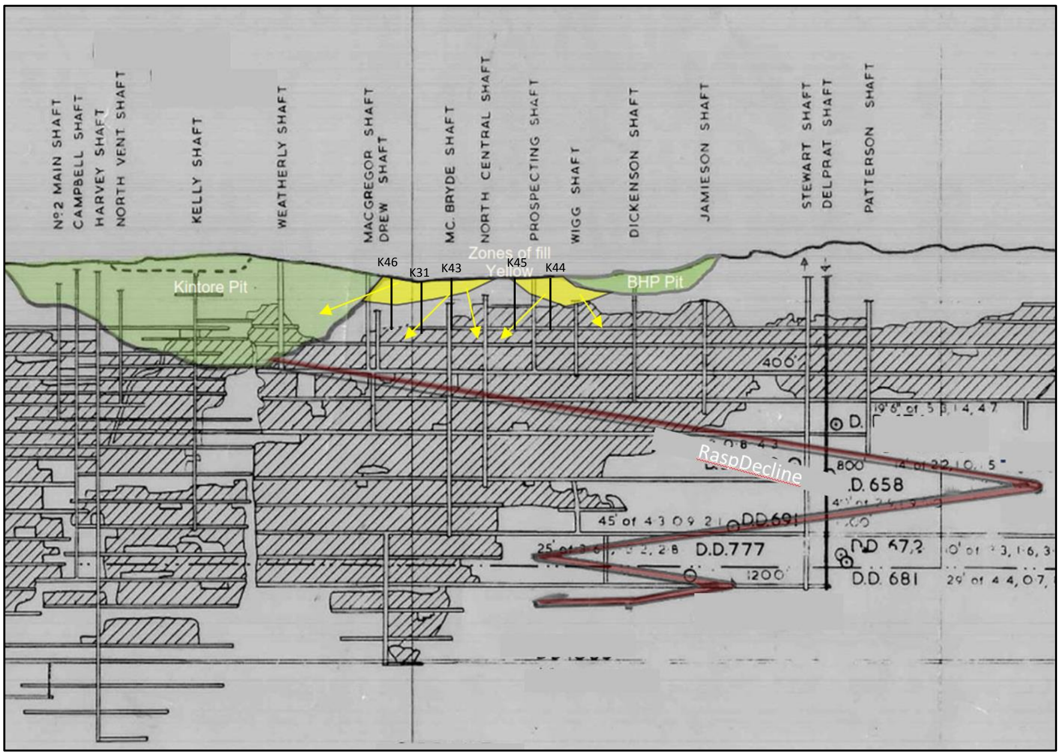


Figure 12- Potential fluid pathway related to historical fill between the BHP Pit and Kintore Pit. Note the 5 percussion drill holes drilled by MMM (locations approximate)

Percussion holes drilled by MMM (including holes K46, K31, K43, K45 and K44, see Figure 12) indicate poor ground conditions and the presence of fill material in this zone. In addition, percussion intercepts match the depth of the fill in the north eastern wall of the Kintore Pit, see Figure 13. It is important to note that no seepage has been observed at the base of the existing tailings within the Kintore Pit.

Figure 13- Fill/tailings slope in North Eastern wall of the Kintore Pit

2.2.2. Intact Footwall Shafts

Weatherly Shaft is the main shaft located in the eastern part of Kintore Pit. It has the capacity to divert water through possibly still intact footwall drives within Block 11 through Mc Brydes Shaft and primarily through the 400 ft, 500 ft, 600 ft, 1000 ft (Western Mineralisation 7 Sub) connection and 1200 ft Levels. These connections lead to Delprat and Stewart Shafts (Figure 14, Figure 15 and Figure 16) which have a connection to the Western Mineralisation workings through the 1000 ft level. Because the 1000ft level is open, this is the potential main pathway for water to future mining in the Western Mineralisation.

Figure 14- Surface shaft Collar locations and current status

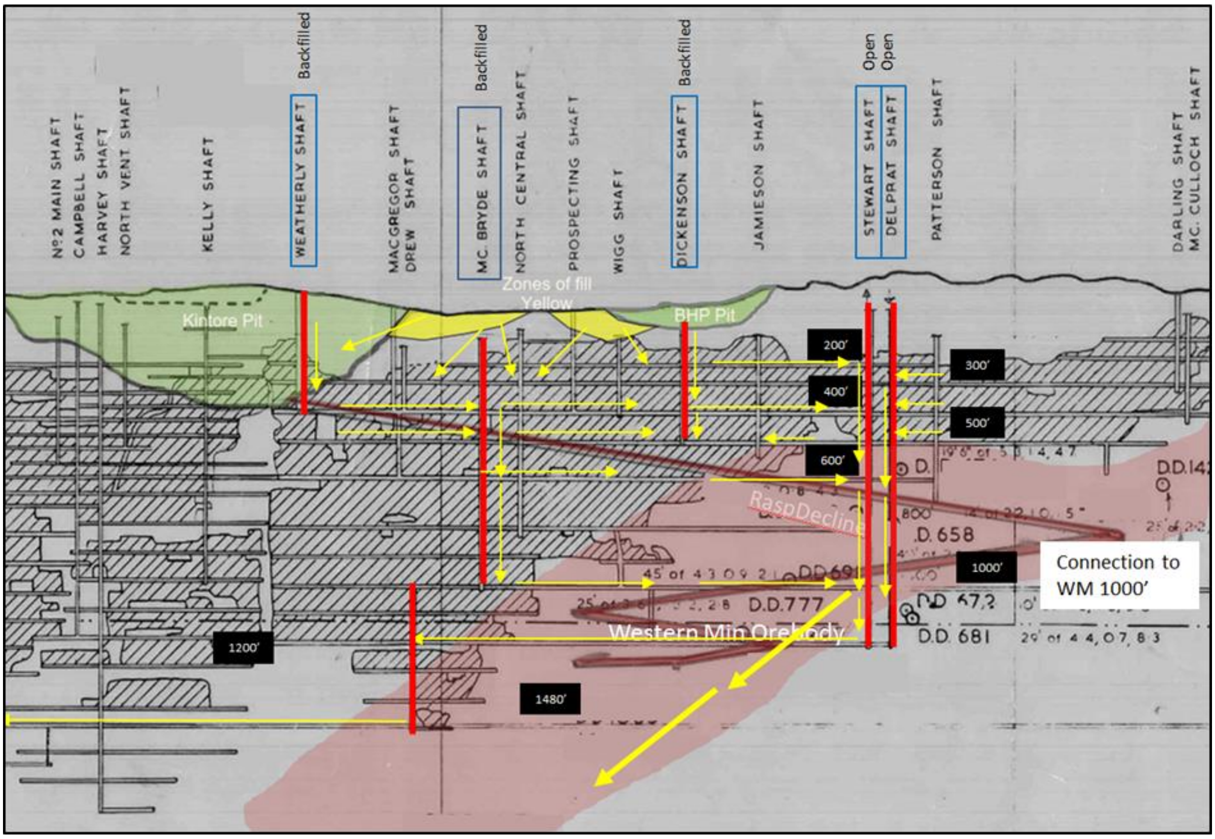


Figure 15- Potential pathways for Weatherly, McBryde Shaft, Dickenson Shaft, Stewart Shaft and Delprat Shaft

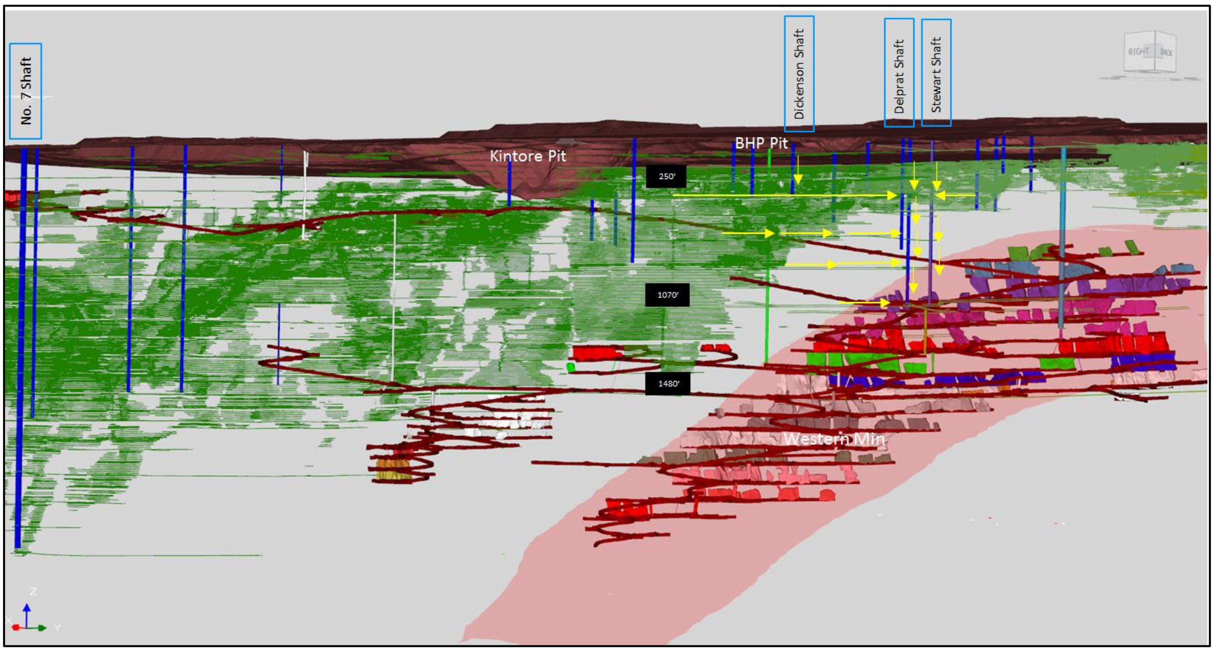


Figure 16- Potential fluid pathways for the Dickenson Shaft, Stewart Shaft and Delprat Shaft

Another potential fluid pathway involves the Dickenson Shaft (collapsed and backfilled), Stewart Shaft (open) and Delprat Shaft, (open) (see Figure 17 for surface collars) and the interaction with the 200 ft, 300 ft 500 ft and 1000 ft.

In the unlikely event that significant water accumulated (via the historical workings on the 200 ft, 300 ft 500 ft levels) within the shafts and open drives, the resulting head of water may have high enough head pressures that could result in an inundation impact to the Western Mineralisation at the intersecting 1000 ft level.

Dickenson's Shaft (collapsed – Backfilled) Stewart Shaft (Open)

Delprat Shaft (Open)

Photo Date 11/03/2020

Figure 17- Surface Collar Photos of Dickenson Shaft, Stewart Shaft and Delprat Shaft.

It is important to note that Delprat Shaft is linked to the current 1000 ft level and that this shaft is not making water as at January 2021.

2.2.3. Block 11 – 9sub Level drainage link

In February 2016, the 9sub drive broke through into the historical 1315 ft mine workings when being mined from north to south. Mining was stopped and approximately 10m of the drive was immediately backfilled from the 9 level (see Figure 18), prior to taking the B11_9s_144 DH from the 9 level (not shown on section). This breakthrough has the potential to act as a fluid pathway draining the 1315 ft Block 11 water filled sand fill mine area to the Western Min. via the 10 level and the 1480 to the WM 12L through the 10L RAR (Return Air Raise) and the escape airway.

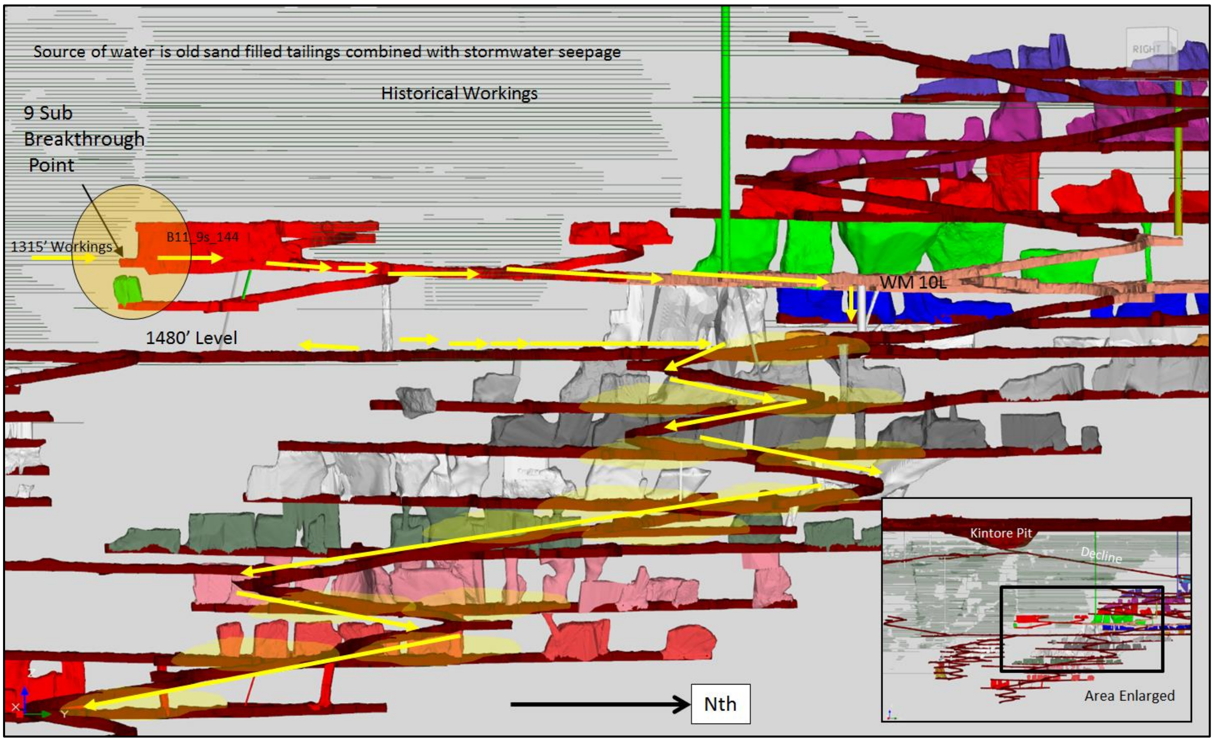


Figure 18- Potential WM fluid pathway from 9sub and connection with the 1315 ft workings

2.3. POTENTIAL FOR PILLAR FAILURE TO INDUCE A FLUID PATHWAY

In the event of a large scale regional seismic event (big enough to potentially liquefy saturated tailings) it is feasible (however, unlikely) that backfilled/ partially backfilled or open stopes within the Kintore Pit or in other areas of the mine may collapse and induce a fluid pathway - if these workings form a connection with an existing water body.

The critical controls proposed to manage the risk of tailings or water entering historic and active workings within the proposed TSF3 include:

8. Filling of the MLD drive with waste to remove access beneath the Kintore Pit.
9. Dewatered tailings co-disposed with waste rock, compacted and placed in the Pit as engineered fill.
10. Installation of a drainage layer in the Pit with a seepage collection system managed as part of current mine dewatering system.
11. Rock fill (waste rock) layer placed over and against historical workings in the bottom and walls of the Pit.
12. Installation of an engineered barrier at the underground portal entrance.
13. Filling voids in Pit walls as they become known and accessible.
14. Monitoring of placed tailings to monitor liquefaction potential of tailings; And as required additional barriers will be installed at specified locations if liquefaction potential is identified from monitoring.

These additional barriers at specified locations to isolate active areas from the risk of inrush are only required if the tailings have the potential to liquefy, for this to occur three conditions must be satisfied:

4. Tailings at near saturation
5. Tailings void above the critical void ratio
6. Change in stress condition, such as a breach of the rock surrounds into historic mine workings or a rise in the water levels within the tailings.

It is proposed to periodically assess the potential liquefaction risk of the placed tailings in the Pit by conducting in situ testing of the entire depth of tailings. According to Golder, this will enable an assessment to be made whether the tailings are dry or wet and approaching conditions, (identified above) , conducive to liquefaction. Only then will the additional barriers be installed, (Golder, 2020 (1896230-047-Rev1)).

If all the first 3 critical controls fail four major open stoping voids exist of potential concern which would require the fourth control – i.e engineered barriers: one located in the vicinity of the 1480 drive (Figure 19 and Figure 20) and the other Block 11- 10sub level stopes (Figure 21). An additional two are directly proximal to the Kintore Pit, West Void Pillar (Figure 22) and 525-1 stope void, (Figure 23).

2.3.1. Failed and unfilled 1480s stopes

A series of stopes were attempted to be mined in 2015 from the 1480 ft sub level. These stopes called the 1480 sub stopes were mined as blind uphole stopes and due to the relatively long strike lengths the stope crowns failed (see Rip up area in Figure 19). In addition to the crown failure, reports of large rocks, water and timber preferentially reporting to the drawpoints were observed prior to abandonment. The presence of large amount of timber and water (derived from stormwater seepage and sand fill) indicate that the stopes have breached up dip of the Main Lode shear into the historical workings, 1480 ft and above. The total estimated maximum void in this area is 4,404m^3, see Figure 19.

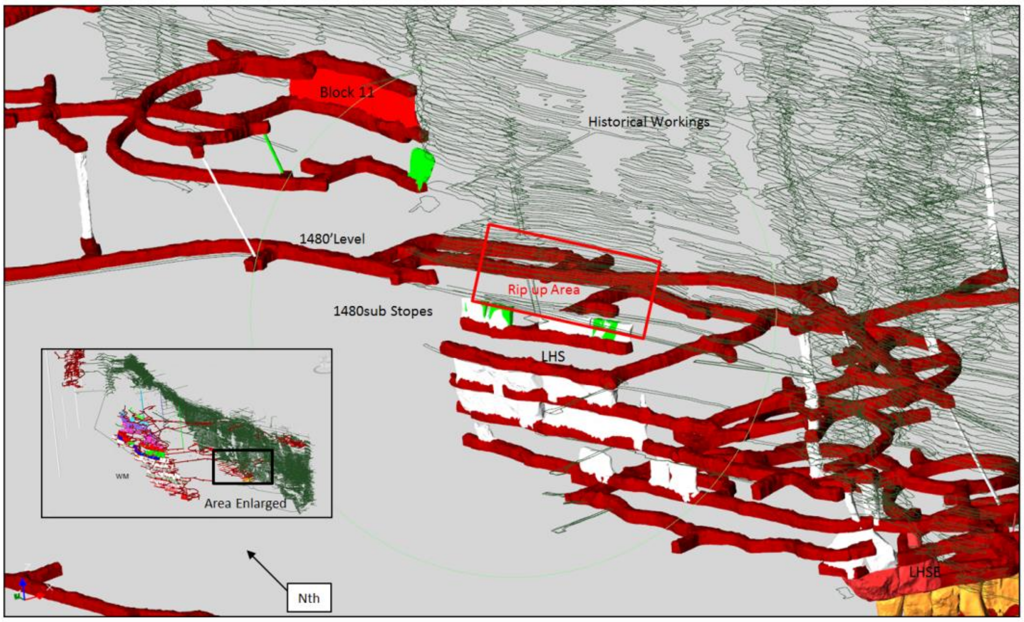


Figure 19- Oblique view showing locations of 1480sub stopes in relation to Western Min.

These stopes were not backfilled and left to subside, the 1480 sub drive itself was backfilled with waste. A total maximum unfilled void potential of 4,404m^3 in Main Shear hosted ore could potentially exist however reports indicated that draw points were choked with large rocks prior to abandonment. Water generated (arising from stormwater seepage and sand fill seepage) from the stopes is pumped out utilising the current mine pumping system. In the event that an water generated from flows derived from the 1480 ft level the fluid pathway would move down the MLD Decline and report to the 1615, 1630, 1715 and 1715sub levels, (see Figure 20).

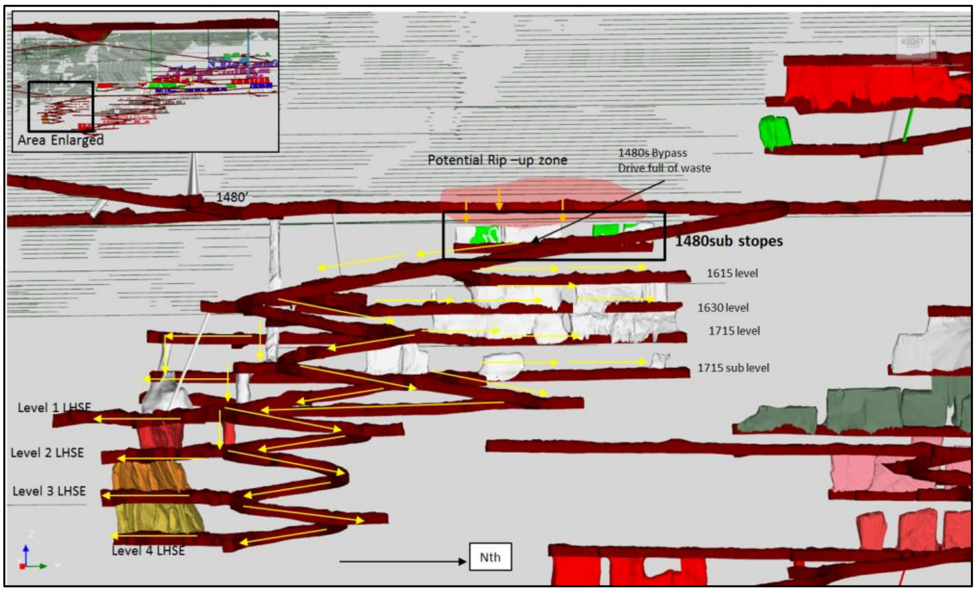


Figure 20- Pathways associated with ingress from the 1480sub stopes to LHS and LHSE.

2.3.2. Unfilled 10s Stopes:

The 10sub Block 11 stope represents a total maximum open unfilled void of 4,161m^3, see Figure 21, (denoted by rectangular box in upper right hand quadrant of diagram). These stopes could not be filled due to the 9sub downhole stopes being taken first.

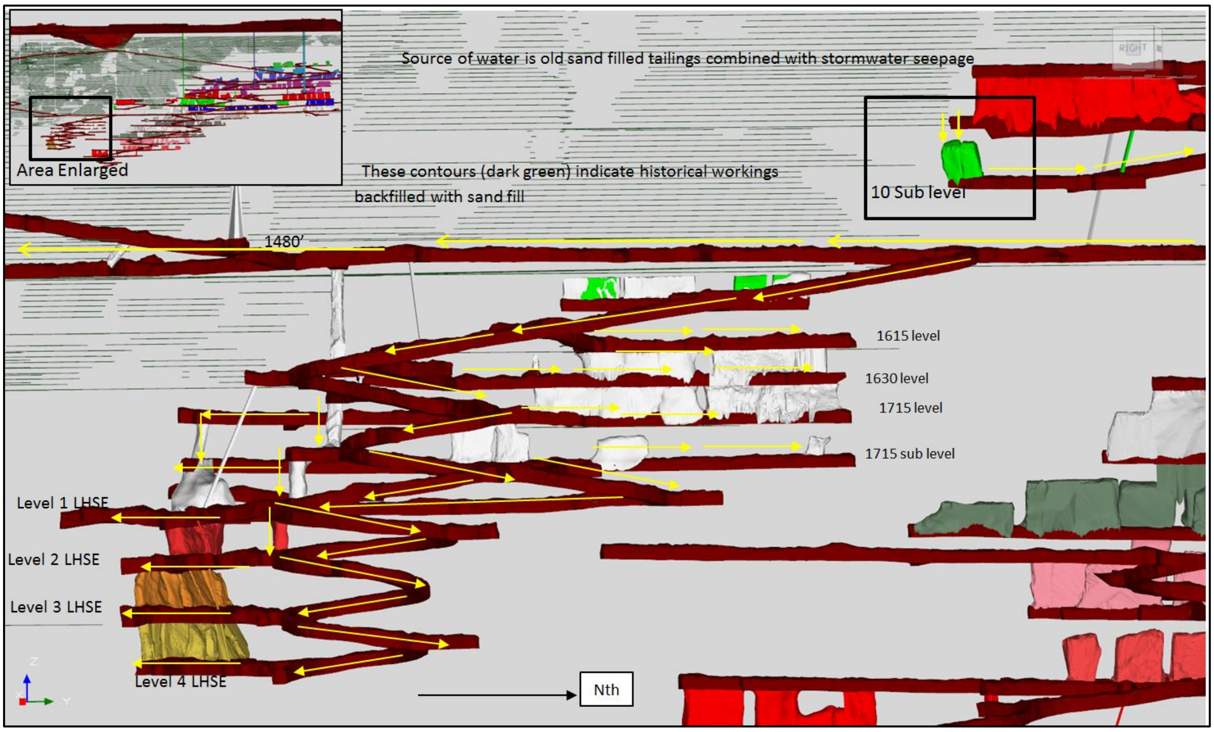


Figure 21- Block 11 10sub stope illustrating fluid connectivity with the 9sub failed stopes.

Water derived from stormwater seepage and saturated sand fill would accumulate in the 10sub level drive and fill up the drive eventually moving up the 10 sub level drive onto the 1480 ft drive and then report to the Shaft 7 pump as described in Figure 10. An additional pathway may also be evident as per Figure 18.

2.3.3. West Pillar Void: ML Crown

The "West Pillar" stope off the MLD drive under the historical 3 level workings was taken in 2014. This stope was left as a planned open void (954m^3) and the crown rapidly deteriorated as a result of a large open void immediately above the stope. This stope crown dropped revealing a large historical mining void as a result of the intersection (see Figure 22). This area is close to the boundary of the zone of subsidence noted in Section 2.1.3. Within this zone of subsidence it was customary underground to fill the historical stopes with sand fill. It is unsure if the large void above the West Pillar stope was filled with sand, however erosion of this sand fill could become a potential channel way for fluids from the Kintore Pit and destabilise the southern wall of the Pit.

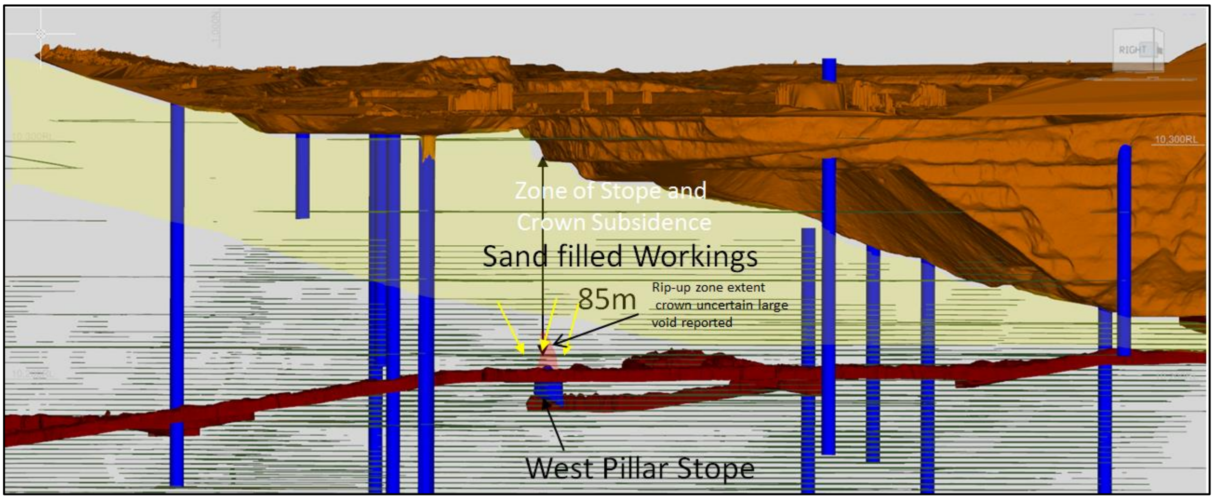


Figure 22- Potential pathway from Kintore Pit to West Pillar stope below the historical 3L workings

In the event of a liquefaction event the potential resulting fluid pathways would be the same as defined in Figure 10.

2.3.4. 525 1 Stope Void:

A final potential fluid pathway identified is the open / partially open MLD 525-1 stope, (see Figure 23). This stope lies off the MLD drive and was fired and mined in 2013. This stope performed poorly from the outset due to firing issues, with stope inspection reports from that time period indicating an abundance of loose sandfill. The original void shape volume immediately post extraction was 2,440m^3. In an attempt to recover remaining economic ore the sand was extracted. However, it is unknown how much sand was extracted after the CMS.

The potential fluid pathways would be the same as those identified above in Section 2.3.3.

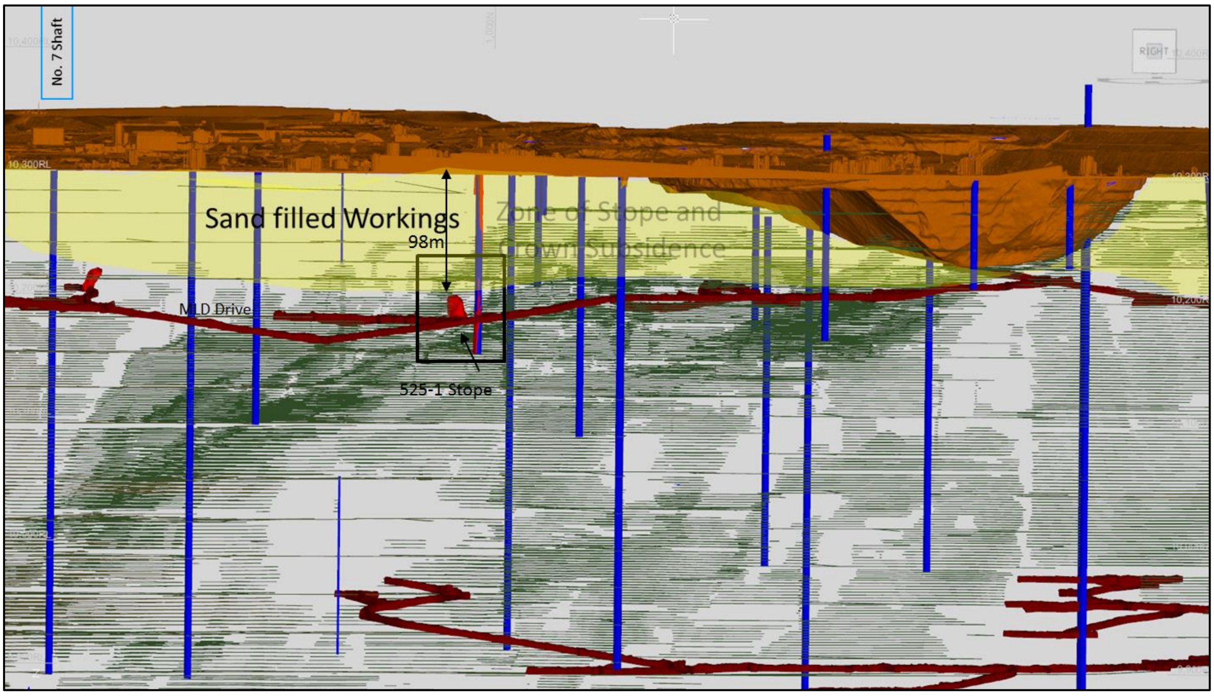


Figure 23- Potential pathway to 525-1 stope below the historical 3L workings

2.3.5. Potential Northern Fluid Pathways, with respect to TSF2.

The Thompsons Shaft is located in Block 16 and was opened late within the British Mine in 1910, Figure 24- Thompsons Shaft (after Nixon 2017)and Figure 25. The Shaft depth is 365m in depth and the Shaft collar is capped with a steel grate. The Shaft itself is classified as of historical significance and is timber lined and still in good condition. All workings are historical dating from 1910 to 1930.

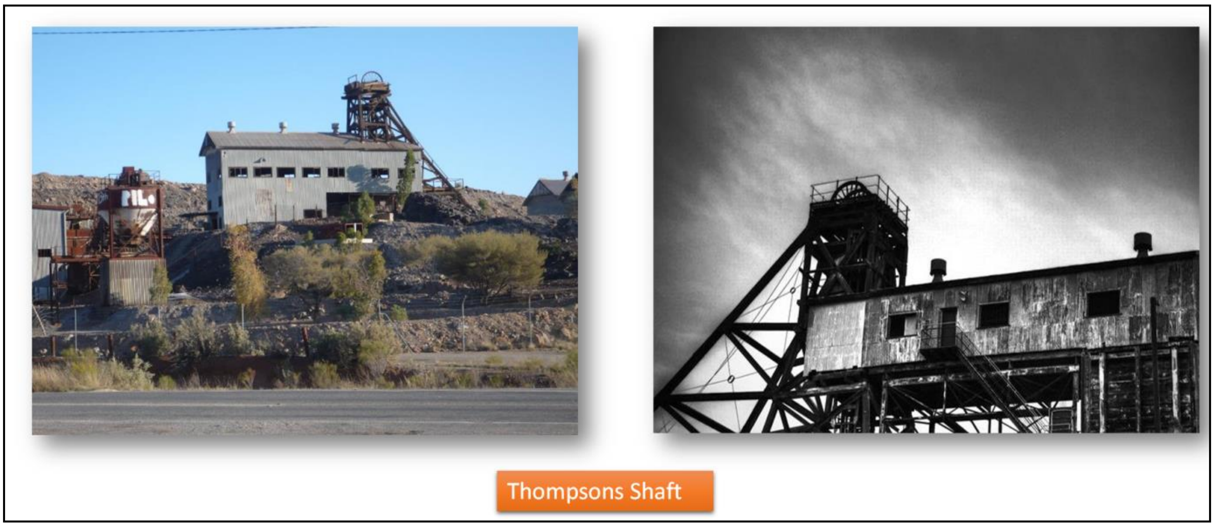


Figure 24- Thompsons Shaft (after Nixon 2017)

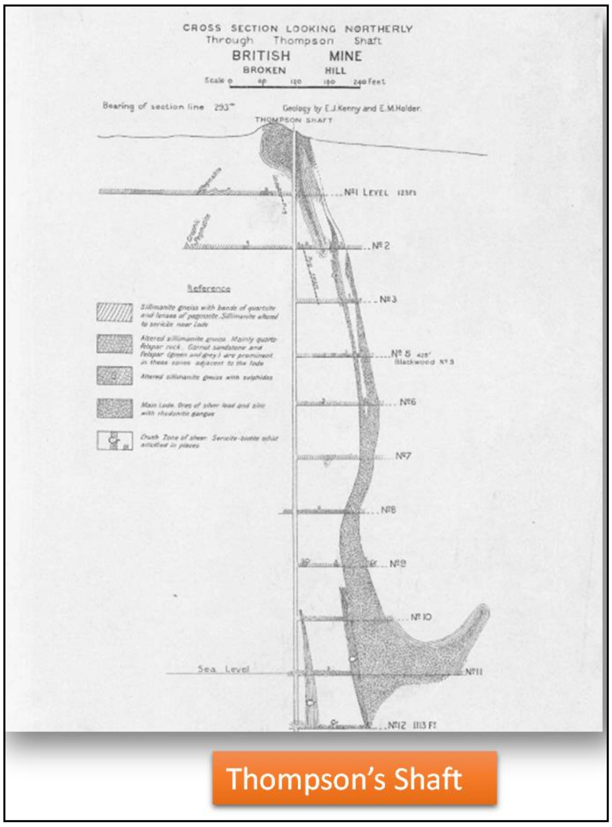


Figure 25- Thompson's Shaft (looking North) - 1922 (After Nixon, 2017)

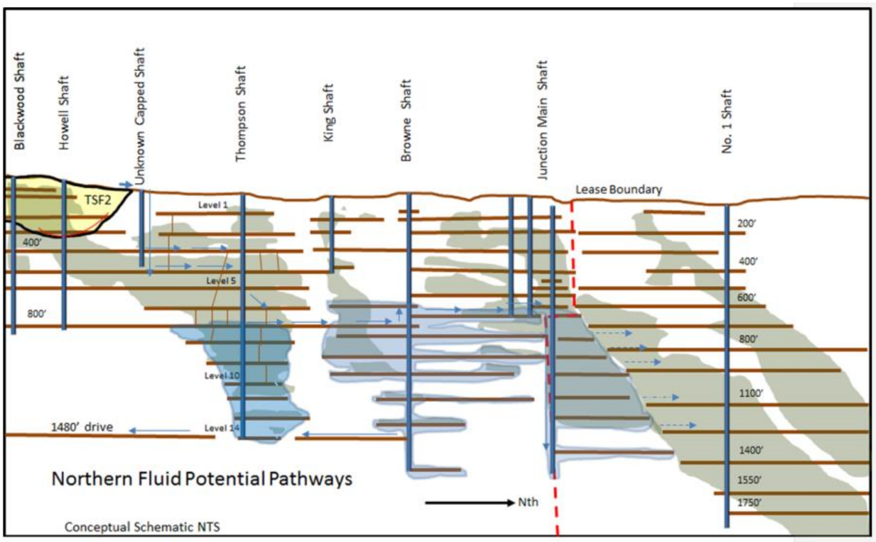


Figure 26- Thompson and Browne Shaft Potential Fluid Pathways

Golder Associates Pty Ltd have completed a Dam Break Assessment for the installation of embankments of TSF2, indicating that the Thompson Shaft would not be inundated in the event of a failure of embankment 2 of TSF 2 (Parker M, Jan. 2020). In the unlikely situation where the embankment experienced an H6 failure event (an event that results in conditions that are unsafe for vehicles and people. All building types are considered vulnerable to failure), the water would flow from the embankment and impact (potentially erode) the concrete plug of the Unknown Capped Shaft (

Figure 26) adjacent to the TSF2. The water could then inundate the lower working levels of the Thompson Shaft area and saturate all of the levels up to an including the 800 ft level, (see

Figure 26). It is assumed that the water would then fill the 800 ft level and form a connection with the Browne Shaft.

The Browne shaft, unlike the Thompson Shaft is connected to the 1480 ft south sloping drive and some water would report to the Shaft 7 as a result (~3.4Kms). Minor water would also report to the Junction Mine. According to the historical long sections the Perilya North Mine levels are offset from the Junction Mine levels, which may effectively seal the Junction Mine historical workings from the Perilya No.1 shaft level workings, effectively mitigating the risk of inundation. This offset requires further confirmation.

3. ADDITIONAL BARRIER LOCATIONS

Preliminary additional barrier locations are based on the minimum number of barriers required to isolate historic Main Lode workings from current mine openings. These locations remove the 'unknown' from the inrush potential by installing barriers at known locations where historic workings have been intersected. This will involve blocking access to the BD Pillar, LHS and LHSE mining areas on completion of mining in these areas. It should be noted that these barrier locations have been selected with the aim of minimising the number of barriers required. Maintaining access to other Main Lode areas is still possible, however the number of barriers required will subsequently increase. Maintaining access to these areas should be reviewed in conjunction with the Exploration Department to identify any high potential targets that may have specific access requirements.

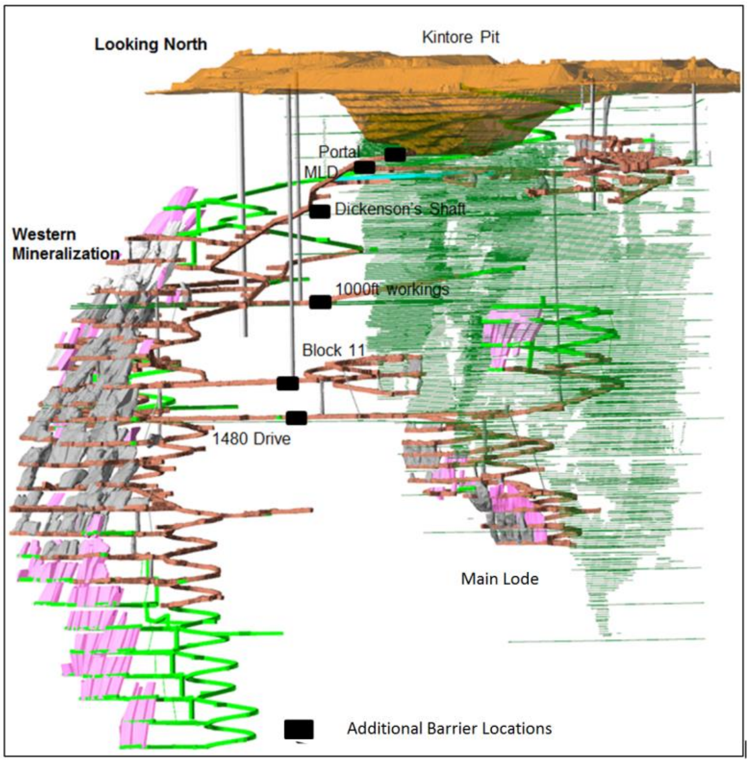


Figure 27- Proposed Barrier Locations

Preliminary design work highlights the following locations as the minimum required to isolate the inrush potential. This involves a separation between the Main Lode and Western Mineralisation workings. As mentioned previously, if access to specific Main Lode areas is critical for the Life Of Mine strategy, additional barriers and strategies will be required. All pathways are defined in Section 2.

- Portal (Planned to install before start of tailings placement)
- MLD
- BLK 11
- 1480 Drive
- 1000 ft
- Dickenson's Shaft Western Min Decline below SP3

The barrier positions are illustrated above in Figure 27. In addition to the construction of the barriers above, two internal rises have been identified as an inrush risk if left open. These are the MLD-1270 rise and the BLK 11 exhaust rise. The 1480 drive barrier will control the risk posed by the two raises if they are open when Kintore Pit tailings / waste rock co disposal placement begins.

Barriers will require engineered designs to ensure they are adequate to control the identified hazards

3.1. GEOTECHNICAL INSPECTION NOTES OF POTENTIAL BARRIERS

3.1.1. Western Min Decline below Portal

Fair to good bedded rockmass (RQD 60), 3 joint sets (Jn 9), Planar Rough (Jr 1.5), Surface Stain Only (Ja 1), Dry (Jw 1), Near surface (SRF 2.5). Fair Rockmass (Q 4). Coordinates 9727mN, 1365mE, 10226mRL. Corroded split sets through shotcrete. Shotcrete to grade, no major cracking. Signs of salt precipitation but no noticeable water inflows (decline sprays).

Further geotechnical detail can be found in Tucker,C., 2019 G01986_AA_REO01_V04.

3.1.2. Western Min Decline below intersection with MLD

This Barrier location is illustrated in Figure 28 and referenced by the following coordinates 9962mN, 1148mE, 10212mRL.

Geotechnical characteristics: Fair to good bedded rockmass (RQD 50-60), 3 joint sets (Jn 9), Planar Rough (Jr 1.5), Surface Stain Only (Ja 1), Dry (Jw 1), Near surface (SRF 2). Fair Rockmass (Q 5). Moderately corroded resin and mesh in backs, moderately corroded split sets and mesh in sidewalls to grade, minor scats. Intersection with MLD shotcreted. Dry rockmass, damp area in photos due to decline sprays.

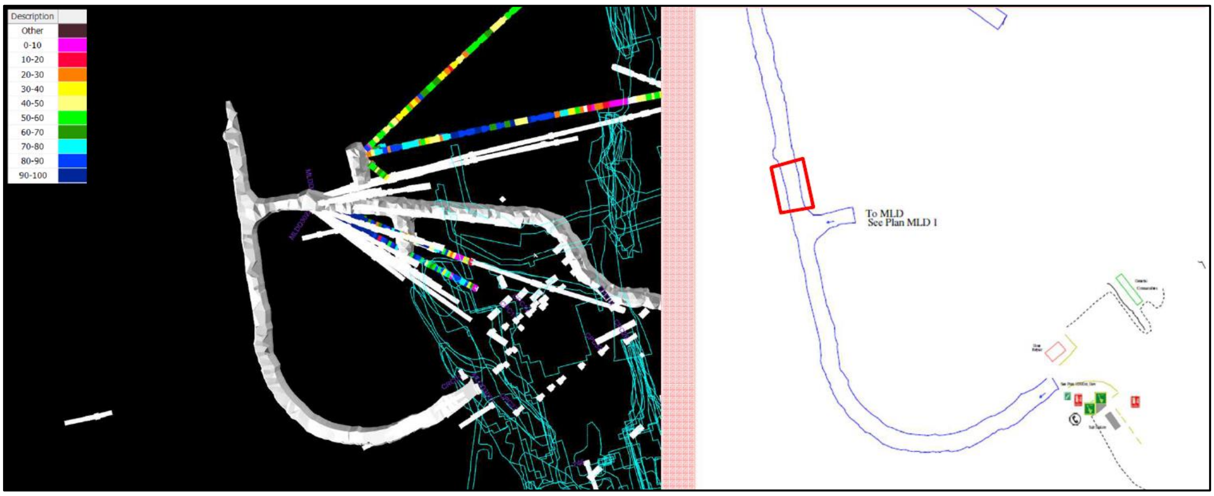


Figure 28- MLD Barrier Location and Drill hole RQD

The physical location photos are shown below in Figure 29.

Figure 29- Photos or proposed barrier location (Western Min Decline below MLD)

3.1.3. Block 11 Access Incline east of ladderway intersection

This Barrier location is illustrated in Figure 30 and Figure 31 and referenced by the following coordinates 9451mN, 1698mE, 9944mRL.

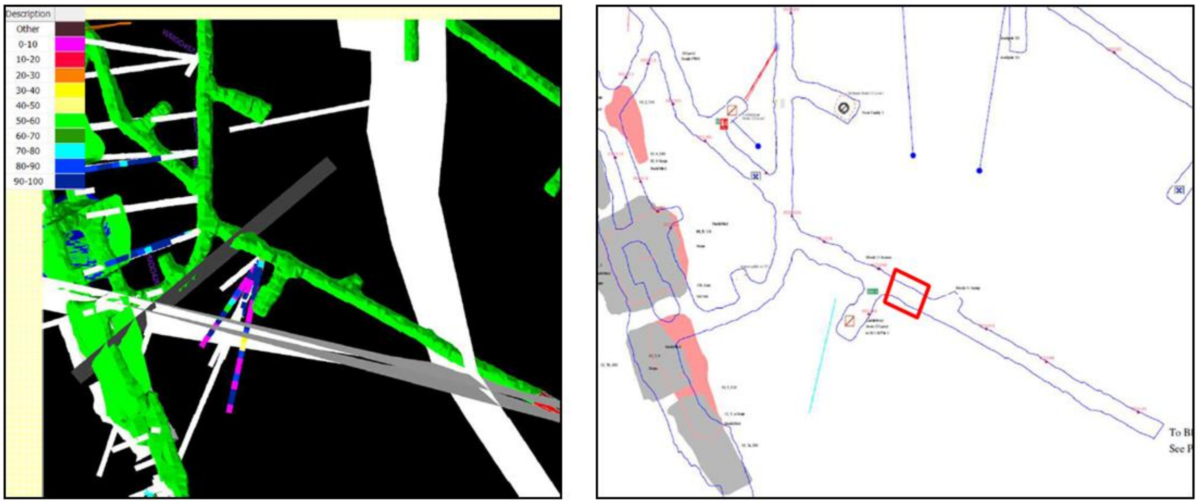
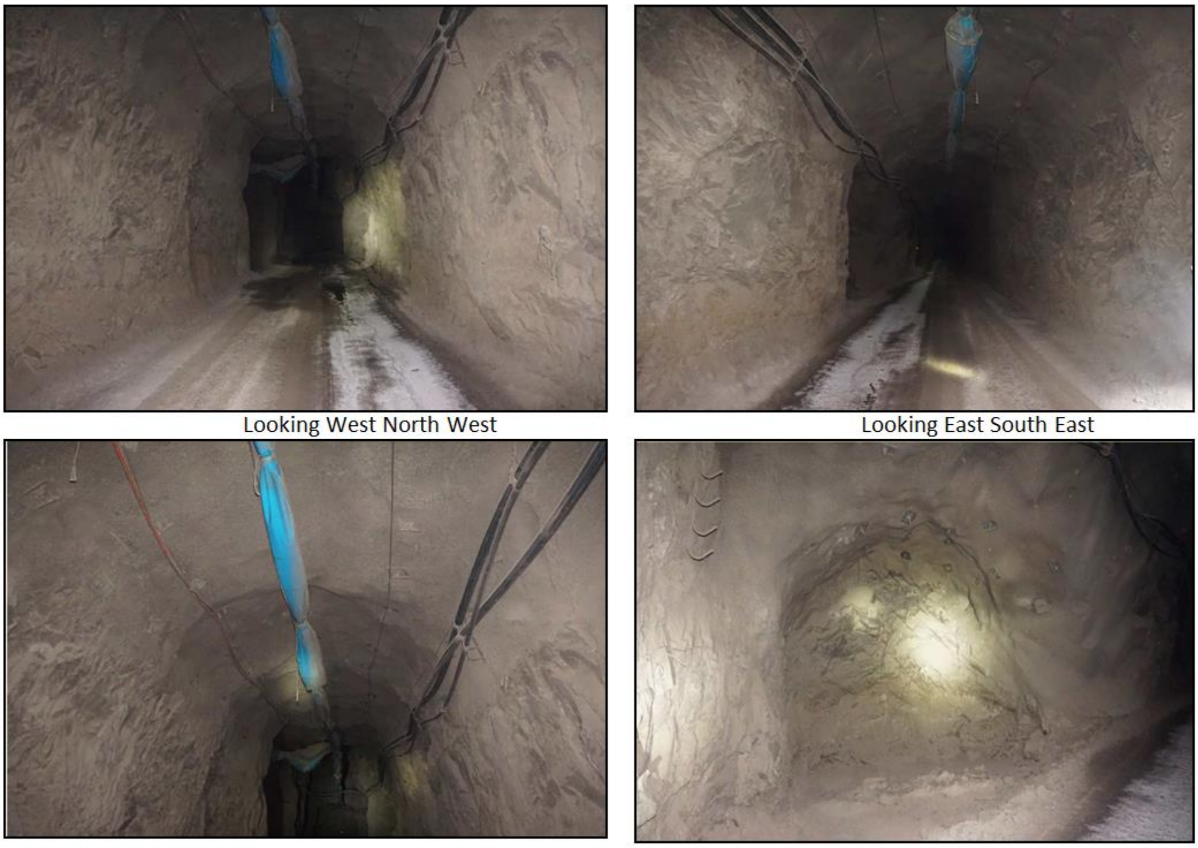


Figure 30- Block 11 Barrier Location



Looking West North West

Looking East South East

Backs West North West

Inactive Sump Looking North North East

Figure 31- Block 11 Barrier Location – Photos

Geotechnical Characteristics: Fair to good bedded rockmass (RQD 50-60), 3 joint sets (Jn 9), Planar Smooth (Jr 1), Surface Stain Only (Ja 1), Dry (Jw 1), Medium confining stress (SRF 0.5). Good Rockmass (Q 13). Lightly corroded resin through shotcrete in backs, moderately corroded split sets in sidewalls. Dry rockmass. Sump inactive, filled in.

3.1.4. 1480 Access Drive west of intersection with airway

This Barrier location is illustrated in Figure 32 and Figure 33 and referenced by the following coordinates 9600mN, 1514mE, 9900mRL.

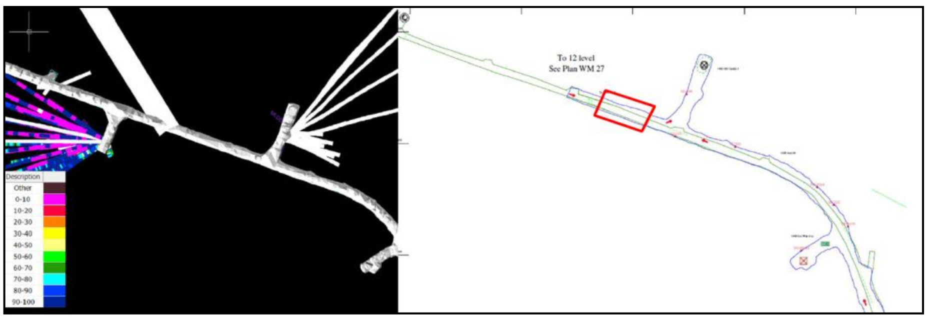


Figure 32- 1480 ft Barrier Location

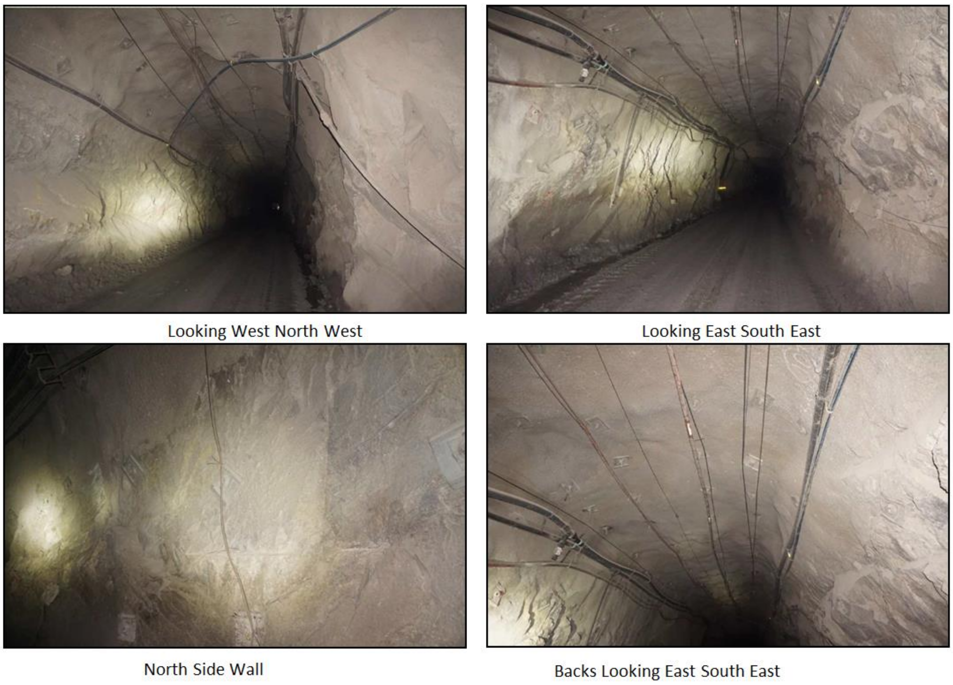


Figure 33- 1480 ft Drive Barrier Location – Photos

Geotechnical Characteristics: Good bedded rockmass (RQD 70-80), 3 joint sets (Jn 9), Planar Rough (Jr 1.5), Surface Stain Only (Ja 1), Dry (Jw 1), Medium confining stress (SRF 0.5). Good Rockmass (Q 27). Lightly corroded resin through shotcrete in backs, moderately corroded split sets in sidewalls. Dry rockmass.

3.1.5. 1000 ft Level East of Parkbay

This Barrier location is illustrated in Figure 34 and Figure 35 and referenced by the following coordinates 9612mN, 2052mE, 1046mRL.

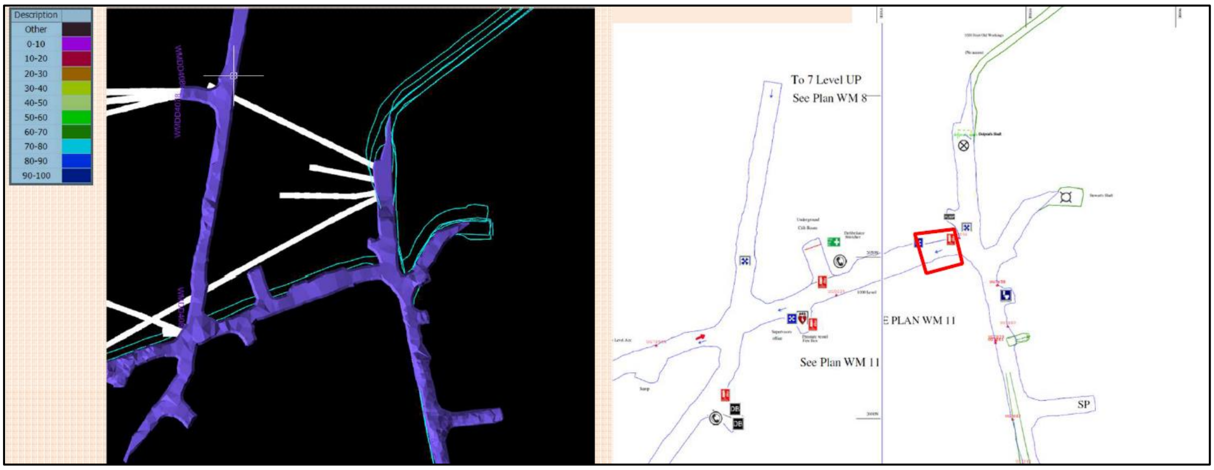


Figure 34- 1000 ft Barrier Location

Geotechnical characteristics: Good bedded rockmass (RQD 60-70), 3 joint sets (Jn 9), Planar Smooth (Jr 1), Surface Stain Only (Ja 1), Dry (Jw 1), Medium confining stress (SRF 0.5). Good Rockmass (Q 16). Moderately corroded resin through shotcrete in backs, split sets through shotcrete in sidewalls. No major cracks. Dry rockmass, damp area due to sump.


Looking South West

Looking North West


Backs Looking East


Backs Looking North West

Figure 35 - 1000 ft Barrier Location – photos

3.1.6. Dickenson's Shaft Western Min Decline below SP3

This Barrier location is illustrated in Figure 36 and Figure 37 and referenced by the following coordinates 9903mN, 1149mE, 9906mRL.

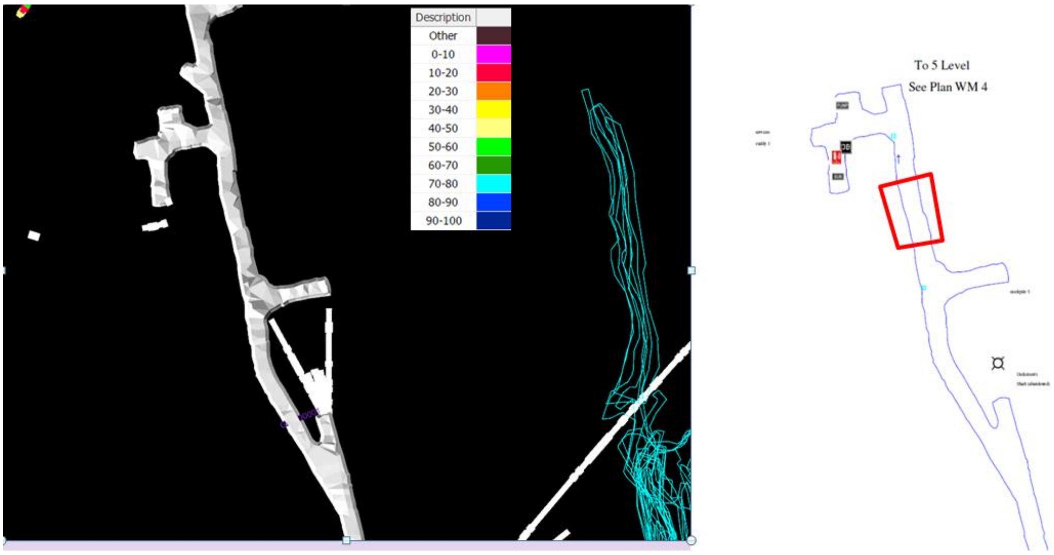


Figure 36- Dickenson's Shaft Western Min Decline below SP3 barrier Location

Figure 37- Dickenson' s Shaft Barrier Location – Photos

Geotechnical Characteristics: Fair to good bedded rockmass (RQD 50-60), 3 joint sets (Jn 9), Planar Rough (Jr 1.5), Surface Stain Only (Ja 1), Dry (Jw 1), Near Surface (SRF 2). Fair Rockmass (Q 4). Lightly corroded resin through shotcrete in backs, lightly corroded split sets through shotcrete in sidewalls. Dry rockmass.

3.2. ORDER OF BARRIER PLACEMENT

The portal barrier will be in place before tailings placement to Kintore Pit commences. If required the order of installation of the remaining barriers will depend on the risk of inundation on each area.

3.3. INRUSH CONTROL ZONES AROUND HISTORIC WORKINGS

As per the PHMP Inrush and Inundation suitable Inrush Control Zones (ICZs) around the historic workings will be determined by risk assessment as required. Any work within an ICZ will require additional controls to be determined by risk assessment. This would include drilling remnant pillars, mining within active pillars etc.

The location of the ICZs will be reviewed annually to ensure they are effective. Crew training will be required, as part of the Ground Awareness Training.

Underground an ICZ will be delineated by a specific barricade and spray paint on the walls and back of drive. The location of the barricades will be reviewed annually as part of the Geotechnical Drive Condition assessment.

The mine design software will be updated so that the ICZ limits are shown on Mining Instructions (MI) and other design documentation.

4. WATER MONITORING REQUIREMENTS AND WATER MANAGEMENT

4.1. AIM OF MONITORING PROGRAM

A groundwater monitoring program will be developed, with the aim of the monitoring program to:

- Monitor groundwater levels, commencing at least 12 months prior to tailing deposition into Kintore TSF3.
- Identify potential groundwater changes during mining and post mining with particular attention given to the effect of changes to ground water regime, impact on the catchment yield and interaction with the stored waters.
- Identify hydraulic characteristics of overlying and intercepted groundwater systems, and determine changes to ground water systems due to mining and dewatering operations.
- Collect water level data from all agreed groundwater-monitoring locations
- Monitor seepage rates at identified yet to be determined location points

4.2. MINE WATER BALANCE

RASP currently use flow meters for daily water balance calculations. These flow meters are located on the 12L North Footwall Drive, Pump Station 3, Lower Harvey Shaft Mono and S22 Dam from Pump Station 1.

The aim of monitoring is to detect any abnormal flow within the system. This allows the mine to identify when surface water is a component of an inflow and to detect any other ingress of water from underground sources.

There are stages of monitoring control, they are:

- **Principal Monitoring Controls** are the primary means of defining and initiating a response to abnormal water flows and inundation. This control is the combination of underground water balance determinations related to the current mining areas, coupled with regular sampling to provide the data that establishes trigger levels and responses related to defined levels of Kintore TSF water inflow to the workings.
- **Secondary Monitoring Controls** will result in triggers that alert mine management to the potential for an abnormal inflow and that initiate low level alarms within the principal monitoring Trigger Action Response Plan (TARP). They are the monitoring components used to provide early warning of a potential water inflow to the workings and that may activate an alarm. The secondary monitoring controls will monitor the following;
    - Groundwater (piezometer, seepage at plugs) –Procedure yet to be determined
    - Subsidence (Monthly inspection by Geotechnical Engineer) as per PHMP Ground and Strata Failure
    - Surface water (Including rainfall runoff) as per inspection regime detailed in the PHMP Ground and Strata Failure
    - Underground mine water balance through current monitoring methodology of Shaft 7
    - Visual inspections of underground workings as per inspection regime detailed in the PHMP Ground and Strata Failure
    - Visual inspections of plugs–Procedure yet to be determined
    - Changing drainage patterns (Flowmeters) –Procedure yet to be determined

4.3. TRIGGER ACTION RESPONSE PLAN

TARPs will be implemented for the monitoring programs.

Typical triggers for water inundation and inrush are based around the expanded total mine water balance each day and readings (reported daily at the Managers Meeting) from the monitoring equipment installed at each plug. There will be different levels of hazard classification for differences in ML/day imbalance and differences in plug monitoring equipment. These defined differences will form the basis for trigger levels in the TARP. These readings should be tallied each day and flow rate and instrument readings averaged out over a 7 day period.

5. TAILINGS MONITORING

A routine monitoring and testing regime will be implemented for the tailings placed into Kintore Pit to assess the liquefaction potential of the tailings. This will be specified in the design of TSF3 and detailed in the TSF3 management plan. The monitoring system will have a TARP in place to guide actions to control the risk posed.

6. ADDITIONAL HAZARDS

6.1. MLD

The MLD drive is located 10m below the original floor of the Kintore Pit and intersects old workings connected to the Pit. It has been identified that the additional load induced by the tailings placed into Kintore Pit may induce failure of the intervening pillar.

It is therefore proposed to backfill the MLD drive below the Pit footprint with waste rock to prevent access and limit the ingress of tailings if failure occurs. An assessment of infrastructure which will require relocation in the southern end of the MLD will be required before access is lost. The routine inspections of the open F-Pillar stope will not be possible and alternative controls will be required.

A ventilation assessment of the impact of the backfilling will be required.

Water flowing from the MLD will require assessment as will the base of raises connecting the MLD with active areas such as the MLD to 1270 raise noted above.

6.2. MANAGING THE RISK FROM ADJACENT MINES

6.2.1. PERILYA SOUTHERN OPERATIONS

The Perilya South mine water risk is currently managed by appropriate water pumping infrastructure. Any anticipated seepage from TSF3 will be handled by current mine infrastructure. In the event that additional volumes are realised, then any changes must be communicated to Perilya so that their system can handle any excess water capacity if Rasp infrastructure fails.

6.2.2. PERILYA NORTHERN OPERATIONS

Water inundation and risks by utilising Kintore Pit as TSF3 are not expected to be an issue for the Perilya North mine. The nature of the workings, geometry of the orebody and gravity are expected to prevent water from affecting the northern workings.

References

Baye.H.G.; 1985. Broken Hill Vughs- Occurrence and some probable causes. Paper number 32. AusIMM proceedings Broken Hill paper series

Golder Associates Pty Ltd., 2020. Kintore Pit: Preliminary Mine Plug design. Unpublished report by Golder Associates (1896230-047-R-Rev1).

Golder Associates Pty Ltd., 2020. Blackwood Pit Tailings Storage Facility – Dam Break Assessment. Unpublished report by Golder Associates (1896230-041-R-Rev0).

Inundation and inrush hazard management; 2015 NSW code of practice / WHS (mines) legislation

MDG-1024 – Guideline for Inrush Hazard Management (2007); Department of Trade and Investment, Regional Infrastructure and Services, 2015

Lang.B., 2012 Permanent Sealing of Tunnels to retain Tailings or Acid Rock Drainage. IMWA Proceedings 1999, International Mine Water Association 2012 pp 647-655

https://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0011/543935/NSW-code-of-practice-Inundation-and-inrush-hazard-management.pdf

https://www.resourcesregulator.nsw.gov.au/__data/assets/pdf_file/0007/419524/MDG-1024.pdf

Tucker.C., May 2019. Geotechnical Assessment of the MLD / Zinc Lodes Drive below the Kintore Pit. Unpublished report by Ground Control Engineering Pty Ltd.