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March 20, 2016

Robert Holmes
Director of Mineral Resources
Department of Energy, Mines & Resources
PO Box 2703
Whitehorse, Yukon Y1A 2C6

Dear Mr. Holmes,

Please see the attached update to Minto Mine's Underground Mine Development and Operations Plan. This update is intended to replace the document by the same name submitted in June 2014 (*Underground Mine Development and Operations Plan,* Minto Explorations Ltd. June 2014).

The attached document provides information previously submitted and approved as well as, updated information on the following areas;

- Details regarding the next area of underground development (Area 2)
- Updated as-built drawing, production data and revised mine designs for the Minto South Underground.

If you have any questions or concerns regarding the attached document, please do not hesitate to contact me at ryanh@mintomine.com / 604-759-4634, or Ron Light at rlight@capstonemining.com / 604-759-4639.

Regards,

Ryan Herbert
Environment Manager
Minto Explorations Ltd.

Attachments:

- *Underground Mine Development and Operations Plan 2016-01,* Minto Explorations Ltd. March 2016

Minto Mine

Underground Mine Development and Operations Plan

2016-01

Prepared by:
Minto Explorations Ltd.
Minto Mine
March 2016

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1 Introduction

This Underground Mine Development and Operations Plan (UMDOP) has been prepared to satisfy the requirements of Quartz Mining Licence (QML-0001). Previous versions of this plan were created to license the Area 118 zone of the Minto South Underground and the M-zone Underground project; this revision presents plans for the Area 2 zone.

1.1 Background

Minto Mine has been in operation since 2007. Operations consisted solely of open pit mining from 2007 until 2012, at which time development of the Minto South Underground commenced. Development continued through early 2013.

In January 2014, through continued consultation with Yukon Government Department of Energy, Mines and Resources, Minto sought approval for changing the mining sequence such that the “M-zone,” originally the final ore zone to be mined in the Phase IV plan, could be brought ahead in the schedule and accessed from a portal at the bottom of the completed Area 2 Stage 2 pit. Approval to proceed was granted on January 10, 2014.

The M-zone was completed in October 2014, at which time mining resumed in the Minto South Underground; specifically, the Area 118 zone. The zone is still actively being mined as of March 2016, with completion expected in early April 2016.

This document provides updated plans for the mining of the next zone in the Minto South Underground. This zone, named Area 2, will be mined using the same longhole open stoping method used for both M-zone and Area 118.

This revision to the UMDOP includes information previously submitted and approved, while providing updated as-built drawings, production data, and revised mine designs for the Minto South Underground.

In August 2013, Energy, Mines and Resources published a guidance document for quartz mining projects that details the requirements for a Mine Development and Operations Plan under the QML. Some of those requirements are largely related to the surface mine operations and have been addressed in various other QML-0001 submissions, primarily the "*Mine Development and Operations Plan*.”

2 Current Operations

Figure 2-1 shows an aerial overview of the mine site as of September 2014, the most recent aerial orthophoto taken. Notable changes since then, not shown, include the following:

- Mining of the Minto North pit was started in August 2015;
- Dumping of waste rock from Minto North to the Main Waste Dump Expansion;
- Removal of M-zone infrastructure and commencement of tailings deposition to Area 2 pit;
- Construction of the Mill Valley Fill Extension 2 began in January 2016; and,
- Re-sloping of the completed Southwest Dump as part of progressive reclamation activities.

2.1 Area 118 and Area 2 Underground Development via Minto South Portal

Figure 2-2 shows the current extents of the main ramp in the Minto South Underground, including the 690 level and the start of the decline to the Area 2 zone. Figure 2-3 shows completed development on the 740 level of the Area 118 zone, and Figure 2-4 shows the 710 level. The complex geometry of the completed longhole stopes is best represented in a 3D perspective view, shown in Figure 2-5.

Stoping is currently in progress on the 710 level, and is expected to finish in April 2016. The 740 and 690 levels are complete.

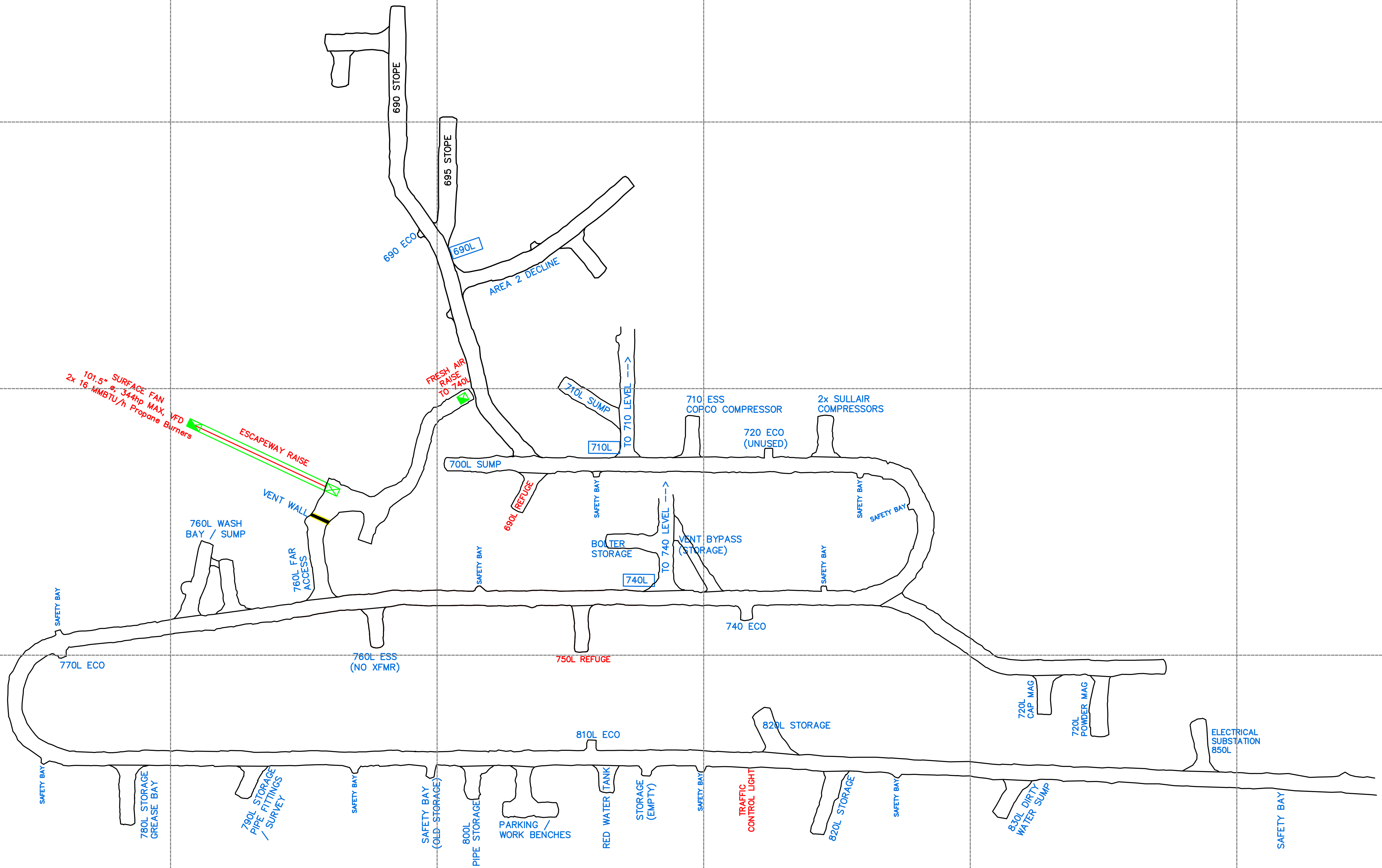
2.2 M-zone (completed)

The M-zone was completed in October 2014.

Between January and May 2015, additional surface mining of the Area 2 pit was then undertaken, recovering remnant ore from the pillars between the pit and the adjacent M-zone underground workings.

As remnant mining was retreating, backfilling of the Area 2 pit began, burying the portal and the breakthroughs between stopes and surface with tailings.

Figure 2-1: Site overview.



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File path:	X:\Mine Technical\00 - Survey\Underground\Overall\2016\03-March								
File name:	OVERALL- March 12 2016.dwg								

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Figure 2-2
Minto South Underground
Main ramp and 690 level
March 12, 2016

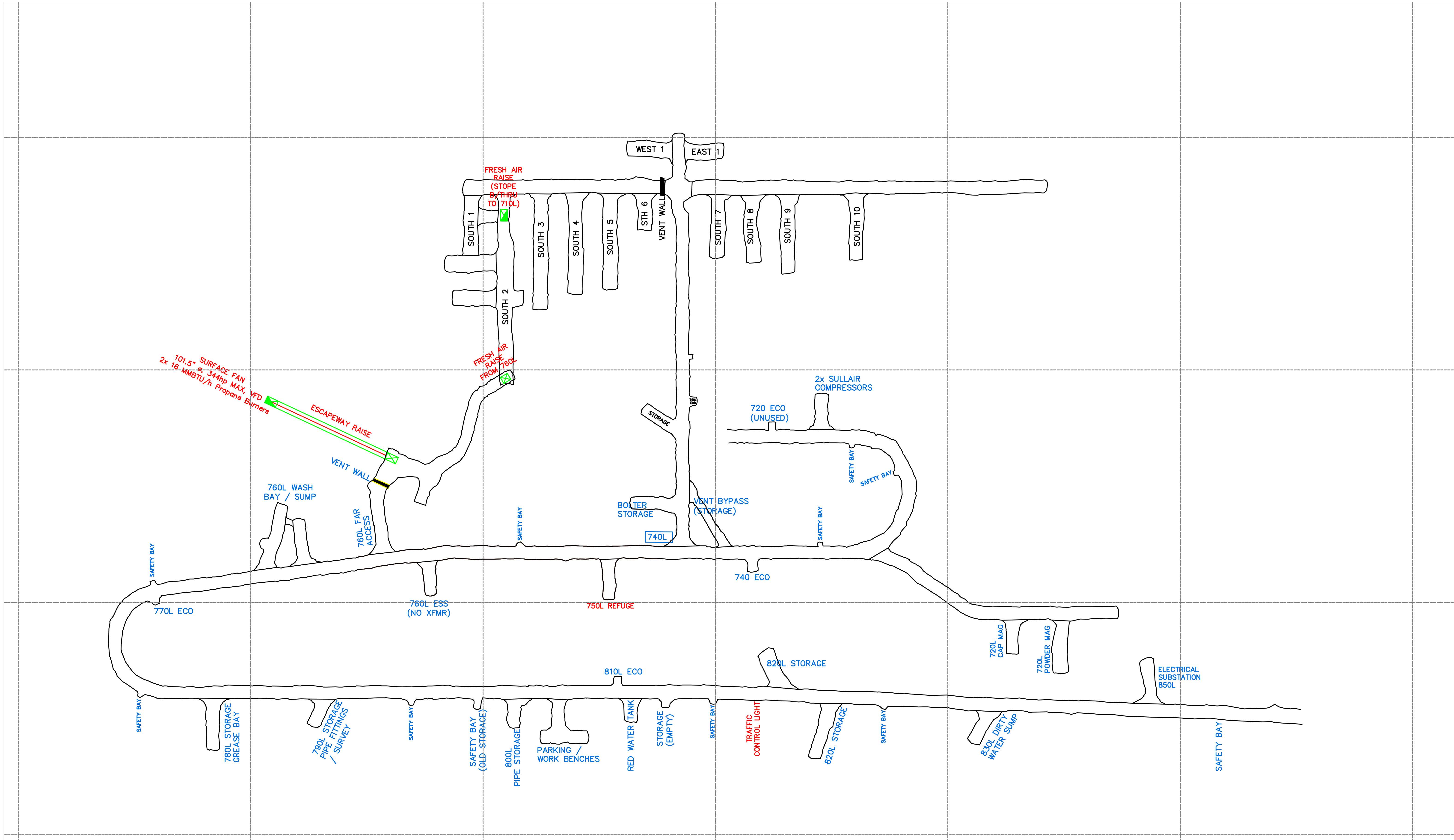

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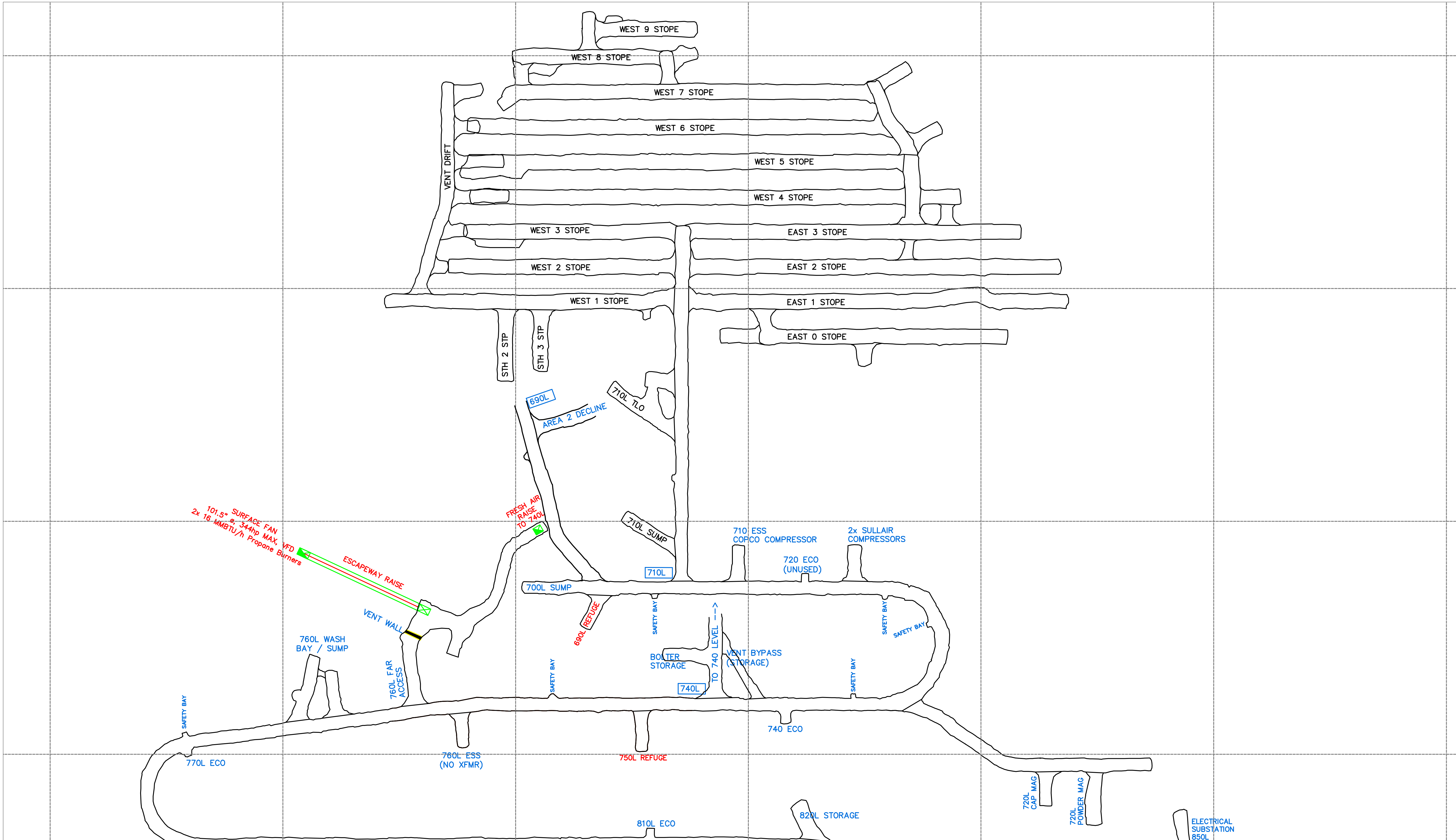
Figure 2-3

Minto South Underground

Main ramp and 740 level

March 7, 2016



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File name:	OVERALL- March 12 2016 - 710 level plot.dwg							

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Figure 2-4

Minto South Underground

710 Level

March 7, 2016

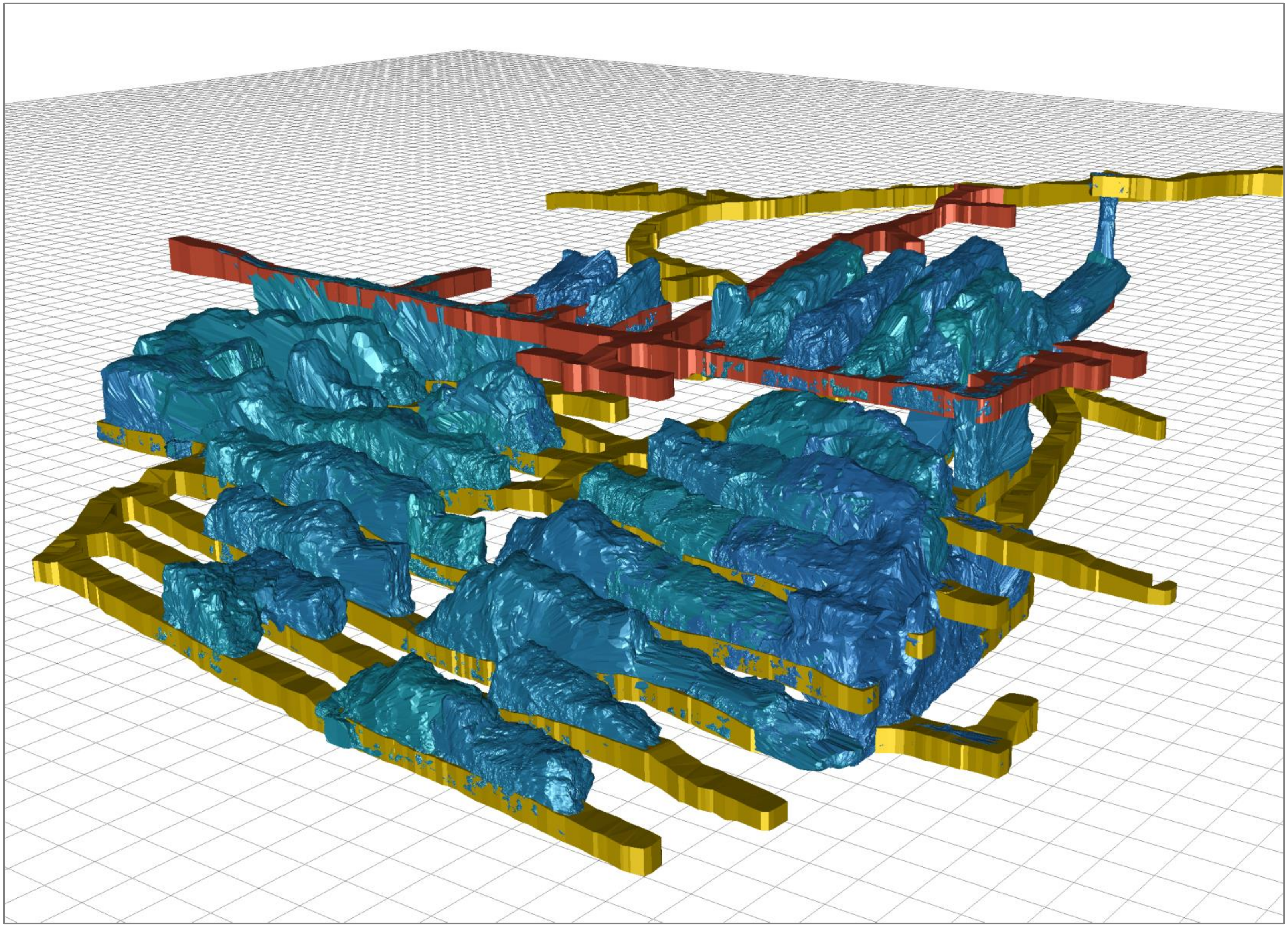

Figure 2-5: Perspective view of Area 118 zone looking southeast. 740 level development shown in red. Some development and stoping omitted for clarity.

3 Deposits and Ore Reserves

The following table summarizes the nomenclature associated with Minto's ore zones and lists the phase of permitting under which each has been assessed.

Underground Complex	Access	Zones	Permitting
Minto South Underground	Minto South Portal	Area 118	Phase IV
		Area 2	Phase IV
		Minto East	Phase V/VI
		Copper Keel	Phase V/VI
		Wildfire	Phase V/VI
M-zone	M-zone Portal	M-zone	Phase IV
Wildfire Underground	Wildfire Portal	Wildfire	Phase V/VI

Table 3-1: Nomenclature for underground complexes, portals, and zones at Minto.

A separate underground complex, known as the Wildfire Underground, was presented during the environmental assessment process. This would mine relatively shallow ore zones from a separate portal with its own dedicated infrastructure. Originally planned to be mined after the completion of the Minto South Underground, it is not currently in the mine plan and is not described in this document.

Figure 3-1 shows preliminary development and stoping designs for the aforementioned ore zones.

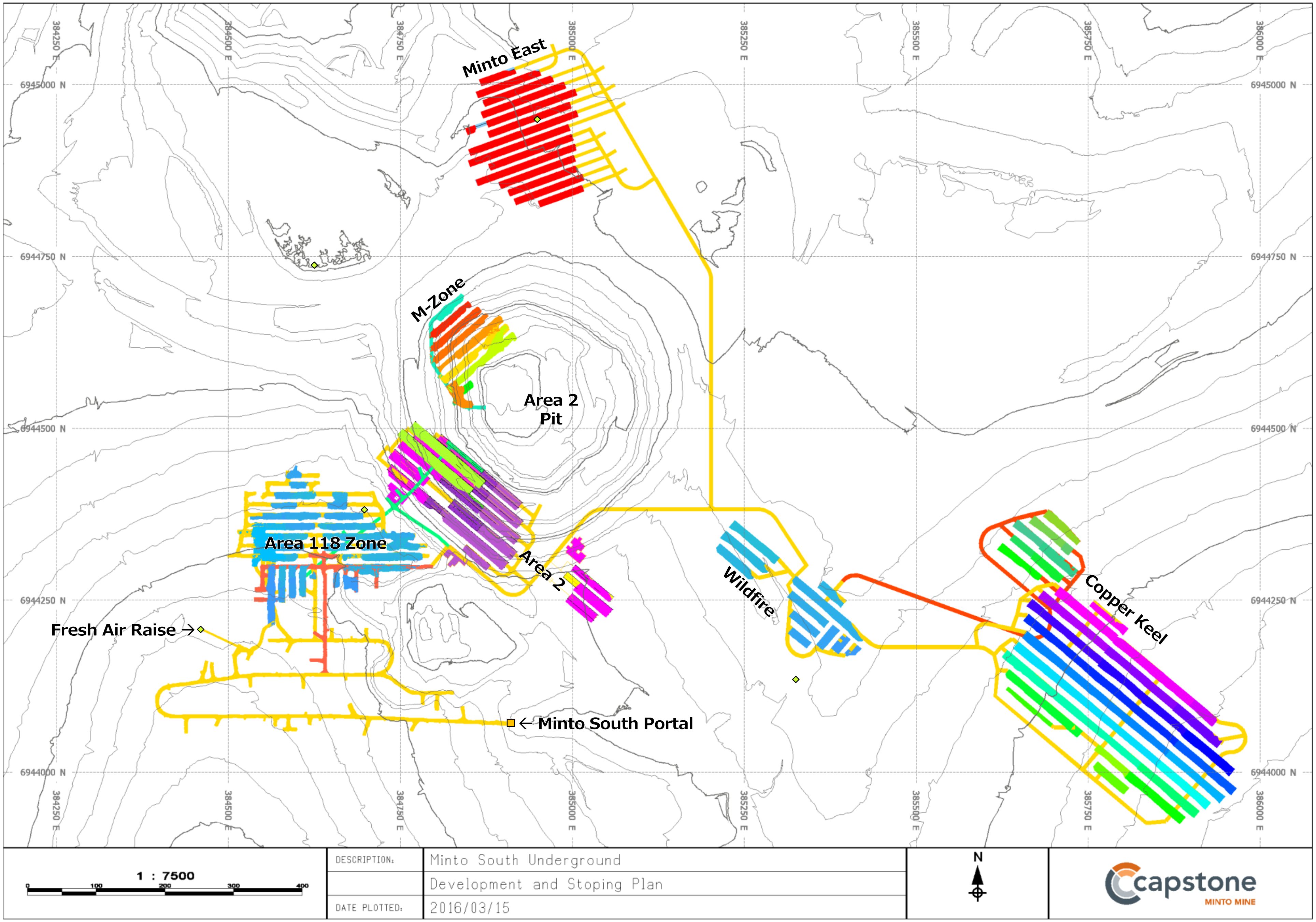

Figure 3-1: Plan view of underground development and ore zones.

3.1 Ore Production and Scheduling

The latest Reserve statement for Area 2 underground mining included 549 kt of ore at an average grade of 1.65% Cu.

The tonnages produced by the underground mine will change as detailed stope designs are prepared, taking into account the local ground conditions and optimizing the locations of stopes based on in-fill drilling.

The mining rate is currently planned at 1,400 tonnes per day of ore. With continuous mining the zone would be completed in late 2017. The extent of mining and timeframe will be contingent upon market conditions.

4 Mine Development and Design

4.1 Mining Method

The M-zone and Area 118 zone were both mined using a longhole open stoping method, and the Area 2 zone will be mined in the same manner. All three of these ore zones can be described as lenses of foliated granodiorite (fG), bounded at their hanging wall and footwall contacts by equigranular granodiorite (eG) host rock. The fG zones are typically 5-30m thick, and the grade within them varies from 0% to approximately 6% copper. The fG zone typically dips at 20° to 35°.

To mine these zones, a series of parallel sill drifts are driven along the strike of the deposit, following the footwall contact. From these sill drifts, generally driven 6m wide and 4.5m high, a top-hammer longhole rig drills rings of 3" up-holes into the deposit above, stopping at the hanging-wall contact.

To provide adequate void for blasted muck when starting a new stope, 1.8m x 1.8m inverse raises are drilled. These are composed of six 6" reamed holes, which are left unloaded, surrounded by a pattern of eleven 3" blast holes. Generally, each stope is started with one ring of blast holes on either side of the inverse raise; subsequent blasts increase the number of rings fired simultaneously to take advantage of the void space in each block.

After drilling is complete, the rings are loaded, blasted, and then mucked out from the sill drift, which serves as a drawpoint. The average blast size is 3,000 tonnes. Mucking is via remote-controlled LHD; all stopes are non-entry so no workers are exposed to the open stope. Ore is trucked to surface along the main ramp that accesses the deposit.

For the Area 118 zone and M-zone, production drift centerlines were 15m apart. From each 6m-wide sill drift, drill holes fanned out to blast a 10m wide stope, and 5m thick rib pillars separated each stope, supporting the hanging wall. For the Area 2 zone, production drift centerlines will be 20m apart and stope and pillar widths will be varied based on the ore thickness (stope and pillar height). Typical stope widths will be 15m and pillar widths 5m, for more details on the stope geometry see Section 6.

Significant variability in copper grades is seen within each ore zone; therefore, diamond drilling completed as part of earlier exploration is supplemented by infill drilling done from each sill using the production drilling equipment. In the 118 zone, additional diamond drilling was done from the underground workings; a similar program is planned for the Area 2 zone.

The mining method does not use backfill; however, small quantities of development waste are sometimes placed in completed stopes to reduce haulage requirements.

4.2 Access

The main ramp of the Minto South Underground measures 1,130m to the start of the Area 2 decline. It is generally 5.0m wide and 5.0m high, though the decline to the Area 2 zone will be driven 5.5m high to provide additional clearance between vent ducting and haul trucks.

This access is to be used for all ore and waste haulage, personnel/equipment access, and services. It is also used as an exhaust airway. A 3m x 3m raise provides an emergency escapeway from the Area 2 decline to the 710 level.

Re-muck bays are typically developed every 150 m along the decline to improve the efficiency of the development cycle; they are designed to hold two rounds of development muck. The re-muck bays have the same dimensions as the decline and are generally 15 m in length. Once they are no longer needed for development, they are repurposed as equipment storage, pump stations, drill bays, service bays, etc.

Ground support generally comprises 2.4m-long fully grouted resin rebar bolts on a 1.5m x 1.5m pattern with a 1.8 m bolt in the center for the back and all 1.8m bolts for the walls. Mesh is installed to within 1.5 m from the floor. Additional support is installed in intersections. More detail on ground support is presented in Section 6.

4.3 Stope Layout

Figure 4-1 shows a perspective view of the Area 2 stope design in relation to the completed Area 118 zone.

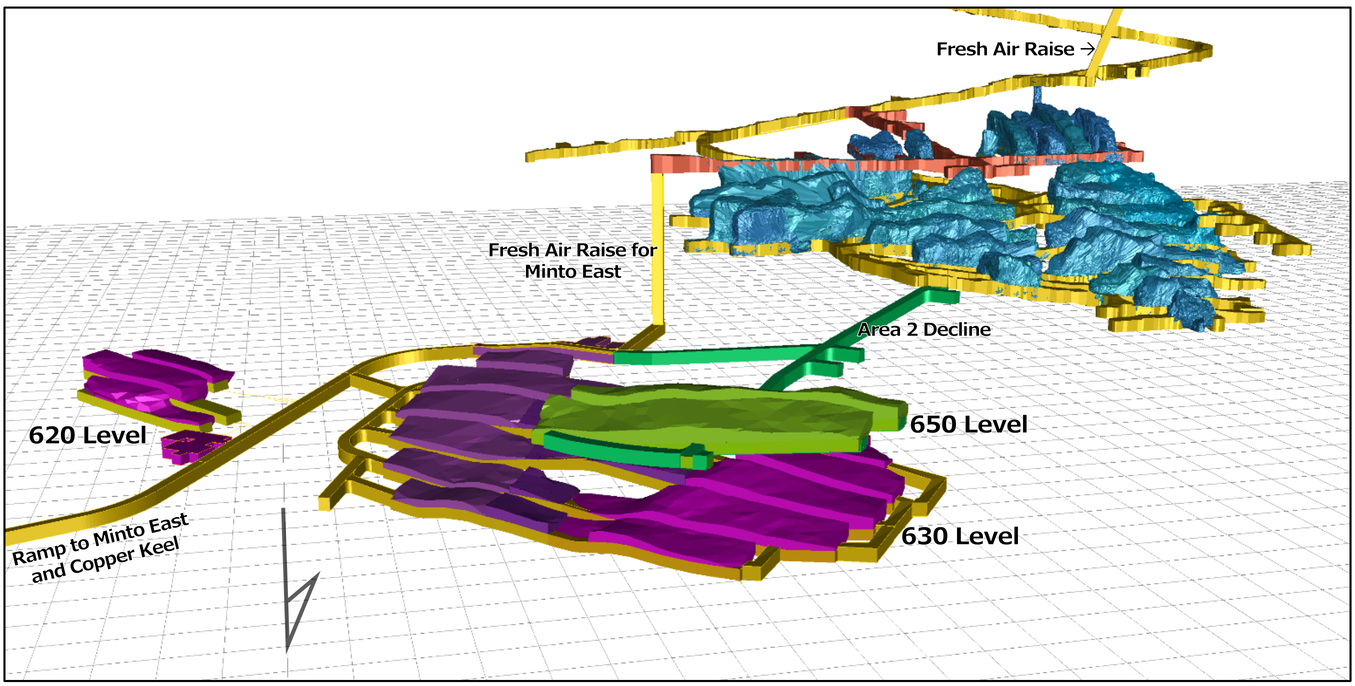

Figure 4-1: Perspective view of the Area 2 zone.

The zone is composed of two stacked lenses, as shown in the section below. The upper lens is accessed from development at the 650 level, while the bottom lens is accessed from the 630 level.

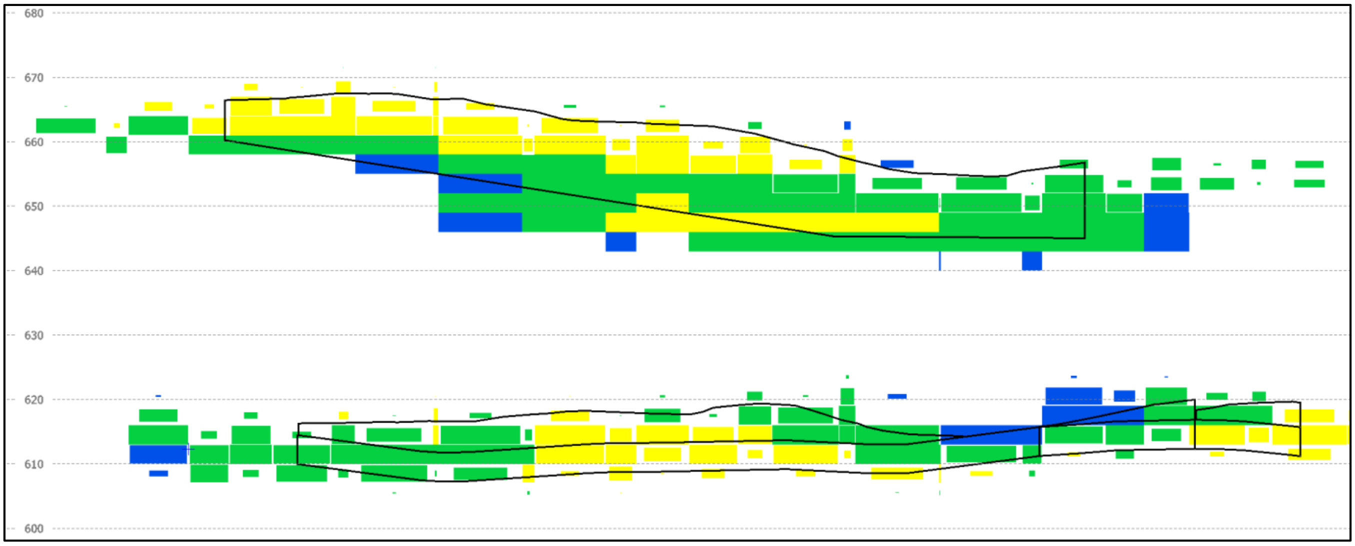

Figure 4-2: Section, looking northeast, through upper and lower lenses of the Area 2 zone. Stope and sill drift outlines shown.

A small satellite lens at the 620 level is also part of the zone.

The upper lens will be mined first. The decline will enter the lens at the 650m elevation, halfway along its strike length. Production headings will branch off both east and west.

As development on the 650 level is completed, the decline to the 630 level will be started.

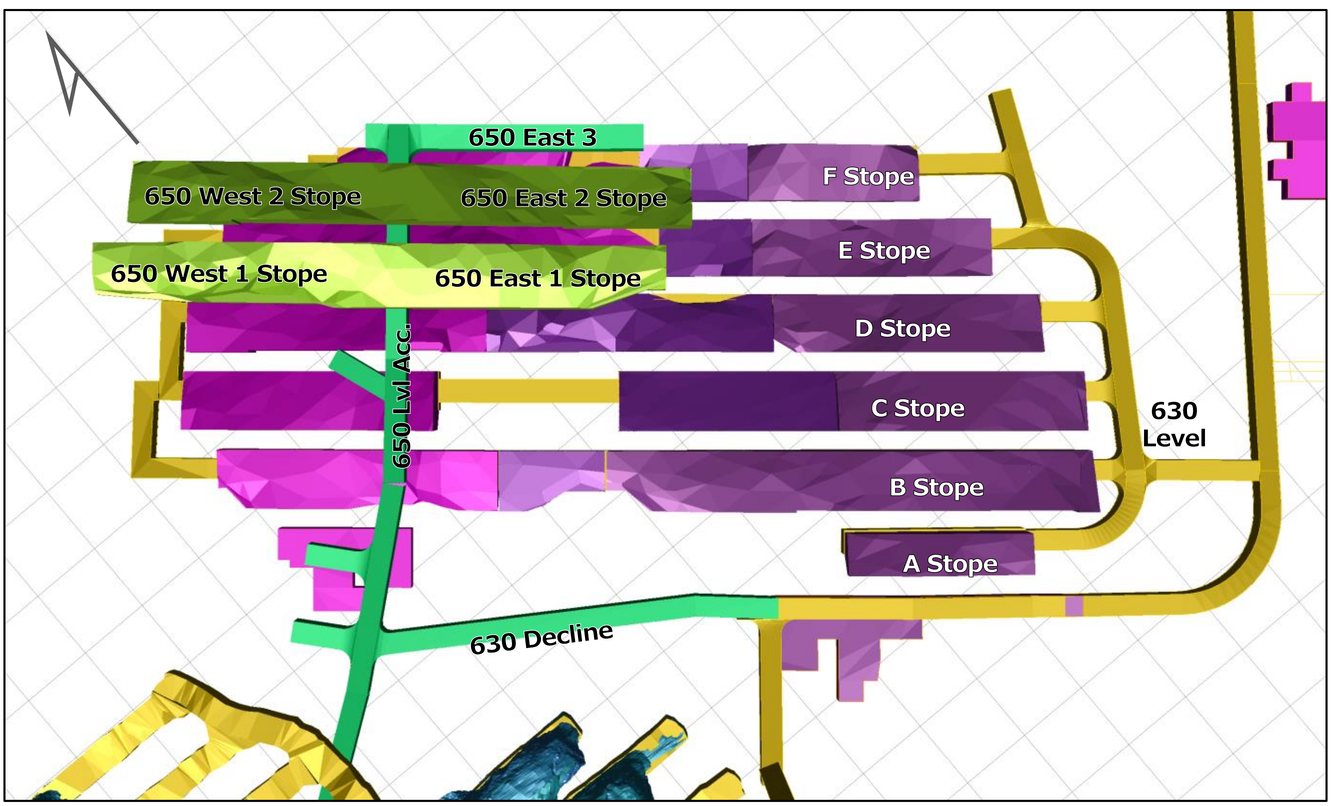

Figure 4-3: Top-down perspective view of the Area 2 zone.

The 630 level will be developed from the east end, driving west. Stoping will begin at the west end and retreat to the east.

5 Mine Operation

5.1 Material Handling

A combination of 7, 8 and 10-yard LHD units and 42 tonne trucks are used for ore and waste haulage. The broken ore from the stopes is mucked by LHDs to remuck bays, or loaded directly onto trucks, which carry ore from the mine to a small stockpile adjacent to the portal. The surface mining fleet then takes ore to open pit stockpiles or to the mine crusher on a daily basis.

Waste rock from development headings is either hauled to surface in the same manner, or trammed to a mined-out stope and dumped there. Development rounds are assayed and the waste is moved to the appropriate waste dump as outlined in the *Waste Rock and Overburden Management Plan (WROMP)*. The protocols for segregation and placement of waste materials are consistent with the protocols for surface mining.

6 Geotechnical Assessment

Geotechnical characterization and design work, summarized in the following sections, has been carried out by SRK Consulting Ltd., Itasca Consulting Group Inc., Golder Associates Ltd., and Minto's Mine Technical Department for the Area 2 and Area 118 underground areas. A ground control management plan was developed and implemented in 2013 and has been used for all underground development to date. The plan is updated annually, the most recent update was in December, 2015.

6.1 Orebody Geometry

Table 6-1: Summary of Orebody Geometry

Parameter	Area 118	Area 2 (upper lens)	Area 2 (lower lens)
Depth (m)	150-200	110-145	90-225
Area (m)	235 x 190	135 x 35	220 x 115
Dip (degrees)	18-45	10-30	10-30
Vertical Thickness (m)	5-35	5-21	5-31

The following points (italicized excerpts from the SRK Phase V Prefeasibility Study) summarize the general ore body conditions:

The (mineralized) zones bifurcate, which means that a mineralized zone can contain a significant amount of waste, or that thinner ore zones can merge with larger zones. A bifurcating geometry complicates geological modelling and may expect to increase internal dilution.

The width and dip of mineralized zones are locally variable. The zones therefore appear to pinch-and-swell. The change in thickness might be as much as an order of magnitude over less than 30 m in horizontal distance.

At least some of the irregularity in the geometry and thickness of the mineralized zones is due to small-scale and large-scale structural displacements. No detailed structural model has been completed for either deposit, but at least two faults appear to be present in Area 2, and three possible faults displace the modelled zones in Area 118. Similar structures may be present throughout the deposit, each with displacements of a few metres or less.

The boundary between Area 2 and Area 118 zones has been modelled as a fault. The drill hole intersections are of sufficient density to show the position of the fault accurately. Two additional faults have been modelled in order to explain intersection positions in Area 118, and these faults divide the Area 118 resource into three domains.

No study has been done on the drill core in order to define the characteristics of the faults. There are indications that these faults have the characteristics of high strain shear zones, rather than brittle structures.

6.2 Hydrogeological Assessment

A hydrogeological assessment has not been completed to define the potential inflows to the underground workings. Inflows encountered to date in the Area 118 and M-Zone underground areas have been associated with discrete water-bearing faults and with un-grouted diamond drillholes. No unmanageable inflows have been intersected and a typical sump and pump dewatering system has been used without any grouting work required.

6.3 Mining Method

The mining method (described in detail in Section 4) used in Area 118 and M-Zone, and planned for Area 2, is longhole stoping. In small areas where the orebody is thin and/or flat, room and pillar or post-pillar cut and fill mining may be used. The longhole method used is open stoping (non-entry) without backfill, leaving rib pillars in place, and drilled and mucked from undercut drifts only. For Area 118 and M-Zone, constant stope and pillar widths were used throughout the orebodies, regardless of the ore thickness. For Area 2, the mine layout will be optimized using variable stope and pillar widths to target the designed extraction ratios: in thicker parts of the orebody, wider pillars and narrower stopes will be used; and in thinner parts of the orebody, wider stopes and narrower pillars will be used.

The following is a summary of the planned excavation and pillar geometry.

Table 6-2: Summary of Excavation Geometry

Excavation/Pillar	Area 118	Area 2
Development drifts, ramps	5.0 m (W) x 5.5 m (H)	5.0 m (W) x 5.5 m (H)
Production drifts	6.0 m (W) x 4.5 m (H)	6.0 m (W) x 4.5 m (H)
Longhole stope (non-entry)	10 m (W) x 9-25 m (H)	10-15 m (W) x 10-19 m (H)
Longhole pillar (non-entry)	5 m (W) x 9-25 m (H)	5-10 m (W) x 10-19 m (H)
Room (entry)	10 m (W) x 5-10 m (H) (5 m lifts with backfill)	10 m (W) x 5-10 m (H) (5 m lifts with backfill)
Pillar (entry)	5 m (W) x 5-10 m (H)	5 m (W) x 5-10 m (H)

6.4 Rock Mass Characterization

Rock mass characterization is based on core logging and laboratory testing completed by SRK and underground mapping carried out by Minto. Summaries of rock mass quality and strength are contained in Table 6-3 and Table 6-4.

Table 6-3: Summary of Rock Mass Quality

Area	Source	Rock Type	Total Length Logged (m)	RMR(76)			Q'		
				min	max	avg	min	max	avg
Area 118	Core Logging (SRK)	Ore	1207	31	82	64	0.17	99	21.1
		Waste (HW)	433	31	82	65	0.24	100	21.4
	Underground Mapping (Minto)	Ore	147	59	89	79	1.4	150	17.7
		Waste	204	65	92	85	2.6	50	17.5
Area 2	Core Logging (SRK)	Ore	211	31	82	65	0.05	99	19.4
		Waste (HW)	89	45	79	64	2.07	93	21.7

Table 6-4: Summary of Intact Rock Strength

Area	Rock Type	Total Length Logged (m)	Avg. Logged Strength	Total Length Mapped (m)	Avg. Mapped Strength	Number of Point Load Tests	Avg. Point Load Strength (MPa)	Number of UCS Tests	Avg. UCS (MPa)
Area 118	Ore	1443	R4 (50-100 MPa)	126	R5 (100-250 MPa)	3	245	7	125
	Waste (HW)	527	R4 (50-100 MPa)	60	R5 (100-250 MPa)	1	163	8	135
Area 2	Ore	232	R4 (50-100 MPa)	-	-	14	200	1	104
	Waste (HW)	92	R4 (50-100 MPa)	-	-	9	185	2	126

Rock structure has been characterized using mapping in the underground development to date and in the open pits. Rock structure is summarized in Figure 6-1 and Figure 6-2, and in Table 6-5 and Table 6-6.

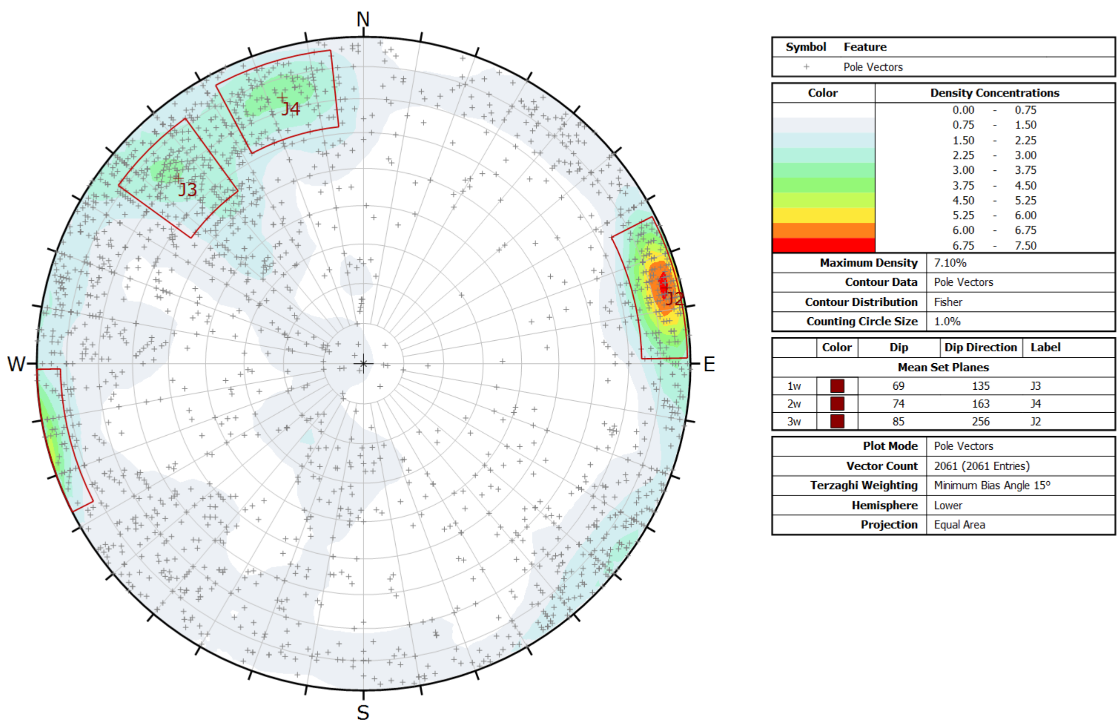

Figure 6-1: Stereonet of Rock Structure in Area 118 Underground

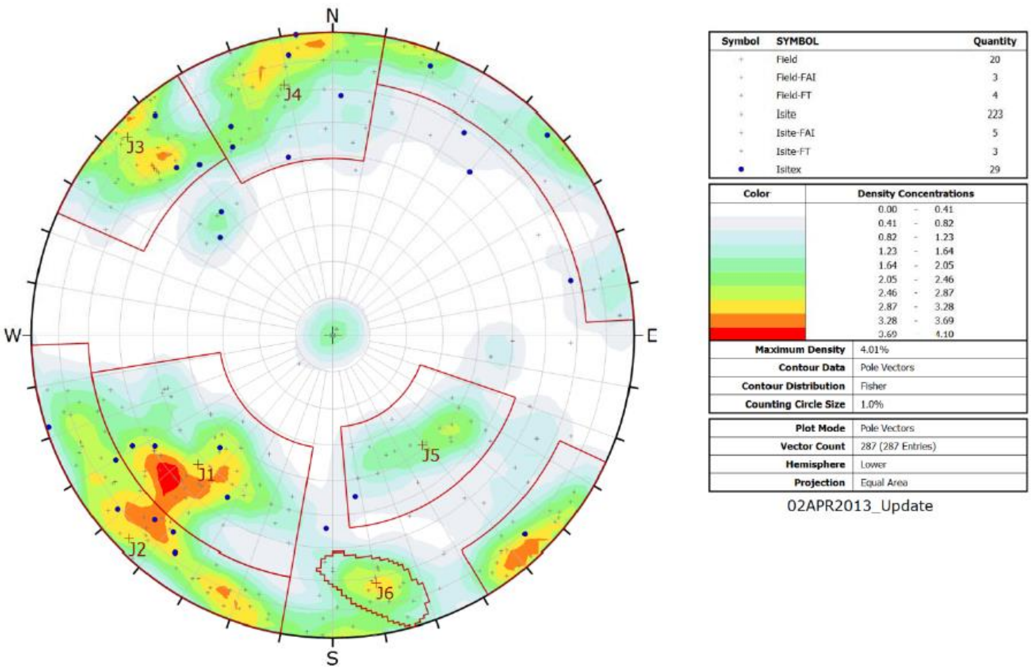

Figure 6-2: Stereonet of Rock Structure in Area 2 Open Pit

Table 6-5: Summary of Major Joint Sets

Major Joint Set	Open Pit Mapped Orientation		Underground Mapped Orientation		Area Observed	Comments
	Average Dip	Average Dip Direction	Average Dip	Average Dip Direction		
J1	54	45	-	-	• Area 2 Pit • Area 118 Pit • Minto North Pit • Area 118 UG	Major fault orientation in Area 2 Pit ("320 Fault"). Fault orientation in Area 118 underground but not indicated as a major joint set.
J2	80	41	85	256	• Area 2 Pit • M-Zone UG • Area 118 Pit • Area 118 UG	Major set in Area 2 Pit. Major set in Area 118 underground with slightly different orientation.
J3	58	137	69	135	• Area 2 Pit • M-Zone UG • Area 118 Pit • Area 118 UG • Minto North Pit	Major set in all areas.
J4	78	163	74	163	• Area 2 Pit • M-Zone UG • Area 118 UG	Major set in most areas.
J5	40	322	-	-	• Area 2 Pit • Area 118 Pit • Minto North Pit	Minor set in open pits. Not observed underground.
J6	73	350	-	-	• Area 2 Pit • M-Zone UG	Moderate set in open pits. Observed underground as steeper dipping set in M-Zone underground.

Table 6-6: Summary of Major Structures

Structure Description	Average Dip	Average Dip Direction	Comments
Fault	66 (65-76)	35 (15-40)	Major fault intersected throughout Area 118 underground waste and ore development. Zone of up to several meters of altered, weak rock. Often water bearing.
Fault	64-74	40-50	Major fault zone in Area 2 Pit ("320 Fault) and regional fault orientation. Up to 5m zone of gouge, altered fractured rock.
Fault	60	160	Gouge filled fault in M-Zone underground.
Fault	59	292	Minor fault in Area 118 underground waste rock.

6.5 Stability Analyses

6.5.1 Longhole Stoping

Stope spans for future mining areas were designed using a combination of empirical analysis, numerical modelling and experience in the Minto underground to date. Stability graphs for the range of rock quality conditions and the planned stope sizes are shown in Figure 6-3 and Figure 6-4. All exposures plot in the stable zone with less than 1m of ELOS (equivalent linear overbreak/slough).

To date, no unmanageable instability has been experienced in open stopes. Stope backs have performed well, typically breaking clean to a planar, discrete hanging wall contact. Only one stope in Area 118 experienced overbreak in the back, for approximately 15m length in 710 E2. The overbreak was associated with pervasive structures and broke up to approximately 10m above the planned stope back. Typical overbreak in stope backs is less than 0.5m, and underbreak from the planned back is more common. Several trial stopes were mined in Area 118 to investigate the performance of wider spans, these included four areas in different parts of the deposit successfully mined up to 20m wide with little to no overbreak.

Instability in the stope walls has occurred in several places where fault zones result in weak, ravelling type behaviour. Unplanned breakthroughs through pillars occurred in two places in Area 118. In M-Zone, two pillars unravelled for approximately 30-40m length. In all cases, pillars were successfully re-established either by narrowing the subsequent stope blasts, or re-slotting to leave a mid-stope pillar. The mining method allows for flexibility to adapt to changing conditions by leaving wider pillars or mid-stope pillars where conditions require.

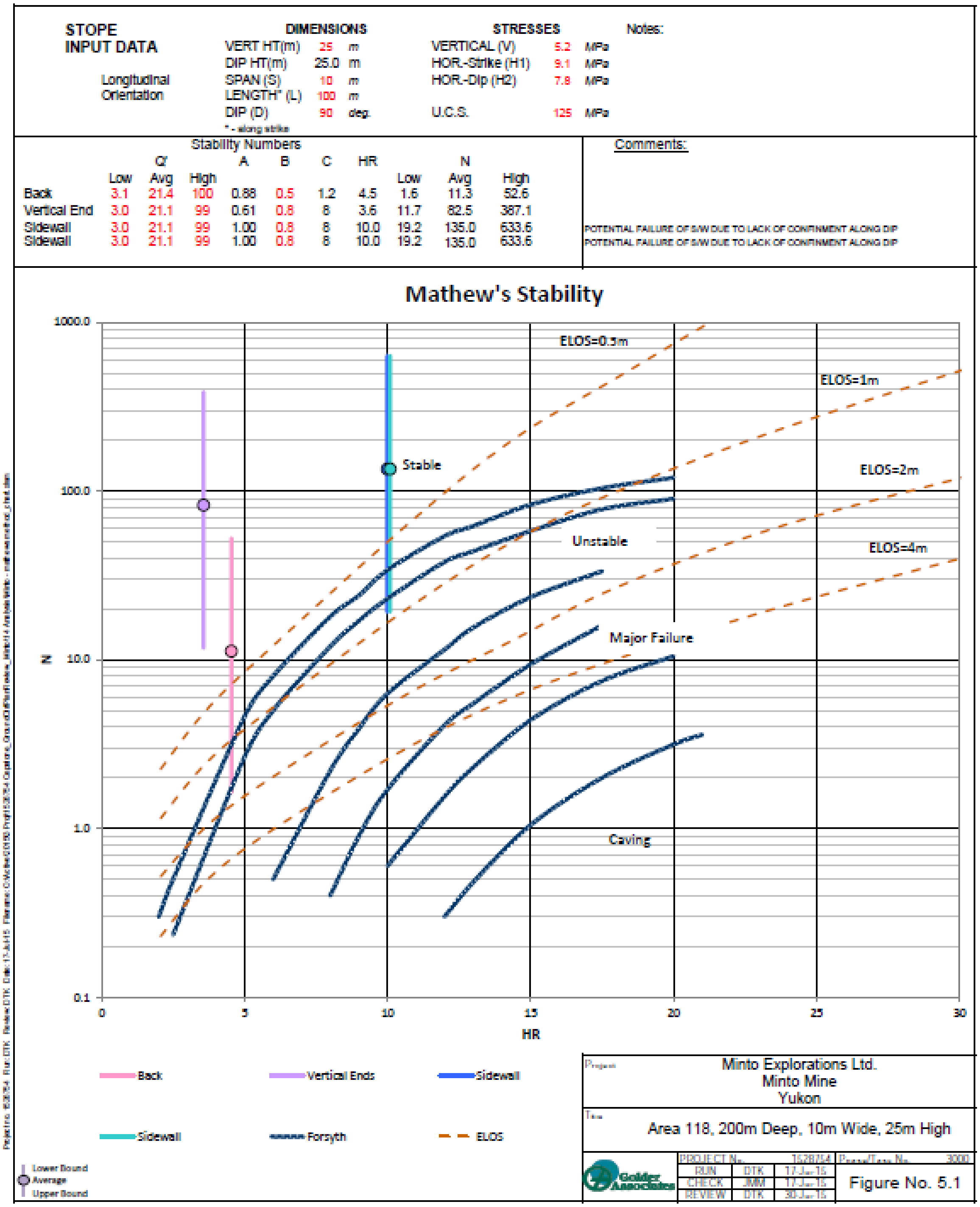

Figure 6-3: Area 118 Stability Graph Analysis (Golder, 2015b)

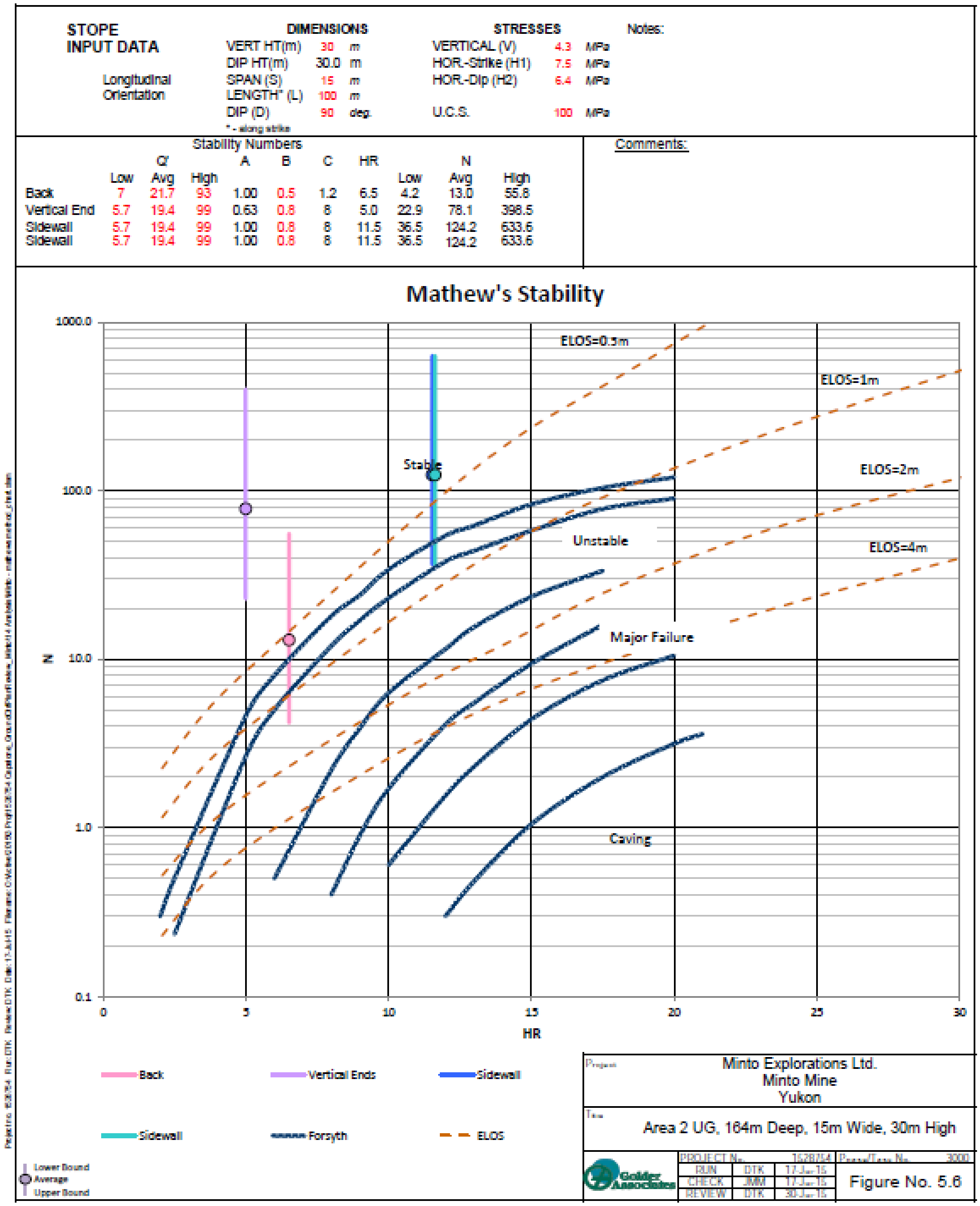

Figure 6-4: Area 2 Stability Graph Analysis (Golder, 2015b)

Numerical analyses were carried out by Itasca to assess the Area 118 underground. Complete results are contained in the report "Minto 118 Zone – FLAC3D Analysis of the Longhole Base Case Option" (Itasca, 2014b). Figure 6-5 shows the finite difference model used for the analyses and rock properties are listed in Figure 6-6.

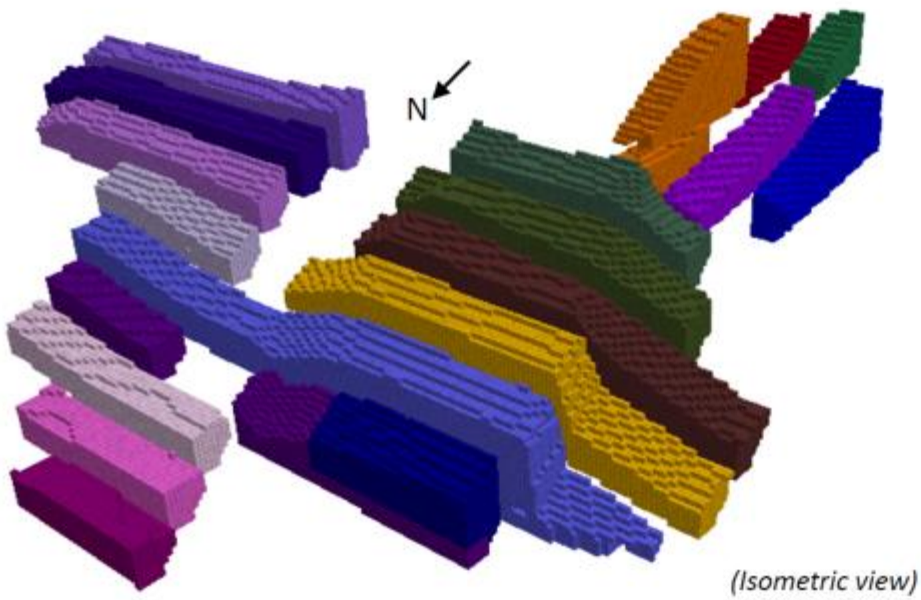

Figure 6-5: FLAC3D Model used for Area 118 analysis (Itasca, 2014b)

Property	Encasing "Waste" material	"Ore" material	Fill
Bulk modulus K (GPa)	26	26	0.025
Shear modulus G (GPa)	16	15	0.015
RMR_{89}/GSI	74/69	76/71	-
Peak friction angle (deg) [1]	61.9	60.5	43
Peak cohesion (MPa) [1]	3.24	2.82	0
Peak tensile strength (kPa)	466	387	0
Critical plastic strain interval (%) [2]	0.92	0.86	-
Residual friction angle (deg)	43.3	42.4	-
Residual cohesion (kPa)	162	141	-
Residual tensile strength (kPa)	0	0	-

1 Established with a tangential fit at sig3max = 3.3 MPa (for a mining depth of 140 m max), and a linear failure envelope. This overestimates friction, but provides a conservative estimate of cohesion, which matters most in our case.

2 Strain-softening interval between peak and residual strength (the same for the cohesion and friction). Based on GSI. The tensile critical strain was set to 0.00001% to reflect the more brittle behaviour of tensile failure.

The two major faults going through 118-Zone were incorporated in the model with ubiquitous joints, making them 3-4 zones wide. They were given the following properties: cohesion = 0 , tensile strength = 0, friction angle = 30°.

Figure 6-6: Rock properties used in FLAC3D model (Itasca, 2014b)

Conclusions from the analyses included the following (Itasca, 2014b):

1. *The FLA3D model showed that the longhole option as modelled is mostly stable at the exception of the back of some stopes (mostly due to their local geometry)*
2. *The plasticity plots showed that most backs and walls behave well*
3. *However, the model showed that the backs on the eastern side of some of the west stopes are failing in tension due to their convex shape*
4. *The σ1 magnitude plots show a stress concentration in the order of 12-15 MPa in most of the pillars, with lower stresses in the north-south oriented rib pillars in the shallower stopes*

These conclusions were verified with successful mining of Area 118. Stopes with planned irregular shaped backs performed well, in some cases planned convexities broke to a more planar shape depending on the hanging wall condition.

For Area 2, pillar stability was assessed using empirical pillar stability methods, summarized in the report "Minto Mine Underground Reserve Update Geotechnical Input" (Golder, 2015b), and shown in Figure 6-7. Figure 6-8 and Figure 6-9 show optimized room and pillar spans for various mining heights. The majority of the Area 2 upper lens is less than 15 m vertical thickness, which corresponds to a stope width of 15 m and a pillar width of 5 m, and a resulting extraction ratio of 75%. For the Area 2 lower lens, extraction is slightly lower due to the increased depth.

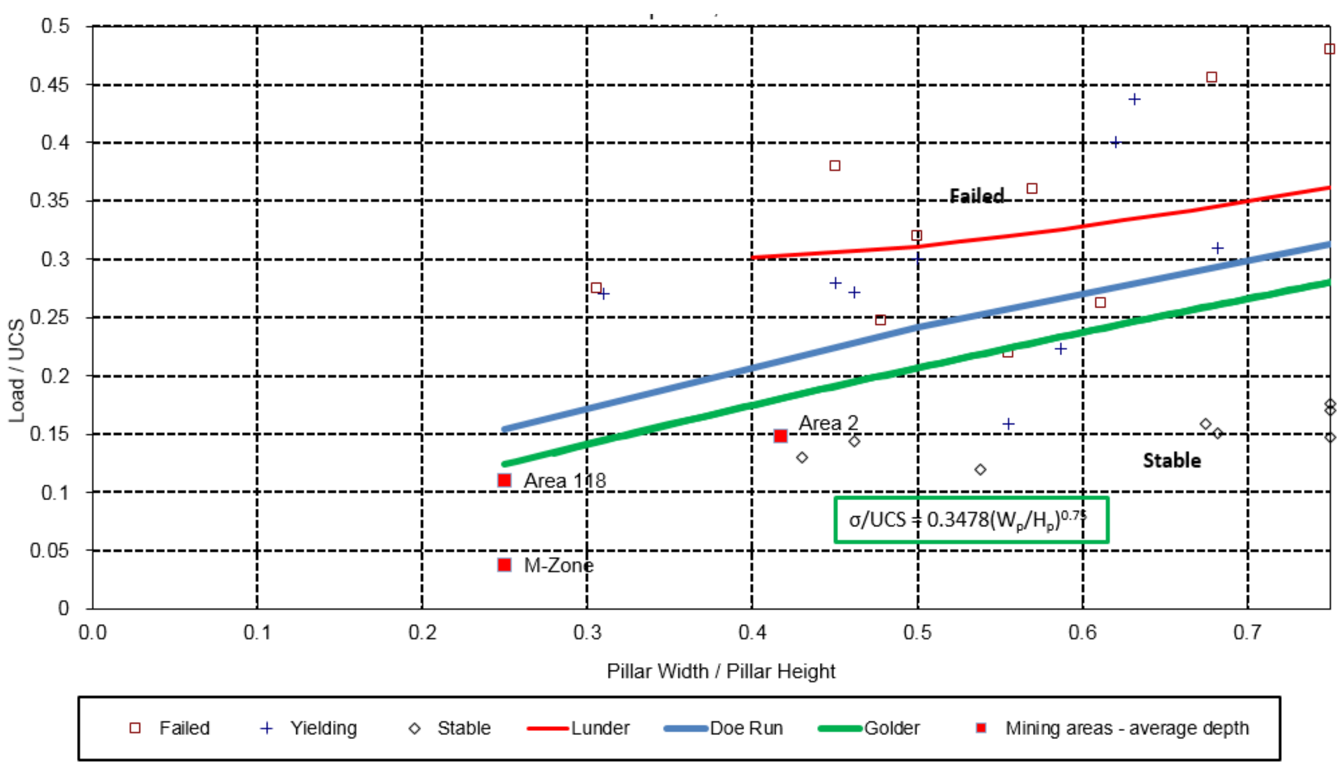

Figure 6-7: Empirical Pillar Design

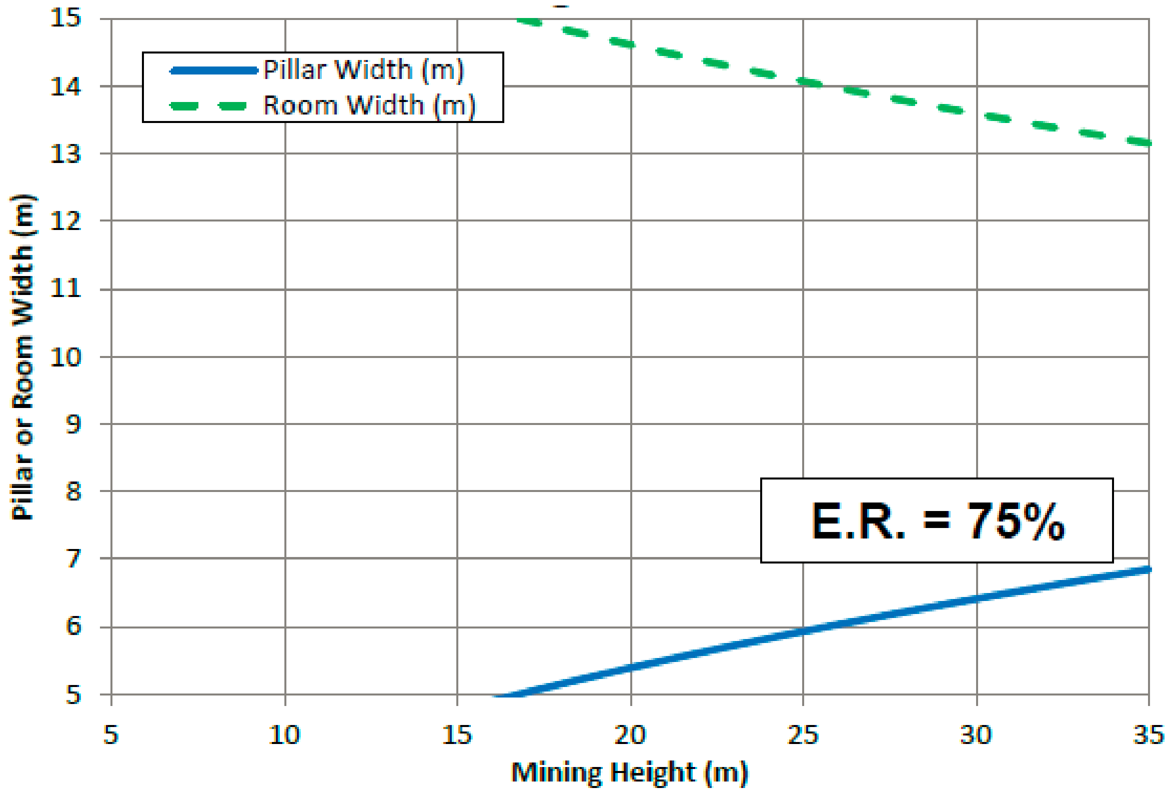

Figure 6-8: Empirical analysis results for Area 2 upper lens

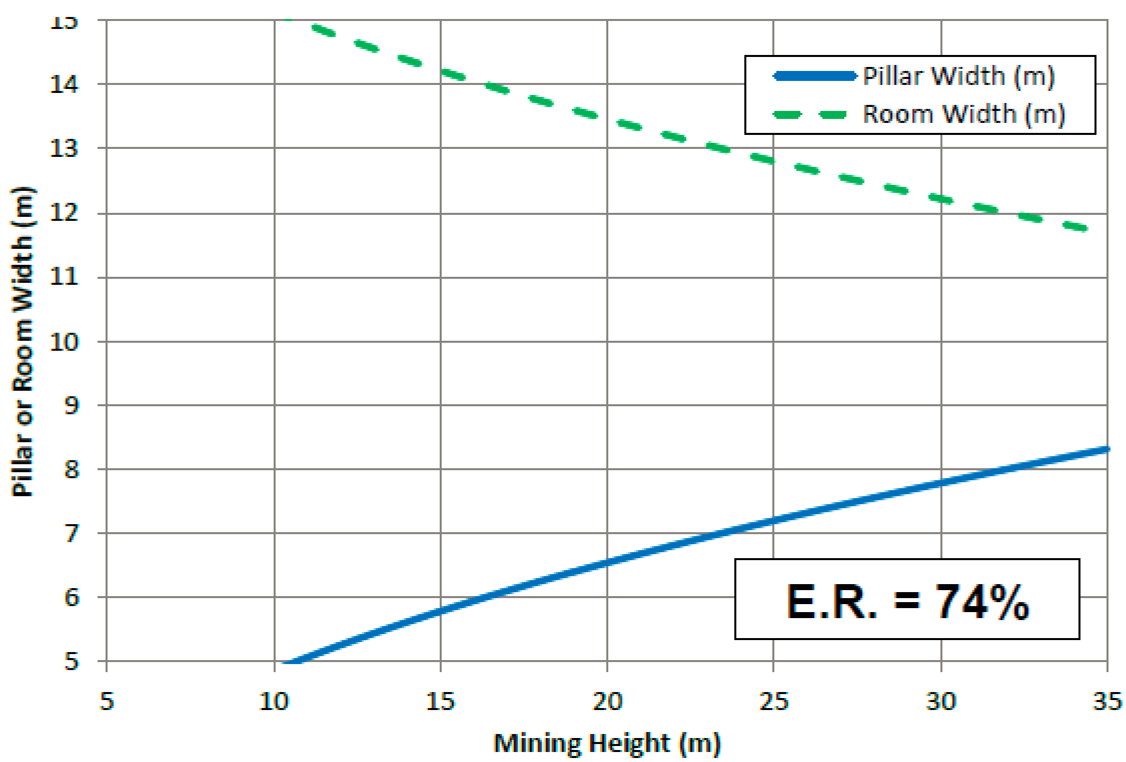

Figure 6-9: Empirical analysis results for Area 2 lower lens

6.5.2 Room and Pillar

Room and pillar mining is expected to make up a small percentage of the overall mine plan, however it has been assessed to allow flexibility where the geometry of the orebody is not suitable for longhole mining.

Planned mining geometry for room and pillar areas consists of 10m wide by 5m high rooms and crosscuts, and 5m square pillars. In some areas, a second 5m lift may be required in which case the lower lift will be backfilled with uncemented waste rock.

The room size has been assessed using both empirical and numerical methods. The critical span curve for man entry openings (Ouchi et al., 2004) is shown in Figure 6-10. 10m spans are predicted to be stable for both Area 118 and Area 2.

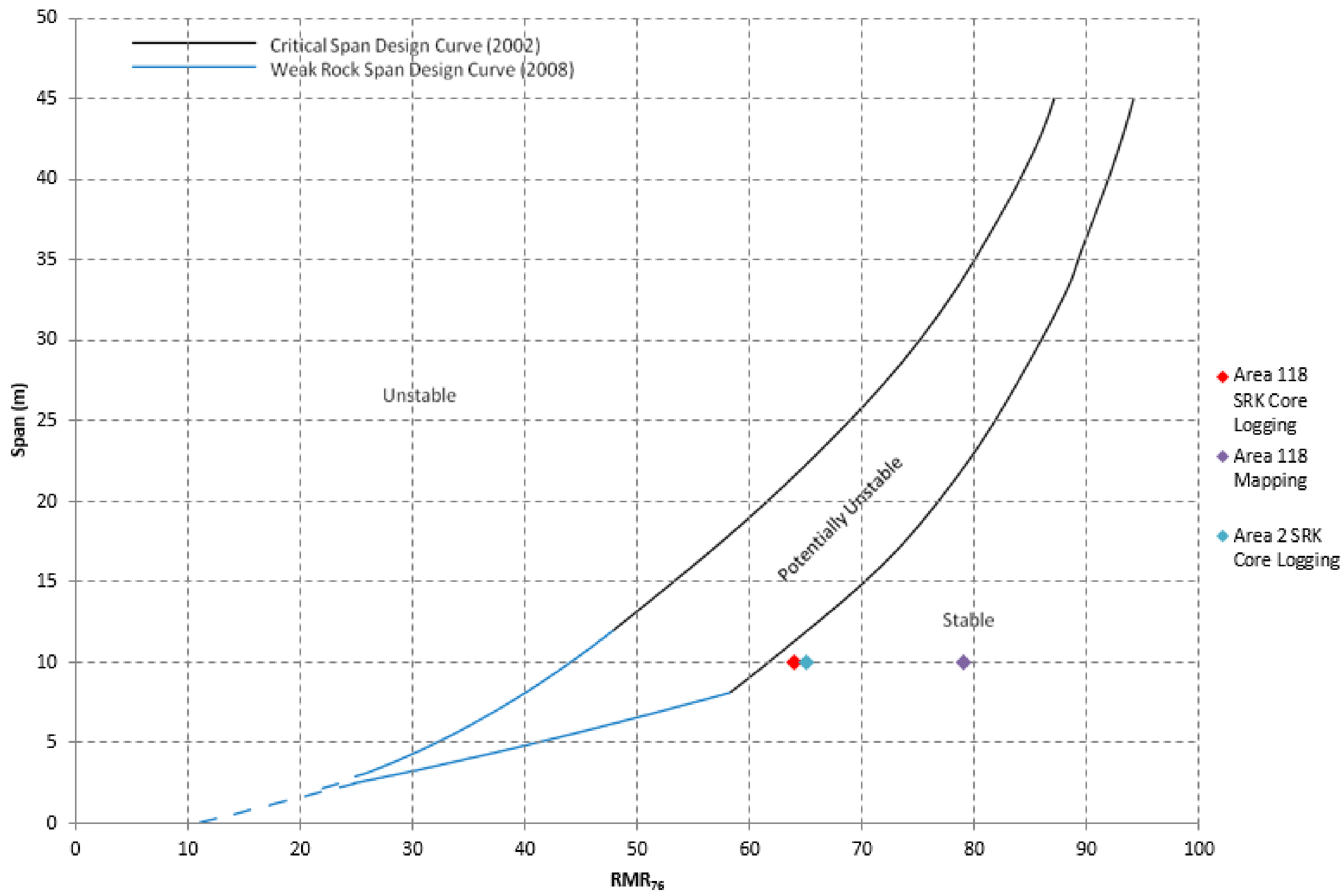

Figure 6-10: Critical Span Design Curve (Ouchi, 2004)

Numerical analyses using a combined discrete fracture network (DFN) and discrete element model were completed by Itasca in 3DEC to further assess room spans, particularly in intersections where greater spans will be required. Complete results are contained in the presentation “Minto 118 Zone – 3DEC/DFN Analyses” (Itasca, 2014). The model used is shown in Figure 6-11.

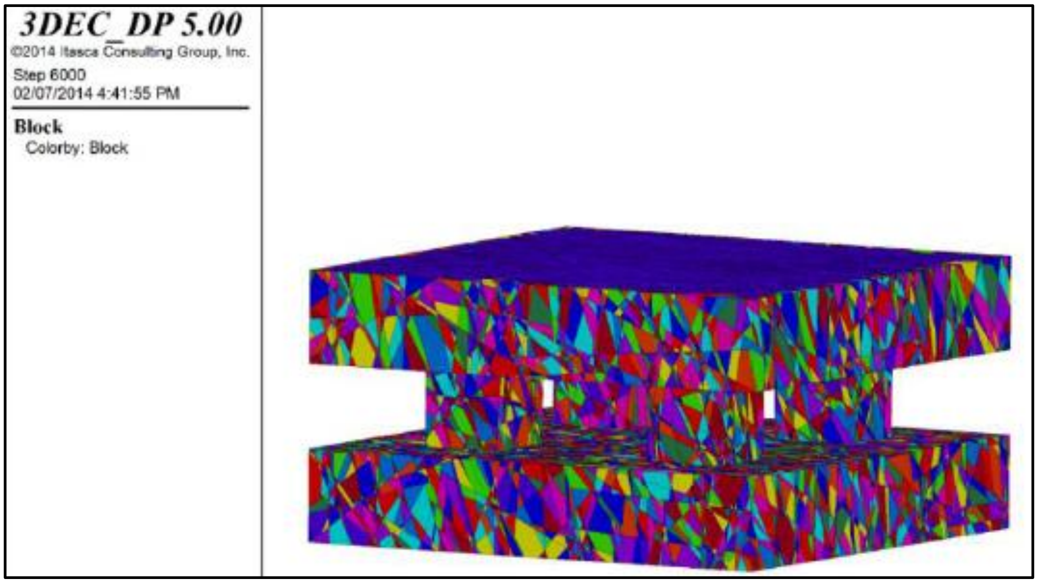

Figure 6-11: 3DEC/DFN Model used for Room Span Analysis (Itasca, 2014)

The analyses were run considering the standard Type 1 ground support, including 2.4m long resin-rebar on 1.5 x 1.5m spacing with a 1.8m center resin-rebar to pin the mesh, as well as secondary intersection support consisting of 5m long Super Swellex on a 1.8m x 1.8m spacing.

The analyses concluded that with no ground support an average of 132 tonnes became unstable in the intersection roof, to a maximum depth of 3.7m into the roof. With ground support installed the roof was predicted to be stable.

Major structures such as faults or highly fractured zones were not considered in the analyses. Where major structures are identified during development mapping, spans will be limited or additional case specific ground support will be designed.

Pillar stability was considered using a combination of empirical and numerical analysis. Factors of safety for several commonly used empirical pillar design methods are presented in Table 6-7.

Table 6-7: Summary of Area 118 Empirical Pillar Analysis

Depth (m)	Pillar Width (m)	Pillar Length (m)	Pillar Height (m)	Room Width (m)	W/H	Factor of Safety			
						Lunder &Pakalnis (1997)	Lunder (1994)	Hedley & Grant (1972)	Average
190	5	5	5	10	1	1.27	1.33	0.86	1.15

Numerical analysis was carried out by Itasca using the discrete element code 3DEC to consider pillar stability for a scenario where post pillar cut and fill would be used throughout the Area 118 orebody. The complete results are contained in the report “Minto 118 Zone – Large –Scale 3DEC Analyses” (Itasca, 2014a). The model used in the analysis is shown in Figure 6-12 and Figure 6-13.

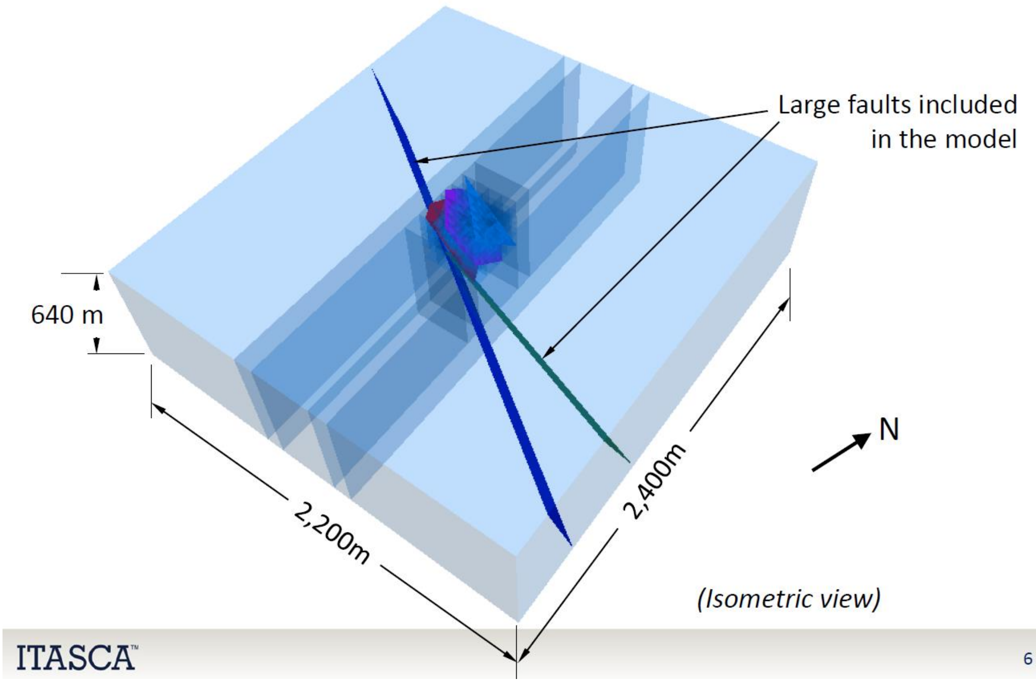

Figure 6-12: Post Pillar Cut and Fill 3DEC Analysis for Area 118 Underground (Itasca, 2014a)

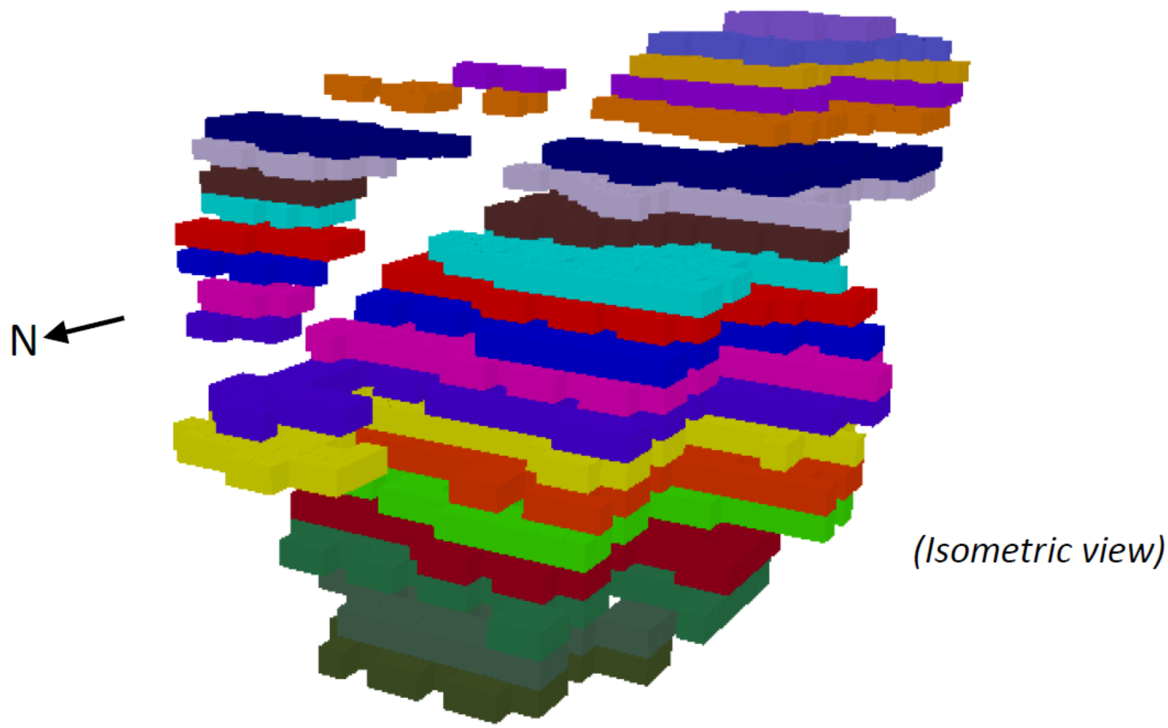

Figure 6-13: Post Pillar Cut and Fill 3DEC Analysis for Area 118 Underground (Itasca, 2014a)

Rock properties used in the model are presented below. Three major faults and a persistently steeply dipping joint set were included in the model as well as backfill for rooms/pillars more than one lift high.

Property	Encasing "Waste" material	"Ore" material	Fill	Faults and joints
Bulk modulus K (GPa)	26	26	0.025	-
Shear modulus G (GPa)	16	15	0.015	-
RMR_{89}/GSI	74/69	76/71	-	-
Peak friction angle (deg)[1]	61.9	60.5	43	30
Peak cohesion (MPa)[1]	3.24	2.82	0	-
Peak tensile strength (kPa)	466	387	0	-
Critical plastic strain interval (%)[2]	0.92	0.86	-	-
Residual friction angle (deg)	43.3	42.4	-	-
Residual cohesion (kPa)	162	141	-	-
Residual tensile strength (kPa)	0	0	-	

[1] Established with a tangential fit at sig3max = 3.3 MPa (for a mining depth of 140 m max), and a linear failure envelope. This overestimates friction, but provides a conservative estimate of cohesion, which matters most in our case.

[2] Strain-softening interval between peak and residual strength (the same for the cohesion and friction). Based on GSI. The tensile critical strain was set to 0.00001% to reflect the more brittle behaviour of tensile failure.

Figure 6-14: Rock properties used in 3DEC model

Conclusions from the analyses included the following (Itasca, 2014a):

1. *The 3DEC model shows that all the post-pillars experience some degree of plasticity, some of them exhibiting 'tension now' and 'shear now'.*
2. *The plasticity plots also show that most room backs and walls behave well. However, the FLAC3D was better suited to evaluate "intact" rock mass performance.*
3. *The σ1 plots show stress concentrations in the post-pillars in the order of 20 MPa.*
4. *The shear displacement and slip plots show that many of those persistent shallow-dipping joints that intersect post-pillars can be expected to sustain some damage, but the associated displacements remain small.*
5. *Similarly, shear displacements are expected to be small.*
6. *The 3DEC model assumes that all pillars are 5m by 5m and comprised of "undisturbed" rock. Poor blasting practices and/or local discrete structures could result in pillars of smaller dimensions and/or lower strength. This would affect the stability of these pillars, and, potentially that of Zone 118.*

6.6 Ground Support Requirements

Ground support requirements for underground development are contained in the Minto Underground Ground Control Plan, updated in December 2015. The following are summaries of ground support elements and requirements for development openings.

Table 6-8: Ground Support Elements

Support Element	Description	Minimum Breaking (tensile) Strength	Comment
Bolts	#6 (20mm) (3/4") threaded rebar bolt w/ full column resin	13 tonnes	-
	#6 (20mm) (3/4") forged head rebar bolt w/ full column resin	18 tonnes	Used for raise development.
	Super Swellex (36 mm)	24 tonnes	-
	Standard Swellex (27 mm)	12 tonnes	Used for face bolting.
Plates	Domed - 15 x 15 cm (6" x 6"), 6 mm (1/4")	-	-
Resin	30mm x 610mm cartridge 30 second (fast) 180 second (slow)	-	-
Mesh	6-gauge welded wire mesh	~ 2-3 tonnes bag strength	Galvanized for permanent excavations. Bright for short-term excavations.
Straps	0-gauge welded wire mesh straps	-	Used for stope brow support.

Table 6-9: Minimum Ground Support for Development and Production Openings

Type		Span (m)	Primary Support (minimum)	Comment
1	**Development Drifts (typical ground conditions)**	5.0	2.4 m (8 ft.) rebar in back around perimeter of mesh sheets 1.8 m (6 ft.) rebar in back and walls to pin mesh at center 1.8 m (6 ft.) rebar in walls to 1.5 m above floor 1.5 x 1.5 m bolt spacing diamond pattern Galvanized welded wire mesh to 1.5 m above floor	Life of mine infrastructure in typical ground conditions.
2	**Production Drifts (typical ground conditions)**	6.0	2.4 m (8 ft.) rebar in back around perimeter of mesh sheets 1.8 m (6 ft.) rebar in back and walls to pin mesh at center 1.8 m (6 ft.) rebar in walls to 1.5 m above floor 1.5 x 1.5 m bolt spacing diamond pattern Bright welded wire mesh to 1.5 m above floor	Non-permanent development (e.g. stope/production room crosscuts) in typical ground conditions.
3	**Poor ground – fault zones**	≤6.0	2.4 m (8 ft.) rebar in back around perimeter of mesh sheets 3.6 m (12 ft.) Super Swellex to pin mesh at center 1.8 m (6 ft.) rebar in walls to 1.5 m above floor 1.5 x 1.5 m bolt spacing diamond pattern Bright/Galvanized welded wire mesh to 1.5 m above floor	Poor ground, typical in fault zones.
Intersection Secondary Support				
1,2,3	**Intersections**	≤9.5	To be installed in addition to primary support pattern outlined above: 3.6 m (12 ft.) Super Swellex in back and shoulders 1.8 x 1.8 m bolt spacing - Installed at least two rows past the intersection in each direction.	Intersection support to be installed prior to taking wall slash.

6.7 Monitoring

Monitoring is described in detail in the Minto Underground Ground Control Plan. The following table summarizes the primary elements of the monitoring programs.

Table 6-10: Summary of Ground Control Monitoring

Element	Description
Inspections	• Daily inspections of active production openings by Geotechnical Engineer, Minto supervision and/or Dumas supervision • Monthly inspections of fresh air raise/manway • Quarterly inspections by the Geotechnical Engineer of all development and production openings • Ground control log book maintained by underground shifters
Geotechnical mapping	Rock quality and structure mapping is carried out regularly by Geotechnical Engineers/Geologists to identify major structures and changing conditions for use in geotechnical analysis and mine design.
Cavity monitor surveys (CMS)	Carried out in opens stopes after each blast.

Additional monitoring may include multi-point borehole extensometers, closure stations and borehole stress meters where conditions dictate.

7 Ventilation, Ancillary Infrastructure, and Dewatering

This section describes the ventilation configuration for the Minto South Underground, capable of delivering 350,000 cubic feet per minute (cfm) of fresh air. The system described in previous versions of this document, supplying 80,000 cfm via twin 48” ducts run down the entire length of the main ramp, has been decommissioned.

7.1 Infrastructure

Air is supplied to the mine by a surface installation commissioned in March 2015. The fan specifications are as follows:

Rated power	344 hp
Motor control	Variable frequency drive
Max rotation speed	880 rpm at 60Hz
Fan specifications	101.5” diameter with adjustable blade pitch
Air heating system	Four propane burners in two modular burner houses
Max air heating capacity	32 million BTU/h

Table 7-1: Surface fan specifications

The variable frequency drive on the fan is currently run at 31Hz: with the existing mine layout, this is sufficient to deliver 240,000 cfm. Testing the fan at full speed, airflow was measured at 350,000 cfm.

Air is heated to maintain above-freezing temperatures year-round. The system comprises four burners and their ancillary infrastructure (blower motors, CO and temperature sensors, electronic controls).

Four 30,000 gallon propane tanks supply the burner with fuel. Two additional tanks will be installed in summer 2016. Propane consumption averaged 4,400 L/d in December 2015.

7.2 Ventilation Circuit

The fan is installed on top of a 3m x 5m raise running from surface to the 760m elevation. This raise also serves as an emergency escapeway / egress.

Figure 7-1 shows a section through the raise and stopes used to transfer air to the bottom level of the mine. On the 760m level, air flows through a 70m transfer drift, then down a short raise to a stope that is open down to the 710 level. Air then flows through another open stope down to the 690 level. By routing air through open stopes, air resistance is minimized.

The start of the Area 2 decline is a short distance upstream from where the intake air exits the 690 open stope. Once the 710 level is complete, a bulkhead will be installed to force all of the airflow down through this path. From there, air will be supplied to the Area 2 zone via twin 48” steel ducts with in-line 150hp booster fans.

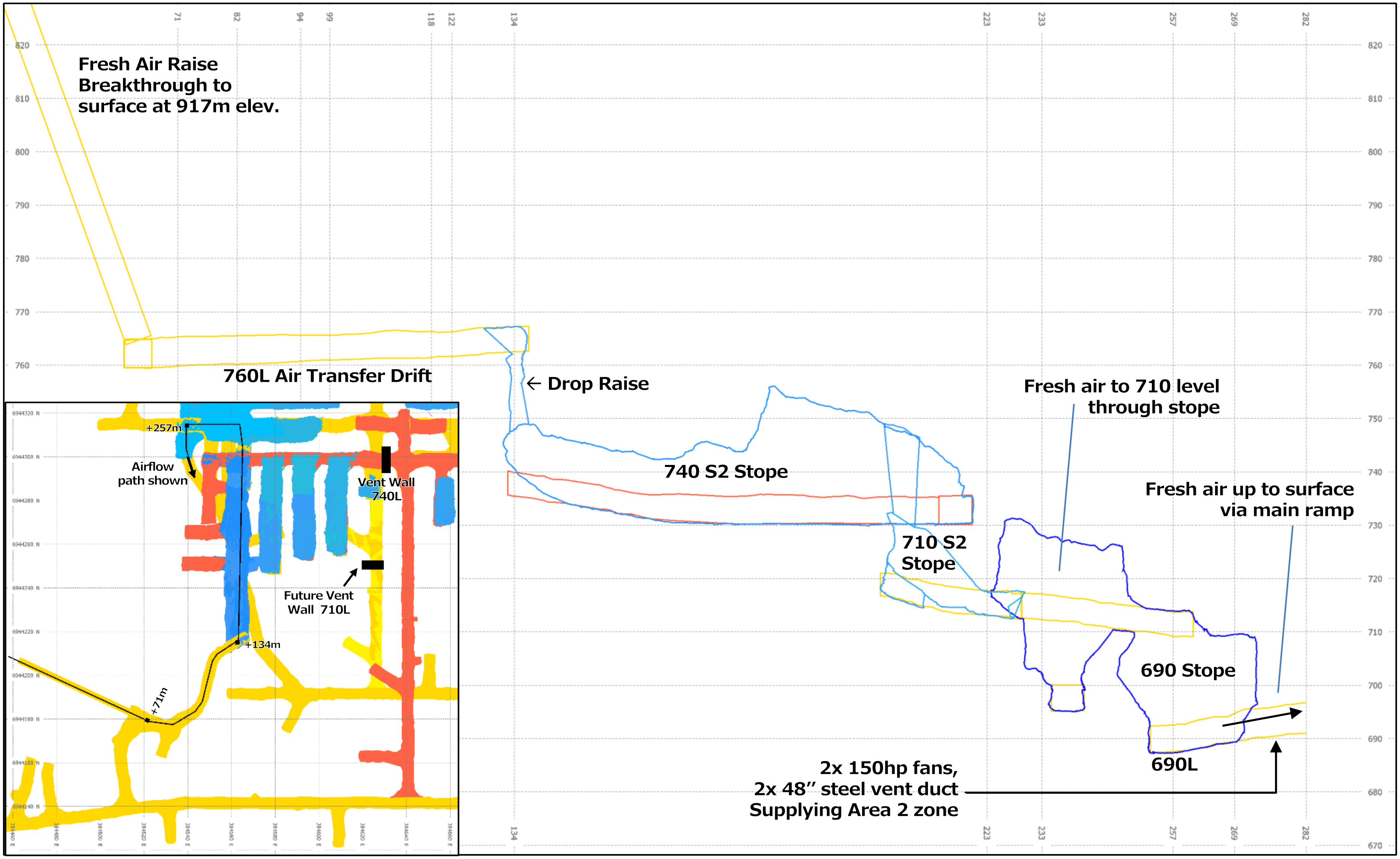

Figure 7-1: Cross-section through fresh air supply path to Minto South Underground.

The air volume required for the fleet currently in use is shown in the table below. The surface fan is controlled by a variable frequency drive, allowing the airflow to be adjusted when equipment is commissioned or retired from the fleet.

Table 7-2: Ventilation requirements for the Minto South Underground

Make / Model	Equipment Type	Fleet	Engine Power	Required Airflow (100 cfm/hp)	Utilization	CFM Required
Atlas Copco ST8B	LHD	3	325	32,500	47%	45,500
Atlas Copco MT42	Haul Truck	2	520	52,000	100%	104,000
Sandvik Jumbo	Jumbo Drill	1	147	14,700	10% †	1,470
Maclean MEM-928	Bolter	1	147	14,700	10% †	1,470
Minecat UT100	Tractor w/ forklift, backhoe	2	99	9,900	33%	6,534
Walden M-60	Scissor Lift	1	86	8,600	33%	2,838
Walden M-60	Boom Truck	1	134	13,400	33%	4,422
Getman	Emulsion Loader	1	99.2	9,920	10% †	992
Toyota Land Cruiser	Flatdeck, mancarrier	3	127	12,700	20%	7,620

† These units rely on diesel engines only for tramming to/from the work site; they run off 600V trailing cables when in use.

Total	174,846

7.3 Compressed Air

Minto currently has three compressors, all of which are installed along the main ramp at approximately 720m elevation:

- 2x Sullair 7509/A (350 cfm at 125 psi, 100hp)
- 1x Atlas Copco GA-315 (1811 cfm at 125 psi, 350hp)

All three compressors are tied into the network of 4” air lines that run throughout the mine. The larger Atlas Copco unit only runs when production drilling is active, as the longhole drills represent a substantial majority of the mine’s compressed air requirement.

Mobile electric equipment such as jumbos and bolters are equipped with their own compressors. The central compressors are needed only for jackleg / stoper drilling, pneumatic dewatering pumps in development headings, and other minor uses.

7.4 Underground Electrical Power

In addition to fixed installations such as fans and compressors, production drilling equipment (jumbos and bolters) run on electric power while stationary.

The mine is supplied with 4160V power via a cable that runs down the decline. This is reduced to 600V, the operating voltage of all mobile equipment, at several substations. The Atlas Copco GA-315 is directly connected to 4160V; all other fixed installations are supplied with 600V three-phase AC. Refuge stations are supplied with single phase 120V power.

7.5 Water

7.5.1 Water Supply

Inflow to the mine through faults and un-grouted diamond drill holes is generally sufficient to supply the mine with water for drilling and dust control. The mine currently recirculates water through a network of sumps. Occasional deliveries of water from surface have been required in past months as mining retreated out of wet areas; however, it is expected that the mine will generally produce a net excess of water.

7.5.2 Dewatering

Water currently collects into three sumps, from which pumps send water to the main dirty water sump at 760L. This is a two-stage clean/dirty sump that removes most suspended solids before water is pumped to a final settling sump near the portal. This portal sump either discharges out to the permanent heat traced line on surface and on to the Area 2 Pit or returns water underground to supply the mine feed storage tank. The Area 2 pit also receives the mill's tailings and process water.

7.5.3 Mine Water Quality and Inflow Monitoring

The Water Use Licence QZ96-006 – Amendment 8 (WUL) outlines the monitoring and surveillance of the underground at Minto. W44 has been assigned as a station number and monitoring frequency as part of the license for the Minto South Portal. A representative sample of underground inflows is taken regularly. Results of the monitoring work are presented in the monthly WUL reports and summarised in the QML and WUL annual report.

7.6 Communications

Both refuge stations are equipped with telephones connected to the mine's internal communications network; external phone numbers are also reachable. These phones are connected via a fiber optic network that runs throughout the Minto South Underground.

An analog emergency communication system (Femco phone) is also installed inside and outside the two refuge stations, the base of the fresh air raise at 760 level, and in the surface muster station adjacent to the portal.

7.7 Blasting Procedure and Infrastructure

An electric central blasting system runs throughout the Minto South Underground; it is activated from a blasting box located at the portal muster station. This typically fires a single electric blasting cap, which is used to initiate the network of non-electric caps that time and fire each hole in a blast. The mine is completely cleared of personnel for both production and development blasting.

Prior to blasting, a locked gate is put into place at the portal, preventing entry to the Minto South Underground until the shift supervisor or a designate verifies that concentrations of post-blast gasses have been diluted to safe levels.

7.8 Explosive Storage and Handling

Emulsion is used for both longhole production and development. A bulk emulsion product known as Dyno Titan RU, formulated for underground use and having high viscosity, is used to load most blasts. This product is delivered via one of two dedicated mobile loading units – one for development rounds and a larger unit for longhole stope blasts.

To provide a backup in the event that the mobile loading unit is out of service, Minto stocks a product known as Dyno SL, which is a cartridge emulsion designed to be manually loaded using a portable pneumatic unit.

In development, a perimeter blasting product (Dynosplit D) is used to reduce overbreak in the back, and Dyno AP (a cartridge emulsion) is used in wet lifter holes.

The following table lists the magazines on site:

License No.	Location	Magazine Contents – March 2016	Capacity
YT-535	Surface	Surface detonators	40,000 dets
YT-533	Surface	Surface explosives	30,000 kg
YT-541	Surface	Underground detonators	75,000 dets
YT-534	Surface	Underground explosives (perimeter control and boosters)	30,000 kg
YT-542	Surface	Surface explosives (pre-shear)	30,000 kg
YT-551	Surface	Underground explosives (packaged emulsion)	35,000 kg
YT-553	Underground	Underground detonators	4,000 dets
YT-550	Underground	Underground explosives	30,000 kg

Table 7-3: Explosives magazines.

The Minto South Underground has two magazines, one for detonators and one for bulk and packaged explosives. Both are equipped with concrete floors and lockable gates. The powder magazine is large enough to store and handle 1.5 tonne totes of emulsion used by the development loader. The larger longhole loading unit is parked on surface at Dyno Nobel's office / shop / silo complex.

Non-electric caps are used to time and sequence blast holes in both production and development blasts. A single electric cap is used for each blast to tie the first non-electric cap into the mine's electric central blasting system.

7.9 Fuel Storage and Distribution

Haul trucks, LHDs, and service vehicles are fueled at a 50,000 liter EnviroTank fuel station installed on surface. Bolters and jumbo drills are generally fueled by a service vehicle.

All underground personnel are trained in site-wide spill prevention and spill response protocols outlined in Minto Mine's *Spill Contingency Plan* (Minto, 2016a).

8 Mine safety

8.1 General Mine Safety

Minto Mine and the development contractor, Dumas Mining, emphasize safety in all duties at the mine; this philosophy is shared by senior management and supervisors. Minto's safety program includes the following:

- Dumas *Zero Harm Safety System* and associated safety card, used and checked daily by supervisors.
- A central system for tracking incident reports and the corrective actions arising from them.
- Safe work procedures (SWPs) for routine tasks that present a risk of injury.
- Job hazard assessments (JHAs) for non-routine tasks; these are used as the basis for SWPs if a job becomes routine.
- Routine job observations and workplace inspections by supervision and technical personnel.

8.2 Emergency Response

Two portable refuge stations are maintained in locations shown on Figure 2-2. These are equipped with compressed oxygen cylinders, CO_2 scrubbers, potable water, first aid equipment, emergency lighting, emergency food rations and chemical toilets. They are also equipped with a digital telephone line and a backup analog telephone (Femco). Each refuge station is equipped to supply oxygen to 18 people for 72 hours.

The fresh air raise from surface to 760 level is equipped with ladders and serves as the mine's main escapeway. As part of Area 2 development, an escapeway will be created between the Area 2 ramp and the 710 level.

All underground personnel are required to carry Ocenco M-20 self-contained self-rescuer (SCSR) devices, which provide oxygen from a compressed gas cylinder for 15 to 20 minutes (up to 32 minutes if the user is resting). In addition to the personal devices, six devices with longer performance durations of 60 minutes are available in two caches located near active mining faces. These caches also contain first aid supplies, an oxygen therapy unit, water, food, flashlights, and blankets.

A mine-wide stench gas warning system is installed at the surface fan to alert underground workers in the event of an emergency.

Minto has an emergency response team trained in underground mine rescue techniques. Details are contained in Minto's *Emergency Response Plan* (Minto, 2016b).

8.3 Fire Suppression

Fire extinguishers are provided and maintained in accordance with regulations and best practices at electrical installations, pump stations, wash bays, and refuge stations. Every vehicle carries at least one fire extinguisher of adequate size and proper type. Heavy equipment is equipped with central fire suppression systems.

For the use of the mine's emergency response team, a trailer containing a foam sprayer, hoses, an inflatable bulkhead, and other firefighting supplies is parked near the fresh air raise.

8.4 Hours of Work

Minto requested and received an hours of work variance (presented in A), specific to the first 4,500 meters of ramp development and associated ore removal.

The requested hours of work variance for these 4,500 meters of underground development included:

- 11 hours per shift of underground exposure for workers in enclosed cabs of mobile equipment.
- 10.5 hours per shift of underground exposure for all other employees.
- Shift rotation of 3 weeks on and 3 weeks off for the contractor's staff employees.
- Shift rotation of 4 weeks on and 2 weeks off for the contractor's hourly rated employees.

In February 2016 an application was submitted for a new hours of variance permit. At the time of preparing this report, the application was under assessment.

8.5 Industrial Hygiene and Fatigue Management Programs

An industrial hygiene (IH) consultant, EHS Partnerships Ltd., was engaged to assist Minto in the development of an underground IH plan and a fatigue risk management programs (acceptable to YWCHSB) for, but not limited to, air quality, noise and fatigue. Regular testing has taken place since underground operations commenced, and results of this program were included in the recent application for an hours of work variance. The Fatigue Management Plan is presented in Appendix B..

Testing has identified some tasks that could result in overexposure to noise and certain airborne contaminants. Testing results are regularly shared with all underground workers. Hearing protection and respirators are available to all underground personnel.

8.6 First Line Supervisory Training

The Contractor will comply with the Yukon Occupational Health and Safety (OH&S) regulation by obtaining First Line Supervisor's Provisional Certificates and working toward full certification during the development.

8.7 Diesel Equipment

All diesel equipment used in the underground operation will be permitted and maintained to comply with section 15.58, 15.59, 15.61 and all related sections on the Yukon Occupational Health and Safety Regulation.

8.8 Shotcrete

Shotcrete is not routinely used at Minto.

8.9 YWCHSB Reporting

Annual Industrial Hygiene reports will be provided to YWCHSB.

Annual update meetings are scheduled to be held with YWCSHB to review the following:

- IH Program data and Fatigue Management Plan progress
- Updated Mining Plan

Any variances to defined engineering or administrative controls put in place and defined by the IH program will be reported to YWCHSB as soon as reasonable along with corrective actions that Minto will take toward elimination of further variances.

9 Conclusion

This Underground Mine Development and Operations Plan incorporates the requirements outlined by the Quartz Mining License. Minto recognizes that some changes to the mine plan and methods are likely as operations continue and more is learned about underground activities on site. This plan will be updated as necessary to reflect newly acquired information and knowledge obtained from ongoing operations.

10 References

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Minto Mine, 2016a. *Spill Contingency Plan.* February, 2016.

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Appendix A

Hours of Work Variance Approval

YUKON WORKERS' COMPENSATION HEALTH AND SAFETY BOARD

401 STRICKLAND STREET, WHITEHORSE, YUKON Y1A 5N8 TELEPHONE: (867) 667-5645 FAX: (867) 393-6279 TOLL FREE: 1-800-661-0443

RECEIVED
OCT 0 9 2012

October 3, 2012

Mr. Ron Light
General Mine Manager
Minto Explorations Ltd.
Suite 900-999 W Hastings Street
Vancouver, BC V6C 2W2

Dear Mr. Light:

Re: Underground Hours of Work Variance

I have reviewed the additional information provided by Capstone Mining in the July 22, 2012 letter and the attached report. This information was provided to support your application to vary the hours of work established in section 15.13(1) of the Yukon Occupational Health and Safety Regulations Part 15 Surface and Underground Mines or Projects.

The letter provided accurately reflects the bulk of the discussion held on May 10, 2012. Upon review of my notes there are four additional items from our discussion that were agreed to which are not specified in your July 22 letter:

1) Capstone Mining will use the adjusted 2012 ACGIH TLV's as the exposure limits for workers working extended hours underground.
2) Capstone Mining will use the current Ontario OEL of 400 micrograms per cubic meter for diesel particulate as a baseline and adjust it for workers working extended hours underground.
3) All refuge stations will have a 72 hour capability.
4) Supervisors will receive specific training to identify cognitive impairment (fatigue, substance abuse, etc.) and deal with any issues in an appropriate manner.

Using the July 22, 2012 letter and the additions listed above as the minimum conditions, I am granting Capstone Mining the requested variance for the initial 4500 meters of underground development at the Minto Mine.

This variance will expire on March 31, 2014. A safety officer may establish additional conditions on this variance based on conditions at the mine site or results of industrial hygiene surveys. Failure to comply with the requirements of this variance will result in immediate revocation.

Sincerely,

Kurt Dieckmann,
Director, Occupational
Health and Safety

Appendix B

Fatigue Management Plan

Minto Mine

Capstone Mining Corporation's

Fatigue Risk Management Plan (FRMP)

Table of Contents

Introduction

This policy was developed in consultation with Capstone management, supervisors, workers and contractors. It is reflective of current research and knowledge of fatigue and safety management systems, particularly fatigue risk management systems. It is designed to align closely with the existing safety management systems at Minto mine. It is based upon a five level fatigue risk management strategy that is designed to provide multiple layers of controls to assist in mitigating fatigue risk factors.

Scope of FRMP

This policy and supporting procedures apply to all supervisors and workers in the underground mine operations at Minto including direct Capstone employees, contractors or employees of contractors. Any worker who will, at any time, be spending more than 8 hours underground in the mine, shall comply with this Fatigue Risk Management Plan and procedures contained within to ensure they maintain the capacity to safely perform work.

Objectives

This Fatigue Risk Management Plan seeks to mitigate risk factors associated with fatigue in Minto Mine's underground mining operations.

The key objectives of this Fatigue Risk Management Plan are to ensure a safe and healthy working environment free of fatigue related injury or illness by:

- controlling work related fatigue risk factors to minimize the likelihood of a worker being fatigued;
- minimising the risks of persons presenting for work or conducting work while impaired by fatigue;
- establish appropriate steps to manage persons who are effected by fatigue; and
- reducing the likelihood of a fatigue related error or incident.

Communication Strategies

To ensure a common understanding of Capstone's fatigue risk management plan, a copy of the plan will be made available to all supervisors and workers involved in underground mining operations. The Minto Explorations Fatigue Management Policy Statement will be displayed in a visually accessible place to demonstrate Capstone's commitment to properly mitigating fatigue factors.

Minto Explorations Fatigue Management Policy Statement

Minto Explorations Ltd. believes that the health and safety of its employees is fundamental to its business operations. Work related injury or illness is unacceptable and the company is committed to the identification, elimination, or control of workplace hazards for the protection of all employees. The goal is to have zero lost time accidents. The company is committed to implementing operational improvements that offer superior safety and occupational health management.

The management of fatigue in the underground mines is an integral part of Capstone's "Fit for Duty" Policy and as such, is a shared responsibility between Capstone, its contractors and its employees. All employees in the underground mining operations must undertake their work in accordance with this policy to the best of their ability and to take all reasonable care for their own safety and health, as well as the health and safety of their work colleagues.

Capstone Mining Corp. understands fatigue is a risk factor and as such is committed to the following:

1. Zero harm to personnel due to fatigue related error.
2. Operating in accordance with industry standards, while meeting or exceeding compliance with all relevant legislative requirements.
3. Providing the expertise and resources needed to maintain a fatigue risk management system designed to recognize and manage fatigue risks to create safe systems of work and safe and healthy work environments.
4. Promoting fatigue awareness through appropriate training and education to ensure workers and supervisors are able to effectively manage fatigue and are able to communicate openly about fatigue related issues.
5. Ensuring employees understand their right and obligation to protect themselves from workplace hazards and alter or stop work if they believe fatigue is compromising the safety of themselves or others.
6. Ensuring all underground mine employees, sub-contractors and visitors are informed of, understand their obligations, and comply with this policy.
7. Measuring health and safety performance with regards to fatigue, the effectiveness of this policy in managing fatigue, and making improvements as warranted.
8. Investigating the causes of accidents and incident including reviewing fatigue factors, and developing effective and immediate preventative and remedial actions as needed.

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Mine Manger

Definitions

For the purpose of this document, the following definitions apply:

Fatigue: A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a worker's alertness and ability to safely perform their duties.
(This definition is modified from Aviation IFALPA IATA FRMS for Operators,2011).

A Fatigue Risk Management Plan (FRMP) is an integrated set of management practices, beliefs and procedures for monitoring and managing the risks posed to health and safety by fatigue. It is based in safety management system theory with an emphasis on risk management.

Capstone's FRMP incorporates:

> **The FRMP Document:** The FRMP document defines and details the way that fatigue-related risk is dealt with in the underground mine at Minto, and is the written version of the FRMP.
> **Risk Mitigation Strategies:** Contained within the FRMP are five levels of defenses designed to reduce the likelihood of a fatigue related error occurring. The FRMP includes tools, strategies and control measures for monitoring and managing fatigue-related risk.
> **Education and Training:** All underground mine employees need to be aware of the risks posed by fatigue, understand the importance of controlling fatigue risk factors and understand the individual and organisational strategies that are employed in managing that risk. This is facilitated through both supervisor and worker education and training programs.
> **Revision and Review Functions:** The system must be monitored for continuous improvement and to ensure it is flexible to changing work practices. The review function is essential and is therefore built into the Capstone FRMP framework.

Employee/Worker: Any person who works on the site, regardless of their employer. This includes direct Capstone employees, contractors and their employees.
Manager/Supervisor: Any person who is directly responsible for the supervision and well being of other employees.
Company/Employer: Capstone Mining Corporation or Minto Explorations Ltd.
Contractor: A company hired by Capstone Mining Corp. to complete work on site. Employees of the contractor are referred to as employees/workers or managers/supervisors.
FRMP: Fatigue Risk Management Plan
Shift: The hours between the start and finish of established daily work schedules.
Work Rotations/Cycles: The working period scheduled between any significant break away from work.
Work Schedules/Rosters: The hours to be worked for each day, shift, week, month or year, as scheduled by the employer.

A complete list of definitions and terms related to this document can be found in Appendix B.

Standards and Legislation

The following standards and legislation were consulted in the preparation of this FRMP.

O.I.C. 2006/178
YUKON OCCUPATIONAL HEALTH AND SAFETY ACT

REGULATIONS: PART 15 – SURFACE and UNDERGROUND MINES or PROJECTS

Hours underground 15.13

(1) A worker shall only remain underground in an underground mine or project for more than eight hours in any consecutive 24 hours, measured from the time the worker enters to the time the worker leaves the underground workings

(a) when an emergency causes an extension of the time,
(b) on one day of a week but only for the purpose of changing shift, or
(c) if the worker is a supervisor, pump worker, cage tender, or a person engaged solely in surveying or measuring or in emergency repair work.

(2) The director may consider and approve an application for a modified hours of work schedule in an underground mine if the director is satisfied that the risk to the health or safety of the workers is not increased.

"**underground mine or underground project**" means a mine or project that is not a surface mine and includes any work, undertaking or facility used in connection therewith.

Emergency Response

An Emergency is defined in Capstone's Safety Management System. In the event of an emergency, workers and supervisors may be required to work outside of normal shift hours and fatigue may become a key safety issue. In the case of an emergency, all efforts should be made to properly mitigate fatigue risk factors through risk management strategies contained within this FRMP. Supervisors should be extra diligent in monitoring fatigue and in assisting workers in being aware of and managing fatigue to the best of their abilities. If possible, the emergency response manager should conduct regular fatigue assessments to determine if fatigue will become a safety hazard. When the emergency situation has finalized, all workers should be allowed a sufficient period to rest prior to recommencing work duties.

Training

Improving supervisor and worker competency in understanding, assessing and controlling fatigue risk factors, is an integral component of Capstone's FRMP. Specific training programs have been designed and delivered to key Minto employees involved in the underground mining operations. All new workers who will be involved in the underground mining operations will be trained in fatigue competency as part of their on-boarding process. Training records will be kept up-to-date to ensure fatigue competency.

Roles and Responsibilities

Capstone and all of its underground mining personnel share in the responsibility to minimize and manage the adverse effects of work related fatigue. As with all safety management systems, the FRMP recognizes an integral role played by management, contractors and workers. Broadly, roles and responsibilities are outlined below.

Workers are responsible for:

- Obtaining sufficient sleep to be fit for work.
- Reporting when they have been unable to obtain sufficient sleep or when they feel at risk of making a fatigue related error.
- Complying with implemented Fatigue Risk Management Plans and policies including following all processes and completing all required documentation related to Capstone's FRMP.
- Participating in fatigue related education and training provided by Capstone.
- Participating in fatigue investigations as required.
- Seeking medical or other assistance with fatigue related health issues (such as illness or sleep disorders).
- Addressing any concerns regarding fatigue with a supervisor as required.

Supervisors are responsible for:

- Ensuring new workers are oriented and informed about issues relating to fatigue and the Capstone FRMP.
- Providing ongoing information and awareness to all underground mining workers regarding fatigue risk factors.
- Ensure workers are following procedures and processes outlined in Capstone's FRMP.
- Conducting regular health and safety meetings that periodically discuss fatigue risk management.
- Ensuring all observed and reported fatigue symptoms are properly addressed through consultation with workers and through agreed actions within the Capstone FRMP.
- Taking action if an employee is not fit for work due to fatigue.
- Reviewing and investigating all reports of fatigue related errors and incidents.
- Ensuring Capstone Fatigue Incident Investigation Information is gathered as part of any underground mine incident investigation.
- Setting a good example for workers by properly managing fatigue factors.
- Addressing any concerns regarding fatigue with workers and management as required.

Employer is responsible for:

- Creating and implementing a fatigue risk management plan and control strategies to mitigate fatigue related risk.
- Providing resources necessary for education and training to assist workers in building competency in identifying, assessing and controlling fatigue.
- Scheduling work to ensure adequate sleep opportunities for workers.
- Providing conditions that are conducive to managing fatigue, specifically providing adequately for nutritional, hydration and fitness needs of workers while at Minto camp site.
- Providing a proper sleep environment for workers when not on duty at Minto camp site.
- Ensuring resources are available to maintain and regularly review and revise the FRMP.
- Supporting employees with non-work fatigue related issues through existing health and safety programs.

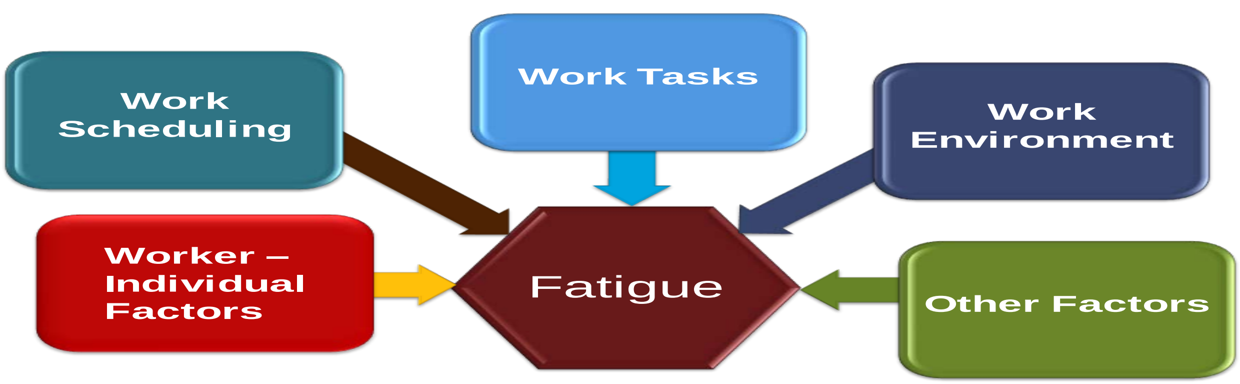
Understanding Fatigue

Understanding fatigue is a key component of any fatigue risk management plan. It is essential for supervisors and workers to understand fatigue factors to be able to properly identify assess and mitigate fatigue risks.

Information required for understanding fatigue includes: circadian rhythms, sleep cycles, causes of fatigue, effects of fatigue, identifying signs of fatigue, and methods of controlling and managing fatigue. These key understandings are an integral part of the supervisor and worker training programs that are provided to all personnel involved in the underground mining operations. These training programs ensure all personnel involved have the understanding and competencies required to properly manage fatigue risk factors. A very brief summary of fatigue understandings is provided below.

Fatigue is an issue because it can impair a workers abilities and can significantly increase the risk of a safety incident occurring. Fatigue causes an increased risk of incidents because of reduced physical and mental abilities and an overall lack of worker alertness. When workers are fatigued they are more likely to have reduced awareness and reduced abilities to respond to changes in their working environment, to react emotionally and/or to exercise poor judgement. This leads to an increased likelihood of incidents occurring due to human error. Fatigue has also been positively linked to multiple long term health concerns such as: digestive issues, ulcers, obesity, diabetes, heart disease, stroke, and immune system deficiencies.

There are numerous factors that influence an individual's likelihood to become fatigued. Key risk factors include: quality and quantity of previous sleep obtained, disruption of circadian rhythms, time of day, age, overall health and nutrition, individual variations, sleep disorders, poor sleep hygiene, stress, family and social obligations, and drug or alcohol use.



[9]

Work factors can also greatly influenced fatigue. Key factors to consider include: shift work particularly length, timing, and frequency of shifts; physical and mental requirements of job tasks; working environment; and inadequate breaks.

There are a number of strategies that can be employed to assist in managing fatigue. These strategies include organizational, individual and team-based countermeasures. All three types of control strategies are employed in this FRMP.

Increased awareness of fatigue factors and increased competency in identifying and managing fatigue will reduce fatigue related risk and the likelihood of fatigue related errors and incidents.

Fatigue Risk Assessments Completed at Minto Mine

Risk management encompasses the identification, assessment, control and evaluation of hazards that pose a meaningful risk to the health and safety of employees/workers (including contractors) and visitors to the workplace.

To properly deal with fatigue risk factors, it is important to:

1. identify where fatigue is a hazard and may pose a risk; and
2. assess the level of risk that a given fatigue hazard represents; and
3. when necessary, put in place controls and mitigation strategies,
4. monitor to make sure that they manage the risk at an acceptable level; and
5. evaluate the implemented controls to ensure they have been successful.

Hazard assessments conducted at the Minto Mine site focused on reviewing hazards associated with fatigue. Assessments were conducted based on observations, consultation and discussions with workers, supervisors and contractors. The following areas were examined: mental and physical work demands; work scheduling and planning; environmental conditions; and individual and non-work factors. Risk assessments were based on both likelihood and severity. Results were graphed and quantified and may be viewed in their entirety in Appendix C. Results were used to create the Capstone 5 Level Fatigue Risk Management Plan. Below is a summary of the quantitative results of the initial hazard assessment conducted.

Table 1.1 Capstone's Minto Mine Fatigue Risk Assessment Results

Factor Grouping	Capstone Risk Points	Total Factor Points	Percent of High Risk Areas
Work Demands	18	30	**60%**
Work Scheduling - Hours	22	50	**44%**
Work Scheduling - Shifts	25	40	**63%**
Work Scheduling - Night Work	40	70	**57%**
Work Environment (listed as high as they are not currently fully assessed)	35	40	**88%**
Off Duty Factors	8	40	**20%**
Totals and Average %	**148**	**270**	**55%**

Fatigue risk factors and assessment have been taken from the following document (Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry, 2009)

In the initial hazard assessment a number of high risk factors for fatigue were identified. These have been specifically outlined and addressed in the FRMP. An outline of some specific control measures used to assist in managing high risk areas are outlined below.

Table 1.2 High Risk Factor Contols

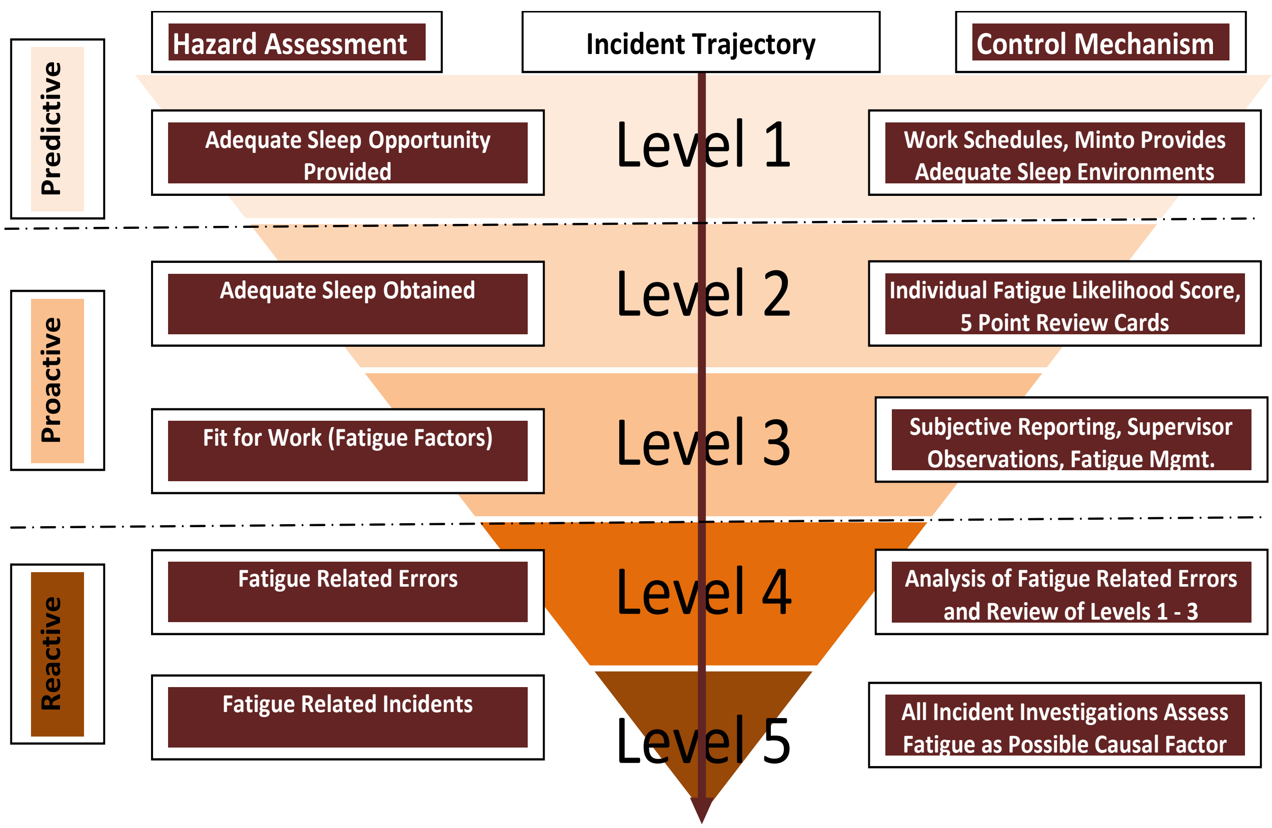
Risk Factor	Control Measures
Work Scheduling • 12 hour shifts • 14 consecutive shifts • 84 hours in a typical work week • Slow rotations - 2 weeks of day shifts, 2 weeks of night shifts • Night shifts	**Increase Sleep Opportunities** **Minimize Non-Work/Off Duty Factors to Increase Sleep Opportunities** • Camp provides limited commute and non-work responsibilities to allow for increased sleep opportunities for workers. • Minimal family and social obligations outside of work to reduce fatigue risks. • Food and lodging provided onsite to minimize obligations outside of work. **Ensure worker access to optimal health requirements to reduce fatigue risk** including: overall nutrition, hydration, recreation and exercise. • Camp menus are designed for optimal worker nutrition and health. A gym is onsite for worker fitness needs. A recreation facility is also available onsite for workers. A variety of bottled beverages and water are always available to workers. Drugs and alcohol are strictly forbidden at Minto Mine site. **Provide Proper Sleep Environment:** • Efforts are made to keep sleeping areas secluded and quiet. There are specific quiet areas set aside for night workers to rest during the day. • All rooms have blinds to reduce daylight. • New camp facilities are planned for the spring and sleep hygiene needs have been reviewed for these new facilities.
Start times before 6 AM	• Start times are being adjusted to 7 AM
Work Demands	
Certain job tasks are physically and mentally more demanding (Stoper, Jackleg)	Certain job tasks, such as Stoper and Jackleg Operators, will have mandatory 15 minute breaks after every 2 hours operating equipment.
Work Environment	
Work environmental factors - currently unknown. Possible exposure to hazardous substances, noise, temperatures, vibration, etc.	On-site industrial hygiene testing is being completed to assess work environmental factors. Control measures will be implemented as required.

Fatigue Management Plans

Addressing safety from the point of view of risk management has become an increasingly accepted way of allowing companies to integrate safety systems and reduce worker risk. There is a growing body of research that shows using a strictly prescriptive approach, relying on hours of service alone as a key mitigation factor for fatigue, is not comprehensive enough to fully insulate workers from the risks of fatigue. A worker can be given ample opportunity for sleep, but due to a variety of circumstances (ex. a sleep disorder, a new baby, an illness, etc) not actually obtain the necessary hours of sleep needed to be alert and fit for duty. Ensuring ample opportunities for workers to sleep is seen as only the first level of safety controls in a complete fatigue risk management plan.

Using a multileveled and comprehensive risk management approach allows companies to identify high risk situations, and then put into place countermeasures that can minimize the likelihood of an incident occurring. This type of system relies on hazard identification, assessment and control measures within a comprehensive safety management system. The Fatigue Risk Management Plan (FRMP) is designed to provide multiple opportunities to introduce countermeasures intended to minimize the possibility of a fatigue related error occurring.

Diagram 1.1 Diagram of Capstone's 5 Level Fatigue Risk Management Plan



Adapted from Centre for Sleep Research, University of Southern Australia

A Brief Overview of the 5 Level Fatigue Risk Management Plan

Capstone's FRMP is based on the 5 Level Fatigue Risk Trajectory and focuses on multiple levels of countermeasures, designed to be used in combination to minimize the risks associated with fatigue.

Details regarding the plan are outlined below.

An Overview of the Plan

Controls	Type	Details
Level 1	Organizational	Adequate sleep opportunity provided
Level 2	Individual/Workers	Self reporting (Fatigue Likelihood Scores)
Level 3	Team	Monitoring for fatigue signs
Level 4	All	Fatigue proofing the system
Level 5	Organizational	System review

- **Level 1 Controls** – Management ensures provision of adequate sleep opportunity through scheduling of work and appropriate sleep environments.
- **Level 2 Controls** – Workers verify that adequate sleep has been obtained through Fatigue Likelihood Assessment and self reporting.
- **Level 3 Controls** – Management and workers ensure behavioral indicators of fatigue are identified and managed.
- **Level 4 Controls** – All ensure the likelihood that errors becoming incidents are minimized – fatigue proofing.
- **Level 5 Controls** –Management ensures fatigue-related incidents are prevented from re-occurring unnecessarily. This is done through fatigue specific incident investigation.

Control s are focused in the following way:

i. Predictive - Level 1
ii. Proactive - Level 2 and 3
iii. Reactive - Level 4 and 5

Additionally:

Levels 1 - 3 require education and training for workers and supervisors to understand the need for sleep, the causes and effects of fatigue, the signs of fatigue, and the safety hazards fatigue can create.

Levels 2 - 5 require a culture that understands and accepts fatigue as a safety hazard, not a worker weakness. Workers must know there are no repercussions for self reporting fatigue.

Levels 4 -5 require a strong commitment from management to follow up on fatigue reports and examine any places in the system that are not properly mitigating fatigue related risks. To be effective the plan must be reviewed on a regular basis to ensure risk controls are effective.

Table 1.3 Details of the 5 Control Levels Including: Key Responsibilities, Assessment Strategies, Documentation Processes and Control Actions.

Level	Responsibility	Risk Factor	Initial Strategy	Assessed Through	Documentation Process	Control Actions Required
1	Supervisor	Adequate sleep opportunities for workers	Ensuring adequate sleep opportunity through work scheduling	Review of initial schedules, rosters, hours/types of shifts, etc and a new review conducted for any major changes	Existing shifts signed off by mine manager. New shifts approved by mine manager prior to implementation.	High risk factors in rostering, scheduling and shift lengths are recognized and mitigated through the many layers contained in this comprehensive FRMP
	Supervisor	Specific job tasks may increase fatigue risks	Review of work tasks and breaks scheduled for specific work tasks	Worker feedback, observed signs of fatigue	Specific tasks (scoper, jack lift) require scheduled breaks that are taken and documented each shift.	Scheduled breaks taken. Job task risk factors are also recognized and mitigated through the other layers contained in this comprehensive FRMP
	Employer	Proper nutrition, hydration and fitness needs for workers to maintain health	Ensuring camp conditions are adequate and can serve to reduce fatigue risks	Review of current camp conditions with regards to nutrition, hydration and fitness needs. Ensuring sleep hygiene is considered in current camp and as new camp is built.	Fatigue Factors: Minto Mine Checklist in Appendix D and part of cyclical review.	Specific efforts are made to ensure proper nutrition through camp menus, hydration through access to fluids and exercise through the onsite gym and various recreational opportunities (ex. hockey rink). Sleep hygiene factors are understood and all efforts are made to incorporate them at the camp. This includes, but is not limited to blinds in the rooms, quiet sleep areas, controlled temperatures in the rooms, etc.

Level	Responsibility	Risk Factor	Initial Strategy	Assessed Through	Documentation Process	Control Actions Required
2	Worker	Workers being fit for work in relation to fatigue factors	Obtaining adequate sleep during off hours and accurately reporting sleep obtained	Individual Fatigue Likelihood Assessment	On 5 Point Review	Follow agreed control strategies listed in Level 2
	Supervisor	Workers being fit for work in relation to fatigue factors	Ensuring workers have obtained adequate rest	Review of 5 Point Review Cards for Fatigue Factors	Fatigue scores found in 5 Point Review Cards are reviewed and recorded.	Follow agreed control strategies listed in Level 2
3	Worker	Ability to manage fatigue risk factors at work	Self-reporting and monitoring of any fatigue symptoms or risk factors	Samn-Perelli Scale	On 5 Point Review	Follow agreed control strategies listed in Level 3
	Worker	Ensuring coworkers are not affected adversely by fatigue factors	Observations for fatigue symptoms in co-workers	Fatigue Symptoms Checklist	Verbally report concerns to co-worker and supervisor. Document on 5 Point Review	Follow agreed control strategies listed in Level 3
	Supervisor	Ensuring workers are not affected adversely by fatigue factors	Observations for fatigue symptoms	Fatigue Symptoms Checklist	Document any observed symptoms, conversations regarding fatigue and control measures taken.	Discuss concerns with worker. Follow agreed control strategies listed in Level 3

Level	Responsibility	Risk Factor	Initial Strategy	Assessed Through	Documentation Process	Control Actions Required
4	Worker	Fatigue related error occurring - (indicates system error in levels 1 - 3)	Report fatigue related errors	Self-assessed based on fatigue levels and actions.	No-loss incident reporting form	Stop Work! Discuss with supervisor. Alter work duties to not include any safety sensitive tasks or do not continue until fit for work.
	Supervisor /Employer (Safety Team)	Fatigue related error occurring - (indicates system error in levels 1 - 3)	Follow up on all fatigue related errors reported.	Worker self-reporting, worker reporting of co-worker error, observations made by supervisor.	No-loss incident reporting form	Take seriously and stop worker immediately! Discuss with worker. Alter work duties to not include any safety sensitive tasks or do not allow worker to continue until fit for work. Post incident follow up to discover where Levels 1 - 3 were ineffective.
5	Worker	Fatigue related incident occurring	Report all Incidents	Incident Investigation	Incident Reporting Form	All work is stopped after an incident. Work does not commence until a supervisor deems it safe to continue.
	Supervisor / Employer (Safety Team)	Fatigue related incident occurring	Investigate all Incidents	Incident Investigation	Incident Reporting Form, Incident Investigation Report including Capstone's Fatigue Incident Investigation Information	If fatigue is in any way a causal factor, a thorough review to discover where levels 1 - 3 were ineffective is required. A review of the FRMP may be required.

Level 1 - 5 Supporting Processes and Procedures

Level 1 - Understanding Management Influences on Sleep Opportunities

Primarily level 1 controls involve organizing work to provide adequate sleep opportunities for workers. It also involves scheduling breaks as needed to avoid fatigue.

Key areas this focuses on are:

1. Work Scheduling
    a. Work shifts
    b. Schedules (including start times)
    c. Rotations
2. Camp Environment
    a. Camp nutrition, hydration and exercise opportunities
    b. Quiet, dark sleeping environments
3. Work Environment
    a. Testing underway
4. Work Tasks
    a. Worker Task Break Schedule

Key documents to assist in this are:

1. Fatigue Factors: Minto Camp Checklist (Appendix D)
2. Summary of Minto Mine's Underground Environment Testing

Level 1 Controls Brief Description:

There are a variety of scheduling factors that can be reviewed to reduce fatigue. These focus on applying what is known about human needs for rest and circadian rhythms to existing company needs for work to be scheduled. Where possible, schedules should be examined and altered to accommodate worker needs for proper rest. Where it is not possible to alter schedules for optimal worker alertness, levels 2 - 5 of the FRMP must be implemented to reduce worker risk of fatigue error.

Camp conditions should be designed, as much as possible, to support worker access to nutrition, hydration and exercise. Proper sleep environments should be available to workers.

Current environmental conditions in the underground Minto mine have not been assessed. Processes are under way to begin the testing and assessment. Until assessments have been completed, high-level controls will be put into place to ensure fatigue risk factors are controlled.

Certain work tasks have been identified as increasing a workers likelihood to become fatigued. As such work breaks have been scheduled that are specific to work tasks. The following table outlines work tasks and mandatory minimum breaks to be provided for workers completing those tasks.

Table 1.4 Worker Task Break Schedule

Job Designation and Key Tasks	Minimum Work/Break Schedule Required
Supervisor Jumbo Driller Scoop Operator (Mucker) Maclean Operator (Rock Bolt Machine) Truck Driver Welders, Electricians, Mechanics	Breaks should be taken as required with a minimum 30 minute break (or two 15 minute breaks) every 6 hours.
Stoper Operator Jackleg Drill Operator	Breaks should be taken as required with a minimum 15 minute break taken for every two hours of equipment operation.
Other non designated tasks or workers	Follow typical break schedule of taking breaks as required with a minimum 30 minute break (or two 15 minute breaks) every 6 hours unless work is physically or mentally demanding and/or the worker is experiencing fatigue. Then a minimum 15 minute break every two hours should be taken.

Currently, under the Dumas contracting system, underground miners work the following shifts:

> 14 day shifts of 12 hours each starting at 6 AM and finishing at 6 PM, a 24 hour break, followed by 14 night shifts for 12 hours each starting at 6 PM and finishing at 6 AM, followed by 2 weeks off.

Upon implementation of this FRMS, Dumas shifts will be altered to the following:

> 14 day shifts of 12 hours each starting at 7 AM and finishing at 7 PM, a 24 hour break, followed by 14 night shifts for 12 hours each starting at 7 PM and finishing at 7 AM, followed by 2 weeks off.

When Capstone moves from using Dumas as an independent contractor to having direct Capstone employees work in the underground mine, the following shift schedule is planned:

> 14 day shifts of 12 hours each starting at 7 AM and finishing at 7 PM, followed by 2 weeks off, followed by 14 night shifts for 12 hours each starting at 7 PM and finishing at 7 AM, followed by 2 weeks off.

Additional Level 1 Controls

Review of NSW controls and choosing appropriate ones to suggest and implement.

Level 2 Controls - Worker Self-Reporting of Sleep Obtained

Worker self-reporting of sleep obtained using the Individual Fatigue Likelihood Assessment. Agreed controls based on fatigue likelihood score.

Diagram 1.2 Individual Fatigue Likelihood Wallet Card (side 1)

Capstone Minto Mine

INDIVIDUAL FATIGUE LIKELIHOOD ASSESSMENT

Step 1. Sleep in prior 24 hours					
Sleep	≤ 2h	3h	4h	5h+	
Points	12	8	4	0	
Step 2. Sleep in prior 48 hours					
Sleep	≤ 8h	9h	10h	11h	12h+
Points	8	6	4	2	0
Step 3. Hours awake since last sleep					
Add one point per hour awake greater than sleep in Step 2					

Workers assess likelihood of fatigue based on previous sleep obtained. Score is determined by calculating sleep obtained in the last 48 hours and by assessing how long it has been since the worker last slept.

Scores are calculated by assigning points to sleep obtained in the last 24 hours (any sleep over 5 hours is 0 points) and adding it to sleep obtained in the previous 24 hours (an average of 6 hours a night or 12 hours in total is 0 points). The score is then compared to the number of hours the individual has been awake.

> Example 1: An individual slept 5 hours the night before their shift and 4 hours the night before that. They have been awake for 3 hours. Score (0 + 6 + 0 = 6) They should request supervisor monitoring.
>
> Example 2: An individual slept 6 hours the night before their shift and 5 hours the night before that. They have been awake for 12 hours. Score (0 + 2 + 1 = 3) They should self monitor for signs of fatigue and manage as needed.
>
> Example 3: An individual slept 3 hours the night before their shift and 3 hours the night before that. They have been awake for 8 hours. Score (8 + 8 + 2 = 18) They are not fit for duty and should not commence work. They should speak with their supervisor and obtain rest before starting a shift.

Note: This sleep scale does not accurately account for individual differences in sleep needs. It also does not account for accumulated sleep debt. Level 3 controls should still be used if needed even if a Fatigue Likelihood score is 0.

Diagram 1.3 Individual Fatigue Likelihood Wallet Card (side 2)

Capstone Minto Mine

INDIVIDUAL FATIGUE LIKELIHOOD ASSESSMENT

Step 4. Add all points together to deterimine your score

Score	Agreed Control Strategies
1 to 4	Self Monitoring
5 to 11	Request Supervisor Monitoring
12+	Do NOT Commence Shift Until Fit For Work

Refer to FRMS policy for detailed explanation of controls

Table 1.5 Possible Symptoms and Agreed Controls for Fatigue Likelihood Scores

Score	Possible Signs and Symptoms	Agreed Control Strategies
12+	Difficulty staying awake and possibly experiencing microsleeps. Uncoordinated physically and experiencing difficulty staying focused. Significant impairment evident.	Document and report risk to supervisor. Do not engage in ANY safety critical work or behaviors. Do not recommence until fit for work.
10	Clear evidence of behavior impairment. Difficulty sustaining attention on simple tasks. Uncoordinated p.	Document and report risk to supervisor. Complete Samn Pernelli and Fatigue Symptoms Checklist. Engage in individual and team fatigue management strategies. Organize supervisory checks and work directly with a co-worker if possible. Nap if possible. Should not engage in safety critical work - task reassignment if necessary.
8	Clear loss of motivation and physically weak and listless. Significantly reduced situational awareness. Task performance impaired.	
6	Difficulty concentrating. Occasional lapses of attention. Poor judgement on complex tasks. Physically affected - sagging body posture, slow blinking, etc.	
4	Difficulty in maintaining extended concentration for complex tasks. Low energy levels and weakness apparent.	Document. Complete Samn Pernelli and Fatigue Symptoms Checklist. Take approved individual or team countermeasures. Self-monitor for symptoms, team monitor by co-workers, task rotation or other job alterations as required.
2	Slowed cognition. Occasional minor fatigue behaviors observed. Minor mood changes observable. Low energy levels or hyperactive.	Controls and fatigue management may be necessary. Assess and monitor for fatigue symptoms.
0	Able to perform tasks safely. Unlikely fatigue impairment, but monitor if required.	No controls unless otherwise indicated by other fatigue risk factors

Level 3 Controls - Team Controls to Ensure Fatigue Risks are Controlled.

Workers experiencing fatigue use level 3 checklists (Samn-Perelli Fatigue Checklist, Symptoms of Fatigue Checklist), report to supervisor and co-workers any fatigue concerns, and engage in individual and team controls as needed.

Supervisors check all recorded fatigue data, watch for signs of fatigue, and take all reports of fatigue seriously. Team controls are implemented as needed. Any worker not fit for duty is removed from safety sensitive work, given alternate tasks or removed from duty as required.

Diagram 1.4 Samn-Perelli Fatigue Checklist (side 1)

Samn-Perelli Fatigue Checklist	
1	Fully alert
2	Very lively
3	Okay
4	A little tired
5	Moderatly tired
6	Extremely tired
7	Completely exhausted

Diagram 1.5 Samn-Perelli Fatigue Checklist (side 2)

Samn-Perelli Fatigue Checklist Controls Based on Score	
1 to 3	Proceed with work, monitor if symptoms appear
4 to 5	Supervisor monitoring required, implement individual and team management strategies, alter work duties if needed
6 to 7	Stop work, obtain rest before beginning shift

This checklist can be used throughout a shift, triggered by the following:

- start of shift (routine assessment)
- start of night shift
- following a nap
- if shift is to be extended
- on call-in overnight shift
- if Level 2 assessment places the person in yellow or red zones
- coworker or supervisor notes symptoms
- individual experiences symptoms
- error committed or noticed
- incident

Supervisor Monitoring

The following is a list of fatigue symptoms to assist with monitoring. Workers should also be taught to monitor themselves and each other for signs of fatigue. Workers exhibiting signs should be approached and questioned regarding fatigue likelihood scores and feelings of fatigue. A mitigation strategy should be worked out with the worker. Remember, those who are fatigued often underestimate the level of their fatigue and are less able to make effective decisions. Err on the side of caution.

Diagram 1.6 Symptoms of Fatigue Checklist

Common Symptoms of Fatigue Checklist					
Physical	**Observed**	**Mental**	**Observed**	**Emotional**	Observed
Yawning		Difficulty concentrating		Quiet	
Slow blinking		Laspses in attention		Withdrawn	
Rubbing eyes or face		Memory lapses		Lethargic	
Aching muscles or headache		Difficulty communicating		Bored	
Uncoordinated movements		Lack of situational awareness		Lacking motivation	
Sagging body posture		Making mistakes		Irritable	
Weak and low energy		Confusion		Easily frustrated	

Individual and Team Fatigue Management Strategies

The following are examples of individual and team control measures that can be used depending on the level of fatigue.

Diagram 1.7 Individual Control Examples

Individual Control (Examples)
Controlled use of caffeine
Adequate hydration and food intake
Adjust working temperature
Adjust lighting
Take a break
Change tasks
Remove safety sensitive tasks from work
Take a 20- 30 minute nap
Increase social interaction
Defer to a second opinion
Increase supervision
Stand Down - do not proceed until fit for work

Diagram 1.7 Team Control Examples

Team Control (Examples)
Communicate fatigue status at morning safety meeting
Communicate high Fatigue Likelihood Score to supervisor and coworkers
Document high Fatigue Likelihood Score
Increase cross checking among coworkers (watching out for each other)
Increase supervision
Task reallocation or rotation (trading tasks when needed)
Delay safety sensitive work when possible
Take a collective break (encourage breaks when needed)
Work together with a co-worker where possible (chat to keep alert)
Engage in conversations and social interactions
Fatigue leave - all crew stand down

Level 4 - Fatigue Related Errors - Assessing the System

One of the key factors in Capstones 5 Level Fatigue Risk Management Plan is the reactive measures used to ensure the plan is working appropriately. Any report of fatigue related error should be immediately followed by an informal investigation to determine where levels 1 to 3 were inadequate in properly mitigating fatigue factors.

The following procedures should occur:

1. All fatigue related errors are reported immediately to a supervisor
2. All fatigue related errors are documented within that shift on no loss incident investigation forms.
3. No loss incident investigation forms are to be submitted to the safety committee for informal investigation.
4. Informal investigation will take place within one week of receiving the incident forms.
5. Informal investigation should include the following:
    a. Discussion with the worker to determine causal factors of fatigue
    b. The effectiveness of the reporting process used on the day of the incident
    c. The reasons that levels 1-3 were ineffective in assessing and mitigating the fatigue risk.
6. Formal fatigue incident investigation tools found in level 5 may be reviewed and used if necessary.

Level 5 - Fatigue Related Incidents - Fatigue Incident Investigation Information Required

All incidents investigated in the underground mining operations need to be assessed to determine if fatigue was a risk factor. Normal Capstone SMS incident investigation procedures are used. The addition of the fatigue incident investigation information will assist in determining if fatigue was a causal factor in the incident. Fatigue incident investigation information must be collected on all incidents occurring within the underground mining operations. All data collected as part of all incident investigations shown to have fatigue causal factors must be recorded and used as part of the fatigue risk management plan review process.

Capstone Fatigue Incident Investigation Information

1. **Date, time and place** of the accident. (not the time of the report) ____________________
____ **Level 1**

2. **Work Schedule History (Schedule, Rotation, Shift Length, Breaks)** **Level 1**

   What was the actual work schedule (regular hours plus overtime) for the **four days** prior to the accident? (Please fill out by date and shift until all four days prior to the accidents are covered).

   Work Shift -1: Start time/Date: ________ End time/Date: __________
   Work Shift -2: Start time/Date: ________ End time/Date: __________
   Work Shift -3: Start time/Date: ________ End time/Date: __________
   Work Shift -4: Start time/Date: ________ End time/Date: __________

   How many hours into the shift did the incident occur? (ex. 3 hours in) _____________

   How far into the work schedule was the individual involved?
   Day #/Shift #: (ex. Day 12/28) _________________________

   What shift was the individual working (day or night)? ____________________

   How long from the last scheduled break? _______________________________

   How long in duration was the last scheduled break? _________________________

3. **Work Task and Work Environment** **Level 1**

   What task was being performed at the time of the incident? What was the work environment like? How mentally or physically stimulating was the task and work environment prior to the accident? (Refer to Capstone's FRMS for details on fatigue risk factors relating to work tasks and work environments).

Job Designation (Title) of individual(s) invlolved, task being preformed, and work environment described: ____
____
____
____

Rate Mental Factors _____________
(on a Scale of 1 - 5 with 1 being very stimulating and 5 being fatiguing)

Rate Physical Factors _____________
(on a Scale of 1 - 5 with 1 being very stimulating and 5 being fatiguing)

Work Environment Rated: ________________
(on a Scale of 1 - 5 with 1 being very stimulating and 5 being fatiguing)

4. **Number of hours of actual sleep** in previous 24, 48 and 72 hours (i.e. 3 days) prior to the accident.

Level 2

Day 1: __________
Day 2: __________
Day 3: __________
Number of hours awake (from previous sleep) when accident occurred. ___________

5. **Overall quality of sleep** 24, 48 and 72 hours (i.e. 3 days) prior to the accident.

Level 2

First Day Prior:	Poor □	Fair □	Good □	Excellent □
Second Day Prior:	Poor □	Fair □	Good □	Excellent □
Third Day Prior:	Poor □	Fair □	Good □	Excellent □

6. Did any **health problems** affect the individuals sleep during the month leading up to the accident?

Level 2

Yes □ No □ Uncertain □ If Yes provide details:

____
____

7. Any **symptoms of fatigue** during the persons waking hours prior to the accident. (either self reported or observed by others)?

Level 3

Frequent Eye Closure □	Lethargic or Low Energy □	Fixed Gaze □
Distracted or Forgetful □	Excessive Yawning □	Head Nodding □

Other: (refer to Symptoms of Fatigue Checklist found in Capstone FRMS)

____
____

8. What **fatigue assessment** and documentation had occurred prior to and during the shift? (ex. Fatigue Likelihood score, self-reporting of fatigue, supervisor noting of symptoms, Samn-Perelli Scale, etc.)

Level 2 & Level 3

____
____
____

9. Any other information relating to the incident or worker relating to fatigue that could be relevant to the investigation.

Level 1 to Level 3

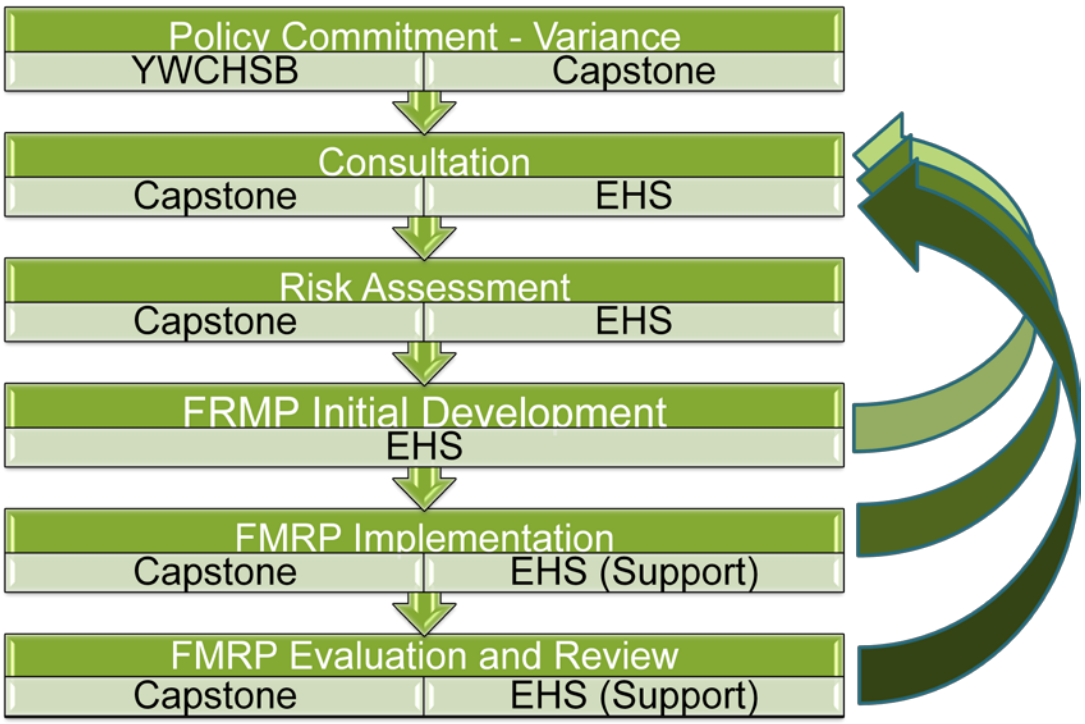
____
____
____

Implementation Strategies

Implementation Role Clarification

Initial policy creation was based upon variance agreements between Capstone Mining Corp. and the Yukon Worker's Compensation Health and Safety Board. EHS Partnerships was brought in as a consultant to assist in identifying, assessing and controlling fatigue risks. The creation of the Fatigue Risk Management Plan has been a process based upon consultation with Capstone and YWCHSB.

Upon completion of the consultation and revision processes, the FRMP implementation process will be completed by the Minto Mine Safety Management Team at the direction of the Capstone Mine Corporation. Consultation and support for the implementation will be available, upon request, from EHS Partnerships.



Communication Strategies

To ensure a common understanding of Capstone's underground mining fatigue risk management plan, a copy of the policy will be made available to all supervisors and workers. The Capstone policy statement will be displayed in a visually accessible place to demonstrate capstones commitment to properly mitigating fatigue factors.

When final revisions are complete, a copy of this plan will be sent to the following:

- i. YWCHSB
- ii. Capstone Corporate
- iii. Minto Mine Management
- iv. Minto Safety Committee
- v. Underground Mine Supervisors
- vi. Underground Mine Workers
- vii. Other Key Stakeholders (Contractors)

b. Participation Requirements
- i. All Underground mine contractors, supervisors, and workers are required to fully participate in the Capstone FRMP including the training provided and the policies and procedures contained within.

c. Supervision Responsibilities
- i. Overall implementation responsibilities fall to Capstone Mining Corp. These may be designated as required to Minto Mine Management and the Minto Safety Team.

Planned Audit and Review

The fatigue management procedure or plan must be reviewed at regular intervals to ensure the continual effectiveness of the controls. Review of control measures should be undertaken when methods, tasks, equipment, hazards, operations, procedures, rosters or schedules are introduced or the environment changes or there is any indication risks are not being controlled.

d. Specific Review Dates
- i. Capstone's FRMP should be reviewed on an annual basis (minimal standard) to ensure the plan is working to properly mitigate the risks of fatigue.

e. Review Roles and Procedures
- i. Annual review will led by the Minto Mine Safety Team and will include:
  1. Review of the FRMP document.
  2. Completion of the Fatigue Management Self Assessment Worksheet found in Appendix E.
  3. Review of all fatigue data including:
     - a. Summary of fatigue information gathered during shifts.
     - b. Summary of all fatigue related errors and no loss incidents and a review of the investigation information conducted on these.
     - c. Summary of any Incident Investigation that identified fatigue as a causal factor.
     - d. Specific review factors to consider include:
       - i. have control measures been implemented as planned?
       - ii. are they working?

        iii. are there any new problems? and
        iv. incidents, near misses, injuries and other data, such as absenteeism and staff turnover rates.
    e. Further review of control measures should be undertaken when hazards, procedures, rosters or schedules are introduced or there is any indication risks are not being controlled.
4. Feedback Method (Internal)
    a. Solicitation of formal and/or informal feedback from workers, supervisors, contractors involved in the FRMP should be gathered.
        i. Specifically:
            1. Do they feel the plan is effectively controlling fatigue risks?
            2. Any ways they feel the plan could be improved.
5. Revision Process
    a. If required, necessary revisions and implementation of revisions should take place within 60 days of the annual review process.

Appendices

A. References
B. Definitions and Terms
C. Minto Mine's Initial Risk Assessment Results
D. Fatigue Factors: Minto Camp Checklist
E. FRMP Self Assessment Checklist

Appendix A: References

1. NSW Mine Safety Advisory Council & NSW Government (2009), *Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry*
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17. Drew Dawson (2011), *Managing Fatigue-related Risk: A Safety Management Systems Approach,* Centre for Sleep Research University of South Australia
18. Drew Dawson Ph.D., Kirsty McCulloch, *Managing Fatigue: It's About Sleep - Stupid,*

Appendix B: Terms and Definitions

Term	Definition
Alertness	The opposite state of sleepiness, the state of cognitive and physiological arousal, and responsiveness to environmental/situation conditions.
Circadian Rhythm	A neural pacemaker in the brain that monitors the day/night cycle (via a special light input pathway from the eyes) and determines our preference for sleeping at night. Shift work is problematic because it requires a shift in the sleep/wake pattern that is resisted by the circadian body clock which remains 'locked on' to the day/night cycle.
Contractor	A company hired by Capstone Mining Corp. to complete work on site. Employees of the contractor are referred to as employees/workers or managers/supervisors.
Controls	System-level defensive strategies designed to minimize fatigue risk on an ongoing basis.
Cumulative Sleep Debt	Sleep loss accumulated when sleep is insufficient for multiple nights (or 24-hr days) in a row. As cumulative sleep debt builds up, performance impairment and objective sleepiness increase progressively, and people tend to become less reliable at assessing their own level of impairment
Employee/Worker	Any person who works on the site, regardless of their employer. This includes contractors.
Employer/ Company	Capstone Mining Corporation or Minto Explorations Ltd
Fatigue	Fatigue is a state of impairment. It is a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a worker's alertness and ability to safely perform their duties.
Fatigue Countermeasures	Organizational, individual and team based fatigue management strategies to reduce the effects of fatigue.

Fatigue Likelihood Assessment	A quantitative measure of the amount of sleep an individual is able to obtain. It is used to determine the likelihood an individual will experience fatigue symptoms or reduced levels of alertness.
Fatigue Risk Management	The management of fatigue in a manner appropriate to the level of risk exposure and the nature of the operation, in order to minimise the adverse effects of fatigue on the safety of operations.
Fatigue Risk Management Plan (FRMP)	is an integrated set of management practices, beliefs and procedures for monitoring and managing the risks posed to health and safety by fatigue. It is based
Fatigue Symptoms Checklist	A list of fatigue symptoms that can be used to assist in identifying when an individual might be experience fatigue.
Five Level Fatigue Trajectory	model utilising multiple layers of defence to manage the occurrence of fatigue-related incidents. It is the major practical or day-to-day aspect of the FRMS and includes tools and controls for monitoring and managing fatigue-related risk. At each level there are opportunities to put in place control strategies to manage the fatiguerelated risk. For an incident to occur, each level must have failed in some part to allow the error to pass through.
FRMS Training	Competency-based training programs designed to ensure that all stakeholders are competent to undertake their responsibilities in the FRMS.
Manager/Supervisor	Any person who is directly responsible for the supervision and well being of other employees.
Micro Sleeps	A short period of time (seconds) when the brain disengages from the environment (it stops processing visual information and sounds) and slips uncontrollably into light non-REM sleep. Microsleeps are a sign of extreme physiological sleepiness.
Mitigations	System-level interventions designed to reduce a specific identified fatigue risk.

Nap	A brief period of sleep, usually defined as less than half of a full night time sleep period. Naps as short as 5 minutes have been shown to provide (temporary) relief from the cumulative effects of sleep loss
Performance	The observable/behavioural manifestation of alertness and sleepiness, and the combination of one’s efforts and the results of those efforts.
Prior Sleep	The amount of sleep obtained prior to a specific time (eg. the start or end of a shift).
Prior Wake	The amount of time spent awake prior to a specific period (usually assessedat the start and end of a shift).
Risk	The potential for harm, a concept that denotes a potential negative impact to some characteristic of value that may arise from a future event. Risks are events or conditions that may occur, and whose occurrence, if it does take place, has a harmful or negative effect.
Risk Management	The process of identifying and managing the factors contributing to risk, errors and incidents, at an individual or an organisational level, and determining how to best handle such exposure.
Safety Management System (SMS)	A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.
Samn-Perelli Checklist	A subjective checklist used to measure a worker's fatigue levels.
Shift	The hours between the start and finish of established daily work schedules.
Shift Worker	a person who works rotating shifts, irregular shifts, evening shifts, afternoon shifts, morning shifts or split shifts. Another term for this work is ‘non-traditional work hours.’

Sleep Disorders	A range of problems that make it impossible to obtain restorative sleep, even when enough time is spent trying to sleep. More than 80 different sleep disorders have been identified, that can cause varying amounts of sleep disruption. Examples include obstructive sleep apnea, the insomnias, narcolepsy, and periodic limb movements during sleep
Sleep Inertia	Transient disorientation, grogginess and performance impairment that can occur as the brain progresses through the process of waking up. Sleep inertia can occur on waking from any stage of sleep but may be longer and more intense on waking from slow-wave sleep (non-REM stages 3 and 4), or after sleep periods or naps containing a high proportion of slow-wave sleep.
Sleep Need	The amount of sleep that is required on a regular basis to maintain optimal levels of waking alertness and performance. Very difficult to measure in practice because of individual differences.
Sleep Quality	Capacity of sleep to restore waking function. Good quality sleep has minimal disruption to the non-REM/REM cycle. Fragmentation of the non-REM/REM cycle by waking up, or by brief arousals thatmove the brain to a lighter stage of sleep without actually waking up, decreases the restorativevalue of sleep.
Sleep Quantity	The total amount of sleep that an individual is able to obtain. It is usually measured to the nearest hour.
Sleepiness	A state of increased motivation to sleep. Difficulty in maintaining the alert state so that if an individual is not kept active and aroused, they will fall asleep.
Subjective Fatigue	Self-reported levels of feelings of fatigue, assessed on a seven-point scale ranging from ‘fully alert, wide awake’, to ‘completely exhausted, unable to function’.
Work Rotations/Cycles	The working period scheduled between any significant break away from work.
Work Schedules/Rosters	The hours to be worked for each day, shift, week, month or year, as

Appendix C: Fatigue Hazard Assessment at Minto Mine

Hazard assessments conducted at the Minto Mine site focused on reviewing hazards associated with fatigue. Assessments were conducted based on observations, consultation and discussions with workers, supervisors and contractors.

The following areas were examined: mental and physical work demands; work scheduling and planning; environmental conditions; and individual and non-work factors.

Risk assessments were based on both likelihood and severity. Results were graphed and quantified . Below is a summary of the quantitative results of the initial hazard assessment conducted.

Table 1.1 Capstone's Minto Mine Fatigue Risk Assessment Results

Fatigue risk factors and assessment have been taken from the following document (Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry, 2009)

Factor Grouping	**Capstone Risk Points**	**Total Factor Points**	**Percent of High Risk Areas**
Work Demands	18	30	60%
Work Scheduling - Hours	22	50	44%
Work Scheduling - Shifts	25	40	63%
Work Scheduling - Night Work	40	70	57%
Work Environment (listed as high as they are not currently fully assessed)	35	40	88%
Off Duty Factors	8	40	20%
Totals and Average %	**148**	**270**	**55%**

Appendix D: Fatigue Factors Minto Mine Checklist

Minto Mine Fatigue Factors Camp Checklist	Check
Accommodations	
Temperature - Rooms should be between 18 - 22 C	
Lighting - Room should be able to be darkened during daylight hours (ex. Effective window blinds, black our curtains, etc.)	
Bed should be firm but comfortable	
Sufficient blankets and comfortable pillow should be provided	
Noise	
Room should be able to block sound. Alternately, quiet areas created for night workers or white noise devices or ear plugs provided.	
Beds	
Matresses and pillows should be comfortable for workers. Adequate blankets provided.	
Nutrition	
Healthy food choices should be available to workers for both day and night shifts.	
Light protien, low fat snacks and meals should be available to night workers.	
Low glycemic index food (low sugar and carbohydrate content) should be available to all workers, especially night shift workers.	
Caffeine should be available at all times if needed.	
Exercise and Recreation	
Recreation opportunities should exist for both day and night workers.	
Exercise facilities should be available for workers on day or night shifts.	
Travel	
Travel to and from work site should be limited if working long night shifts.	
Drivers should be assessed (self checks or other) for signs of fatigue prior to transporting crews.	

Appendix E: Fatigue Management Plan Self Assessment Worksheet

Exercise 3

Fatigue management self assessment worksheet

Individually assess your mine's Fatigue Management Plan. Elements of the self-assessment correspond to elements that need to be addressed in a Fatigue Management Plan.

Mine name:		**Section:**	
Assessment Team Leader:		**Participants (names/positions):**	

QUESTIONNAIRE	RESPONSE						
	Not started	Just started		Progressing		Done	Averaged Score
CONSULTATION, COMMITMENT AND RESPONSIBILITES: Everybody is given sufficient opportunity, time and resources to participate in fatigue management and are clear about their roles and responsibilities.	0	1	2	3	4	5	
Fatigue management is reflected in the site's health and safety policy or there is a stand alone fatigue management policy. The policy has been developed in consultation with employees and contractors and is signed by the most appropriate senior person.	☐	☐	☐	☐	☐	☐	☐
Commitment to fatigue management is demonstrated by having fatigue management procedures (or plan) in place and allocating time, money and training resources.	☐	☐	☐	☐	☐	☐	
Roles and responsibilities for fatigue management are allocated to positions within the organisation.	☐	☐	☐	☐	☐	☐	
An education and communication strategy has been agreed.	☐	☐	☐	☐	☐	☐	
A consultative arrangement has been established to develop a joint approach to controlling fatigue risk.	☐	☐	☐	☐	☐	☐	
FATIGUE RISK MANAGEMENT: Everybody works together to identify the FATIGUE hazards and fix problems at the source before exposures occur.							
Workers are provided with necessary information about fatigue hazards and controls to enable meaningful participation in fatigue risk management.	☐	☐	☐	☐	☐	☐	☐
Work- related fatigue risks impacting on the amount and quality of sleep (such as work scheduling and planning) of employees and contractors are considered when carrying out fatigue risk management.	☐	☐	☐	☐	☐	☐	
The risk management process considers how mental and physical demands of the job and the work environment contribute/ impact the effects of fatigue.	☐	☐	☐	☐	☐	☐	
Fatigue related risks are controlled according to the "hierarchy of control" and controls are monitored and reviewed for their continued effectiveness.	☐	☐	☐	☐	☐	☐	
The health and safety reporting system allows employees to report themselves or others as fatigued without criticism.	☐	☐	☐	☐	☐	☐	
Fatigue-related information is captured in the incident reporting process.	☐	☐	☐	☐	☐	☐	
IMPLEMENTING FATIGUE MANAGEMENT: Everybody is competent to manage fatigue risks within their area of responsibility and supervisors are trusted and decisions are supported.							
Supervisors identify when fatigue is an issue and initiate immediate control measures and record concern for further review (as required).	☐	☐	☐	☐	☐	☐	☐
Employees and contractors are provided education and awareness about the site's fatigue management plan and procedures at induction and on a periodic basis. Consideration is given when communicating to those on shift work and contractors to ensure all have been informed on fatigue management issues.	☐	☐	☐	☐	☐	☐	
Unplanned changes to the work schedule (ie. maintenance, break downs, unexpected shortage of staff) are considered in fatigue risk management planning, for employees and contractors.	☐	☐	☐	☐	☐	☐	
Safety-critical tasks are not performed at times when fatigue is likely to be higher? If tasks need to be performed, fatigue related risks have been considered as part of the risk assessment/ work instructions and procedures.	☐	☐	☐	☐	☐	☐	
Sites have a system/ methods for monitoring hours of work of employees and contractors.	☐	☐	☐	☐	☐	☐	
IMPLEMENTING HEALTH MANAGEMENT - EVALUATION AND REVIEW: The fatigue management plan includes ongoing monitoring and evaluation for effectiveness.							
The fatigue management procedure or plan is reviewed at regular intervals to ensure the continual effectiveness of the controls.	☐	☐	☐	☐	☐	☐	☐
Review of control measures are undertaken when methods, tasks, equipment, hazards, operations, procedures, rosters or schedules are introduced or the environment changes or there is any indication risks are not being controlled.	☐	☐	☐	☐	☐	☐	