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1 Background

This Underground Mine Development and Operations Plan (UMDOP) has been prepared to satisfy the requirements of the Quartz Mining Licence (QML-001) for the development and mining of the underground mine for the Minto Mine site owned by Minto Explorations Ltd. (Minto).

Minto Mine has been in operation since 2007. Operations were focused solely on open pit mining from 2007 until 2012 at which time the underground mine development commenced. Underground development continued through early 2013 at the Minto South portal.

In January 2014, through continued consultation with Yukon Government Department of Energy, Mines and Resources, Minto sought approval for changing the mining sequence to the “M-zone”, with access from the Area 2 pit bottom. Approval to proceed was granted in an approval letter sent January 10th, 2014. The letter contains authorization for the following:

“The Licensee is authorized to:

1. Mobilize equipment and utilities as per Figure 5 of the addendum plan;
2. Implement the Construction Plan.

This approval is subject to the following conditions:

1. The UG Plan must be updated to incorporate the information containing in the Addendum Plan and Construction Plan as well as the information included in the “Updated Capstone Mining Corp., Minto M-Zone Ventilation Conceptual” dated December 9, 2013 and prepared by Stantec.
2. Stopping activities that create rib pillars shall not commence until authorized by the Chief.
3. Any application to the Chief to commence stopping shall include an analysis of rib and crown pillar, stope back, and overlying pit stability.
4. All updates to the Emergency Response Plan must be submitted to the Chief to ensure the plan on file is up to date; and
5. As-built drawings of all underground workings, including fixed infrastructure, must be submitted in the Annual Report required pursuant to paragraph 12.5 of the License.”

In addition to providing information previously submitted and approved for the Phase IV underground, this UMDOP has been updated to compile the documents submitted for the M-zone schedule change approval, and seeks to provide the requirements for the aforementioned conditions.

As required by the QML-001, built drawings of all underground workings will be submitted in the annual report.

This March 2014 UMDOP replaces the April 2013 UMDOP that was approved under the QML on April 19, 2013.

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-001 submissions, primarily the "Mine Development and Operations Plan v1."
2 Site Description

2.1 Current Mine Operations

Figure 2-1 contains an aerial overview of the mine site as of August 2013. The site configuration has not significantly changed since the photo was taken; open pit mining continued in the Area 2 pit until completion in January 2014, mining commenced in the Area 118 pit in January and is expected to continue to July 2014 at a reduced rate. Waste rock from mining operations is being deposited in several locations including; the Southwest dump, the South Wall Buttress, and the Mill Valley Fill Extension. Overburden is being deposited in the Reclamation Overburden Dump, or in the Ice-Rich Overburden dump, depending on the ice content of the material.

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

Underground development commenced at the Minto South portal for Area 118 and Area 2 development in mid-2012 with clearing of the overburden at the portal location, as well as construction of a road to the portal. The first blast occurred at the portal in September, and the portal was collared to 15 m with a steel portal access structure. Figure 2-2 shows the general surface layout at the Minto South portal.

Development continued with access from the Minto South portal in 2014, Figure 2-3 illustrates the extent of the underground development. A fresh air raise, in addition serving as a secondary egress, was completed in January 2014.

2.3 M-Zone Underground

As part of the ongoing optimization of mining plans, Minto has identified an opportunity to extract a portion of the Phase IV underground reserve, accessible from the bottom of the Area 2 pit, earlier in the mining sequence. This specific area was previously a stope within the Area 2 portion of the Phase IV underground, where it was scheduled to be one of the last mined. It was given the name “M-zone” to delineate from other nomenclature of the Phase IV underground plan.

In order to expedite the access to high-grade ore and avoid the risk of mining in close proximity to the tailings and water deposit slated for Area 2, it was determined that a portal could be collared at the bottom of the pit, along the west wall, directly into the ore. After a short development campaign along the footwall of the ore zone, 250,000 tonnes of ore at 1.81% grade can be extracted using an up-hole retreat mining method.

This development requires no new land disturbance, as both the portal and the ventilation raise will be located in the bottom of Area 2 pit. The reserve does not represent an increase in mining rate, as equipment from the currently-active Phase IV underground would be used.

This mining opportunity is time-critical, as the Area 2 pit is scheduled to be filled with tailings and water in Q4-2014.
As per the approval detailed in section 1, the M-zone utilities and development commenced as of January 2014. Development continued with access from the Minto South portal in 2014, Figure 2-3 illustrates the extent of the underground development. A fresh air raise, in addition serving as a secondary egress, was completed in January 2014.
Figure 2-1: Site Overview as of September 2013
Figure 2-2: Schematic of Portal Area Infrastructure
Figure 2-3: Minto South Portal Development as of January 2014
Figure 2-4: M-Zone Surface General Arrangement
3 Deposits and Ore Reserves

3.1 Scope of Phase IV underground

The underground mining assessed as part of Phase IV consists of several known deposits in the Area 2/118 zones that have the grade, continuity and volume to be considered mineable from underground. Future expansions are planned and include the mining of the Minto East and Copper Keel zones from the current portal; and the creation of two potential portals to access the ore zones. These future expansions, known as Phase V/VI, are being prepared for environmental and socio-economic assessment. Once assessment has been completed, the mine expansion plans will be subject to licensing approval under Minto’s Quartz Mining Licence. Figure 3-1 illustrates the relative location of the ore zones and displays a view of the Area 118 and Area 2 deposits.

Figure 3-1: Minto South Portal Plan View
3.2 Phase IV Underground Ore Reserves

Based on the reserves identified to date and the mine designs created around them, the volumes, tonnages, and grades presented in Table 3-1 are expected to be produced over the life of the Phase IV underground operation.

Ore volumes are reported at a cutoff grade of 1.20% and based on the stope designs prepared by SRK for the Phase IV Pre-feasibility Study. The volumes produced by the underground mine will change as detailed stope designs are prepared, taking into account the local ground conditions and optimizing the location of pillars based on in-fill drilling.

The mining rate is currently planned at approximately 2,000 tpd, and the underground mining assessed as part of Phase IV results in a mine life of approximately four years.

Table 3-1: Material Release for the Underground Portion of Phase IV

<table>
<thead>
<tr>
<th></th>
<th>Volume (kBCM)</th>
<th>Mass (kt)</th>
<th>Cu %</th>
<th>Au g/t</th>
<th>Ag g/t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ore</td>
<td>904</td>
<td>2,511</td>
<td>1.88</td>
<td>0.81</td>
<td>6.65</td>
</tr>
<tr>
<td>Waste</td>
<td>131</td>
<td>349</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.2.1 M-Zone Ore

The final ore lens to be mined as part of the Area 2 pit, known as the M-zone, dips at approximately 12° at a dip-direction of 330°, i.e., the lens dips N-NW into the northwest corner of the pit. The lens continues to have economic ore grades and widths for another 175 m into the wall; however, a further pushback of the Area 2 pit was determined to be uneconomic due to the high strip ratio. Underground mining of this lens was therefore selected as the preferred mining method.

Figures 3-2 and 3-3 illustrate the ore lens in relation to the Area 2 pit.
The lens continues to have economic ore grades and widths for another 175m into the wall; however, a further pushback of the Area 2 pit is uneconomic due to the high strip ratio. Underground mining of this lens is therefore an attractive option.
4 Mine Development and Design

As described in previous sections, initial development has occurred by way of the Minto south portal in the Area 118 underground. Activity in that area ceased in order to concentrate efforts on M-zone mining. The operation in 118 underground will continue in preparation of returning to mining in that area upon conclusion of M-zone mining in late 2014. M-zone ore lens will be mined by first establishing a decline from the bottom of Area 2 pit, then driving a series of crosscuts along the footwall of the ore zone at 15 m spacing. The crosscuts are 6.0 m wide. Figure 3-2 provides an overview of all M-zone development.

4.1 Minto South Access

The main access to the Area 118 and Area 2 ore body has been developed at a 15% gradient and is used for ore and waste haulage, access for personnel, equipment, materials, and services. It is also utilized as an exhaust airway.

The decline has been driven on the footwall side of the deposit and will provide multiple accesses to the ore body through the cross-cuts.

The size of the decline was selected according to the mobile equipment size, required clearances, and ventilation requirements during development and production. It was estimated that a 5 m wide by 5 m high decline is satisfactory for a 40 T truck (and 50 t trucks in the future, if desired) and ventilation requirements for 2,000 tpd production rate. A 25 m or greater ramp curve radius will continue to be employed for ease of operation of the large mobile equipment as well as improved maintenance costs.

Re-muck bays are and will be typically developed every 150 m along the decline to allow efficient use of the drilling equipment and will hold two rounds of development muck. The re-muck bays will be of a similar size as the decline and will be up to 15 m in length. After they are no longer used for development, the bays will be used for equipment storage, pump stations, drill bays, service bays, etc.

Installation of 2.4 m fully grouted resin rebar bolts in the back, and 1.8 m fully grouted resin rebar in the walls of the ramp, on a 1.2 m x 1.4 m pattern, and mesh to within 1.5 m from the floor is used for ground support.
4.2 Minto South Plans and Design

Figure 4-2 presents a schematic of the current underground mine design with access from the two portals, further designs are presented in Appendix B.
4.3 M-Zone Access and Development

The ore lens will be mined by first establishing a decline from the bottom of the pit, then driving a series of crosscuts along the footwall of the ore zone at 15 m spacing; the crosscuts are 6 m wide. Figure 4-3 provides an overview of all M-zone development.
Figure 4-3: M-zone Development Overview

Starting at the ends of these crosscuts and progressing back towards the access, rings of up-holes will be drilled to the hanging-wall contact using stinger drill rigs. These holes will be loaded with stick power and blasted. The ore will be mucked via remotely operated LHD, thus eliminating any exposure of personnel to the open void left by the mining process; the void will not be backfilled. Blocks will be 10 m wide, with 5 m rib pillars left between them.

A typical ring design is shown below in Figure 4-4.
The vertical dimensions of the blocks will vary with the distance between the footwall and hangingwall; maximum block height will be 24 m.

A ventilation raise and emergency egress will be excavated near the east end of the M-zone development. The raise will measure 16m in length, 6 ft x 7 ft in cross-section, and be inclined at 49° from horizontal. Sections of the Area 2 pit highwall above the portal will be rock-bolted and screened.
5 Mine Operation

5.1 Handling of Ore and Waste

A combination of 7, 8 or 10-yard LHD units and 42 T trucks were selected as being the most economical option for ore and waste haulage at Minto underground mine. The broken ore from the stopes is mucked by stope LHDs to remuck bays, or loaded directly onto 42 T underground trucks. The trucks are used to carry ore from the mine to one of the current open pit stockpiles.

The waste rock from development headings is mucked by LHDs directly to the trucks or to remuck bays located up to 150 m from the face. The waste rock is then hauled by the trucks to the surface storage pads at the portal.

Upon assaying of the development rounds, the waste is moved to the appropriate waste dump on surface as outlined in the Waste Rock and Overburden Management Plan (WROMP), Phase IV Development. The protocols for segregation and placement of waste materials are consistent with the protocols for surface mining. Future approved submissions of waste rock handling plans that result in changes to protocols will also be adhered to for the underground waste.

As underground mine production continues, it is possible to use mine waste rock from development as stope backfill along with the waste rock from the surface.

Trucks will be used to bring backfill material from the surface to mined-out stopes. This material will consist of underground waste material that has been temporarily stored on surface due to stope timing issues or waste material from the open pit.

Development rounds are mucked from the ramp face to underground remuck bays. These remuck bays hold several development rounds consisting of approximately 300 tonnes each. The content of the remucks are then taken to surface and placed in an identified pile and assayed. Upon the results of the assay, the material is placed on the appropriate ore pile or waste dump.

5.2 M-Zone Scheduling and Equipment

The expected life of M-Zone mining activities is eight months. The M-zone is time-sensitive due to the location of the portal at the bottom of the Area 2 pit, which will be required for tailings deposition by October 2014. Underground development started upon completion of the Are 2 open pit mining.

The short haul distances (maximum 260 m from the portal to the end of A block) make truck haulage unnecessary; all mucking will be done with 7, 8 or 10-yard LHD units. A combination of Minto and contractor fleet will be used for development, production mucking and ground support. A contractor will be used for longhole drilling.

The mining rate is scheduled to ramp up to 1,600 tpd by April. Mining is scheduled to be complete in September.
6 Underground Geotechnical Assessment

Geotechnical characterization and design work has been carried out by SRK Consulting Ltd. and Itasca Consulting Group Inc. for the Area 2 and Area 118 underground mining areas. A ground control management plan was developed and implemented in 2013 and has been used for all underground development to date. Additional studies based on experience in the Area 118 underground are currently underway to further investigate the geotechnical conditions and design.

The following points (italicized) are excerpts from the SRK Phase V Prefeasibility Study:

Resource continuity

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.

Deposit boundaries

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.

The main geotechnical points from this are:

- Mineralization is considered be variable both in thickness, dip, and lateral continuity;
- Displacements occur through mineralization on the meter scale;
- Major boundary fault zones are present in Area 2/118 areas and have been modeled in 3D. A detailed structural model and structural characterization have not been completed, and;
- There is potential for fault zones to be present in the Copper Keel area.

6.1 Hydrogeological Assessment

A hydrogeological assessment has not been completed to define the potential inflows to the underground workings from large and small-scale structures. Minto’s experience with open pit mining has been that static
groundwater is encountered in blastholes, but that surface runoff is the major driver of pit dewatering requirements. Inflows encountered in the Area 118 underground development to date have been associated with several discrete water-bearing faults and with ungrouted diamond drillholes. No unmanageable inflows have been intersected and a common sump and pump dewatering system has been utilized without any grouting work required.

6.2 Area 118 Underground

6.2.1 Mining Method – Geotechnical Considerations

Due to the mineralized zone variable continuity SRK has recommended that a ‘random room and pillar’ mining method is adopted in some areas. This involves driving development size headings through identified mining areas on a contour, and moving left or right (no change in elevation) to keep the hanging wall contact of mineralization in the back of the drive. These headings are completed under geological control only. Infill drilling is then completed from cut-outs driven from the headings. Based on these results a standard room and pillar layout can then be established, and extraction is achieved on the retreat under supported ground (slashing out to full span width). The decision on whether to support the full span or not can be made as the headings are advanced.

The advantages of this method allow the definition and understanding of the orebody character and geometry to be established on advance: therefore the mining method defines the orebody. Additionally back and pillar support can be installed on the advance with the understanding that long term access could be required through the development headings. In essence the mineralization and rock mass is characterized on the advance, and the mining spans and level of extraction determined. This is then extracted on the retreat.

SRK estimated an extraction ratio of around 75% should be anticipated. This would meet the 1:1 pillar height criteria. Extraction ratios in faulted/broken ground areas will need to be reduced locally based on the prevailing rock mass conditions.

6.2.2 Orebody Geometry

Analyses carried out by SRK were based on the following orebody characteristics:

Thickness: 5 to 20m, generally less than 15m.
Span: 50 to 160m, generally less than 100m.
Dip: 0 to 40° from horizontal, generally less than 10°.

The shapes show poor continuity between areas, some of which appear to be based on the result of a single drill hole. It is expected that these could become more continuous once tighter drill hole spacing, underground exposure, and a proper understanding of the ore body geometry is achieved.

6.2.3 Rock Mass Assessment

Bieniawski Rock Mass Rating (RMR₉₉) and Barton Q values were evaluated for the underground zones. An average RMR₉₉ of 65 and Q of 10 were estimated. Experience in the Area 2 (M-Zone) underground to date
indicates better than expected rock quality, with an average RMR$_{89}$ of 77 and Q of 15 based on limited mapping completed. Mining guidelines have been developed from empirical, analytical, numerical models and practical experience.

6.2.4 Underground Excavation Design

Excavation design has been completed for man entry spans and pillars on based empirical guidelines adjusted to the anticipated rock mass characteristics. The following is a summary of the findings:

- Development headings: 5 m W x 5 m H arch back
- Rooms: 10 m span limit with pattern support
- Pillars: 5 m W x 5 m H
  5m W x >5 m H support or fill required

A design span limit of 10m has been recommended for mining in areas of good rock mass quality. Without underground exposures an initial conservative extraction ratio of around 75% was anticipated to account for major structures, adverse small scale structure, or zones of lower rock mass quality. This would meet the 1:1 pillar height criteria. The required ground support systems to increase spans through zones of reduced rock quality should be tested during early mine development.

For most mining areas, superimposed 5m by 5m pillars are planned to limit spans to 10m. These spans would be mined using a cut height of 5m. Pillars over 5m height should be assessed on an individual case basis, and rock support or fill should be utilized.

Man entry design spans have been reviewed based on the critical span curve presented in Ouchi et al. (2004), Figure 6-1, and the Q-system unsupported span limits Figure 6-2. The calculated back span for man entry excavations (Ouchi et al.) was 9-14m. These spans lie on the boundary between stable and potentially unstable back conditions and should be considered as optimistic. The Q-system shows span limits of 6-11m however these are somewhat conservative based on the selected ESR value of 1.6 (permanent mine openings). A design span limit of 10m is recommended for mining in areas of good rock mass quality. Spans will need to be limited where major structures, adverse small scale structure, or zones of lower rock mass quality are encountered.
Figure 6-1: Ouchi Critical Span Curve

Figure 6-2: Q-system Unsupported Span Limits for Permanent Openings (ESR=1.6)
6.2.5 Pillar Design and Stability Assessment

Pillar analyses were conducted using tributary area loads and several pillar equations that incorporate pillar width to height ratios. The Holland equation:

\[
\text{Pillar Strength} = \text{UCS} \times (W/H)^{0.5}
\]

was used to evaluate 5x5 m pillars and 10 m rooms (Table 6-1). Practical experience and the factor of safety indicate this configuration to be reasonable for pillars up to about 7 m height. Taller pillars will need to be reinforced or supported by fill to maintain stability.

Table 6-1: Pillar Calculations

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Pillar (m)</th>
<th>W1</th>
<th>Room (m)</th>
<th>R1</th>
<th>Pillar Height (m)</th>
<th>W/H Ratio</th>
<th>Pillar Strength (MPa)</th>
<th>Extraction Ratio (%)</th>
<th>Factor of Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>120</td>
<td>89</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>5</td>
<td>10</td>
<td>7</td>
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<td>0.7</td>
<td>101</td>
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<td>1.4</td>
<td></td>
</tr>
<tr>
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<td>5</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>0.5</td>
<td>85</td>
<td>89</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>15</td>
<td>0.3</td>
<td>69</td>
<td>89</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

For most mining areas, superimposed 5x5 m pillars are planned to limit spans to 10 m. These spans would be mined using a cut height of 5 m. Pillars over 5m height should be assessed on an individual case basis, and rock support or fill should be utilized. Based on the empirical evaluations of Holland (1964) and Obert and Duvall (1967), these pillars are considered to provide the required support.

6.3 Fill

In thicker parts of mineralization, waste rock backfill will be used to provide support to tall slender pillars, as well as bolt and shotcrete to floor where required. Tall slender pillars will be developed following benching of the floor where orebody thicknesses are greater than 5 m. As the tops of the pillars will no longer be accessible by mining equipment, fill will be required both for support and access reasons through mined areas.

The 5 m stope cuts will be filled with waste rock, from underground mine development or waste from the Area 2 pit, to provide the necessary hanging wall and post pillar support. The waste rock will be placed by 40 T trucks in waste storage areas located at the stope access level and then placed in the stopes by LHD equipment. Waste fill will be pushed tight to the hanging wall and to the back by a push plate attached to the scoop. Stope floor leveling will be established on the next cut and dilution controlled by grade.
6.3.1 Longhole Stoping Opportunities

Longhole stoping may be considered where thicker ore zones are encountered. The following guidelines were developed using the Potvin and Mawdesley empirical Stability Graph methods (see Figures 6-3 and 6-4). These, as well as knowledge gained during development, will be used in the event LH stope areas are encountered.

- Overcut and Undercut Support Requirements
  - Support as per minimum standards for man entry access
  - Support at brows includes intersection type support

- Open stope limits
  - Length 50 m
  - Height 40 m (floor to back)
  - Back unsupported (LH Uppers)
    - 10 m moderate risk 50% failure likelihood
    - 15 m high risk 70% failure likelihood
Figure 6-3: Potvin Stope Stability Graph—Area 118 and East Mining Areas
Figure 6-4: Mawdsley Stope Probability of Failure Graph—Area 118 Mining Areas
6.3.2  Kinematic Wedge Analysis

A wedge analysis has been completed by SRK to understand the potential geometries and sizes of blocks formed during mining. The room and pillar mining method means that all headings are essentially ‘development’ (based on spans) and as such have been considered in the analysis. A drift size of 5x5 m has been used to date in the main ramp with a wider span of 10m also considered. These analyses will be updated with information collected during development as part of regular reviews and updates to the ground control management plan.

6.3.3  Lateral Development

Key observations from the analysis are:

- The formation of potentially unstable wedges occurs in the back and sidewalls of the excavation related to the three primary joint sets.
- The least favourable orientation for lateral development occurs between 340° and 40° azimuth.
- The apex height of the identified wedge is controlled by the plunge and span of the development. This height is generally less than 3 m for a 5 m span.
- Larger wedges are generated with an increased span of 10 m. These will be identified during mining of the primary heading, and will need to be well supported prior to slashing out on retreat.
- The ground support recommendations will provide sufficient support pressure to prevent the wedges generated from being released. Additional support maybe required dependent on the plunge of infrastructure relative to small scale structures.

6.3.4  Vertical Development

Key observations from the analysis are:

- Large wedges are formed in all the walls and back of the vertical excavations (i.e. vent raises).
- The geometry is the wedge is controlled by the plunge of the infrastructure.
- The apex height of the identified wedges is generally less than 0.8 m and support recommendations will provide sufficient support pressure to prevent the wedges identified from being released.
6.3.5 Ground Support Requirements

Ground support requirements for typical conditions are provided in Table 6-2. Where poorer than average conditions are encountered, specific ground control directives are issued. Geotechnical conditions are monitored and characterized with on-going mapping and inspections carried out by Minto geologists and geotechnical engineers.

Table 6-2: Area 118 Minimum Support Requirements

<table>
<thead>
<tr>
<th>Excavation</th>
<th>Maximum Dimensions (m)</th>
<th>Minimum Ground Requirements</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decline, Level Access</td>
<td>5.0 W x 5.0 H</td>
<td>2.4 m, #6 threaded rebar in the back&lt;br&gt;1.8 m, #6 threaded rebar in the walls&lt;br&gt;1.2 m x 1.4 m bolt spacing&lt;br&gt;7-gauge welded wire mesh to within 1.5 m of the floor</td>
<td>All rebar fully resin grouted&lt;br&gt;Welded wire mesh pinned tight to rock surface with 0.9 m split sets between rebar rows</td>
</tr>
<tr>
<td>Intersection</td>
<td>&lt;10 (inscribed circle)</td>
<td>Secondary Support (in addition to minimum support for decline, level access):&lt;br&gt;4.0 m Super Swellex/Python&lt;br&gt;1.8 m x 1.8 m bolt spacing, extended two rows beyond intersection in all directions</td>
<td>Secondary support installed prior to slashing crosscut</td>
</tr>
<tr>
<td>Alimak Raise</td>
<td>3.0 W x 5.0 H</td>
<td>1.2 m, #6 forged head rebar&lt;br&gt;1.2 m x 1.2 m bolt spacing&lt;br&gt;Galvanized chain link mesh on all walls</td>
<td>Chainlink mesh pinned tight to rock surface with 0.9 m split sets between rebar rows</td>
</tr>
</tbody>
</table>

6.4 Area 2 (M – Zone) Underground Geotechnical Parameters

This section summarizes the ground support design for the M-zone portal, the surface work area rockfall protection plan for the M-zone access routes and work areas, as well as the current underground support standards.

6.4.1 Geologic Assessment of the M-Zone Portal

Geologic mapping and assessment of the M-Zone portal location was completed from the 697 to 715 elevations of the Area 2 open pit on Dec 23rd 2013 by Kevin Cymbalisty, Geotechnical Engineer, and from the 691 to 715 m elevations on January 5th 2014 by Doug McIlveen and Gary Paruup, Chief Geologist and Senior Geologist, of Minto Explorations Ltd.
The wall in the immediate vicinity of the M-Zone portal (Zone 3 in Figure 6-5) is composed of a foliated, hard, competent rock termed Foliated Granodiorite (fG). The fG in the portal zone is ore bearing and has a blocky appearance when viewed at the face. The predominate structures in this sector of the pit are five joint sets – J1, J2, J3, J4 and a recently discovered set that was not included in the last SRK geotechnical report (September 30, 2013) identified as 200°. The J1 and J2s are a set of close spaced (0.5-2.0 m), NW striking, moderate to steeply NE dipping joints that are co-parallel and associated with the 320 Fault, the largest structure in the Area 2 pit (Figure 6-6). The J1 and J2’s are intersected by the J3 and J4 sets which consists of similarly close spaced, NE striking, steeply SE dipping joints (Figure 6-6). These 4 sets are persistent in the NW corner of the pit and have been identified as a potential wedge forming hazard due to their close spaced nature and intersecting nature. The 200°s (termed based to their 190-220° orientation) are a set of wider spaced (>3.0 m), SSW striking moderate to steeply NW dipping joints seen dipping into the west wall of the Area 2 pit (Figure 8-6). Due to the 200° set’s in-wall dipping nature and approximate co-parallel orientation with the west wall, these joints are oriented as a potential toppling hazard.
Figure 6-6: Detailed, Up-close, Geologic Mapping of M-Zone portal, 691-697 m (Jan 5, 2014)

Figure 6-7: Detailed, Up-close, Geologic Mapping of Area Immediately to Right of M-Zone portal, (Jan 5, 2014)
6.4.2 M-Zone Ground Support for the Portal Collar

The portal collar/brow was pre-supported with 4m long Super Python bolts installed horizontally into the bench face prior to drilling/blasting into the face, shown in Figure 6-9. The bolts were also used to pin the bottom of draped mesh installed above and around the portal.

Short rounds were taken for the first few rounds into the portal. After each round, pattern ground support was installed as per Minto Ground Control Standards, shown in Figure 6-10. Additional support, including 0-gauge welded wire mesh straps, split sets and Super Python bolts were installed in and around the portal brow.
Figure 6-9: M-Zone Portal Collar Bolting Layout

- 4 METER LONG SUPER PYTHON BOLTS
- 1ST ROW AT 1M SPACING FOLLOWING A PERIMETER OFFSET 0.5M FROM PORTAL
- 2ND ROW STAGGERED FROM INTERIOR ROW AT 1M SPACING FOLLOWING A PERIMETER 1.5M OFFSET FROM PORTAL
- SPOT BOLTING OF WEDGES AS REQUIRED
- DIMENSIONS AS INDICATED ON DRAWING IN METERS

M-ZONE PORTAL COLLAR BOLTING LAYOUT
6.4.3 General M-Zone Surface Work Area Rockfall Protection Plan

In addition to the portal collar support, measures were implemented to mitigate the risk of rockfall hazards from the pit walls for workers and equipment working in the bottom of the pit:

- Scaling of bench faces prior to completing excavation of pit.
- Weekly wall inspection and GroundProbe radar to monitor pit walls – Ground Probe radar setup moved into the pit on the 739 bench to monitor the M-Zone portal area and highwall in detail.
- Rockfall fence installed above portal on the 715 bench to prevent small loose/rockfalls from walls/benches above.
- Rockfall curtain (draped twisted wire mesh) installed above and around the portal.
- Diversion of water above the portal to specific areas to avoid saturation and increased freeze/thaw on the benches/walls near the portal.
- Catch bench cleaning will be completed during the spring, if required.

Figure 6-11: Cross Section of Rockfall Protection Measures
6.4.4 M- Zone Underground Development Support

Ground support designs were based on experience to date in the Area 118 underground. On-going geotechnical mapping and analysis is being completed as development in M-Zone is carried out in order to verify the standards listed in Tables 8-1.

Table 6-3: M-Zone Minimum Support Requirements

<table>
<thead>
<tr>
<th>Excavation</th>
<th>Maximum Dimensions (m)</th>
<th>Minimum Ground Requirements</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decline, Level Access</td>
<td>5.0 W x 5.0 H</td>
<td>2.4 m, #6 threaded rebar in the back 1.8 m, #6 threaded rebar in the walls 1.2 m x 1.4 m bolt spacing 7-gauge welded wire mesh to within 1.5 m of the floor</td>
<td>All rebar fully resin grouted Welded wire mesh pinned tight to rock surface with 0.9 m split sets between rebar rows</td>
</tr>
<tr>
<td>Intersection</td>
<td>&lt;10 (inscribed circle)</td>
<td>Secondary Support (in addition to minimum support for decline, level access): 4.0 m Super Swellex/Python 1.8 m x 1.8 m bolt spacing, extended two rows beyond intersection in all directions</td>
<td>Secondary support installed prior to slashing crosscut</td>
</tr>
</tbody>
</table>

6.4.5 M- Zone Stope Stability

Stope stability analysis was carried out using the empirical method Mathew’s Stability Graph to estimate stable excavation sizes. Rock properties used were based on experience in the 118 underground and A2 Pit.

The following average stope dimensions were used to consider the base case design conditions:

- Height = 18 m
- Length = 80 m
- Span = 10 m

The results, shown in Figure 6-12, indicate the proposed average stope sizes are expected to be stable in the back, endwall and sidewalls with no backfill for the average estimated rock conditions. The stopes plot either in the “Stable” zone or transition zone between “Stable” and “Unstable”, which is typically where stopes are designed to plot. Overbreak estimates are as follows:

Table 6-4: Overbreak Estimates

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Estimated Overbreak (ELOS) (m) for average rock conditions and average stope size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back</td>
<td>1.3</td>
</tr>
<tr>
<td>Sidewall (west)</td>
<td>0.9</td>
</tr>
<tr>
<td>Sidewall (east)</td>
<td>0.75</td>
</tr>
<tr>
<td>Endwall</td>
<td>&lt;0.5</td>
</tr>
</tbody>
</table>
Careful drilling and blasting will be critical to minimize overbreak in the sidewalls (pillars), where even a typical overbreak of 0.5 m on either side of the 5 m wide pillars results in a 20% reduction in pillar size. It is important to note that the difference in overbreak between the east and west sidewalls are due to rock structure orientations – the position of the drill drift will also influence wall stability/overbreak (i.e. vertical drilling one wall vs ring drilling on the other) but is not accounted for in this analysis.

Once geotechnical mapping of the development is completed, the analysis will be updated to consider the in-situ rock quality and detailed excavation sizes. As production mining take place, detailed stope reconciliation using cavity monitor surveys (CMS) and back-analysis will be completed to develop a site-specific stope stability graph.
Figure 6-12: Stope Stability for Average Conditions
6.4.6 Pillar Stability

Detailed pillar stability analyses were carried out by Itasca Consulting Group Inc. to consider the stability of the planned 5 m wide rib pillars and the crown between the stopes and the pit wall. A detailed summary of the analyses is contained in the report “Three-Dimensional Numerical Simulation of the M-Zone at Minto Mine” (Itasca, January 10, 2014) which has been provided in Appendix A.

The analyses were carried out using the finite-difference code FLAC3D. Images of the mesh are shown in Figure 6-13 and Figure 6-14.

Figure 6-13: FLAC 3D Model Mesh
Figure 6-14: FLAC 3D Model Mesh of Stopes

Rock properties used in the model are shown below in Table 6-5.

Table 6-5: Rock Properties used in modeling

<table>
<thead>
<tr>
<th>Property</th>
<th>Encasing “Waste” material</th>
<th>“Ore” material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk modulus $K$ (GPa)</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Shear modulus $G$ (GPa)</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>RMR&lt;sub&gt;geo&lt;/sub&gt; / GSI</td>
<td>74 / 69</td>
<td>76 / 71</td>
</tr>
<tr>
<td>Peak friction angle (deg)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>61.9</td>
<td>60.5</td>
</tr>
<tr>
<td>Peak cohesion (MPa)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3.24</td>
<td>2.82</td>
</tr>
<tr>
<td>Peak tensile strength (kPa)</td>
<td>466</td>
<td>387</td>
</tr>
<tr>
<td>Critical plastic strain interval (%)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.92</td>
<td>0.86</td>
</tr>
<tr>
<td>Residual friction angle (deg)</td>
<td>43.3</td>
<td>42.4</td>
</tr>
<tr>
<td>Residual cohesion (kPa)</td>
<td>162</td>
<td>141</td>
</tr>
<tr>
<td>Residual tensile strength (kPa)</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<sup>1</sup> Established with tangential at $\tau / \sigma_{max} = 3.3$ (for 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.

<sup>2</sup> Strain-softening interval between peak and residual strength (the same for the cohesion and tensile strength). Based on GSI.
Sensitivity analyses were carried out to consider the following scenarios:

- Weakened, blast damaged zone around the excavations. This was analyzed using a zone of weaker rock properties approximately 3.5m around all underground excavations and 10m around the pit wall.
- Rotated in-situ stress orientation.
- Lower friction angle in both ore and waste to consider weaker than expected rock quality.
- Reduced critical plastic strain interval to consider brittle tensile failure of the rock mass.
- Complete removal of the central rib pillar to consider large-scale stability in the event of a pillar failure.

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

1. The M-Zone rib pillars and stope roofs are mostly stable (i.e., show limited yielding) as modeled for both options 1 and 2, even when taking into account possible blast damage by assigning lower strength properties to the rock mass immediately around the underground excavations and open pit, or even assuming the complete failure (total removal) of a central rib pillar. This is mostly due to the low vertical stress in proximity to the open pit, relatively high horizontal stresses that provide confinement to the crown pillar (with the Base Case stress orientation) and fairly strong rock mass properties. No stope-scale runaway failure has been indicated in any of the scenarios we examined.
2. We cannot over-emphasize how crucial good blasting procedures (in terms of limited back-break and damage to the surrounding rock mass) will be in order to minimize the extent of the weaker D = 1 volume.
3. The bull nose near the stope closest to the open pit and the access to the underground area remains a concern for both options. Active yielding can be observed in these areas for both base cases and all the sensitivity analyses. The issue is critically important with regard to maintaining access to the M-Zone.
4. Geomechanical issues are expected mainly on the south side, between the stopes and the pit. Stopes with sequence numbers in the 30’s in Option 1 and in the last four panels on the south side in Option 2 generally show a greater degree of interaction with the open pit due to their proximity to it. The crown pillar and walls in this area are likely to be weakened by the yielding from the stopes themselves combined with that from the pit above. Keeping these roofs stable may be more challenging. Instability in the open pit also could occur as a result of this yielding.
5. There remains some debate on critical plastic strains and the “correct” way to implement them for cohesion and tensile strength loss in inelastic strain-softening simulations. As a result, we recommend keeping the results from the brittle runs in mind, which are more conservative.
6. Although the numerical results do not show severe stress-related failure in the rock mass modeled as a continuum, the stress relaxation indicated around the excavations easily could lead to structural instability (as in the ramp). This aspect is NOT covered in the FLAC3D model. As a result, it will be crucial to assess whether persistent weak structural discontinuities extend around M-Zone, which could significantly affect the stope ribs and roofs. Persistent discontinuities that would delineate kinematically unstable blocks could have a very strong negative effect on the behavior of the excavations and the mining conditions in M-Zone. Considering the structural fabric in the pit above, this aspect needs to be resolved.
Based on these conclusions, Minto will be carrying out the following verification work:

- Detailed geotechnical mapping (structural and rock quality) will be carried out throughout the development. Based on this information the empirical stope stability analysis will be revised and kinematic analyses will be performed to consider structural instability not explicitly assessed in the FLAC3D model. If rock mass quality is significantly different than estimated in the numerical models, the models will be re-run with revised properties.

- As stoping is carried out, CMS will be performed to monitor performance of the backs and rib pillars. If performance is significantly different than predicted by the numerical models, the models will be re-run and calibrated to the actual conditions. Where significant overbreak occurs, particularly in a rib pillar, planned stopes will be revised to prevent over-extraction.

- Based on the performance of the initial stopes (further away from the pit wall), review of the layout for stopes (I and H) near the crown pillar will be carried out. This may include additional instrumentation and/or ground support installed into the crown pillar from surface.
7 Ventilation, Ancillary Infrastructure, and Dewatering,

7.1 Mine Ventilation

7.1.1 Minto South Portal Ventilation

The Minto South Portal ventilation system, designed by Stantec Inc., is a push system with main fans located on surface. Main intake fans provide 132 m³/s (280,000 cfm) through a dedicated 3 m x 5 m intake raise (10 ft. x 16 ft.), which is outfitted with a man-way for egress. Return air is exhausted to surface via the main access ramp. (Refer to the figure below).

Figure 7-1: Minto South Portal Ventilation
A fresh air system consisting on a mine air heating plant and egress manway was driven by Alimak to surface in the 118 Block in January 2014. The Fresh Air Raise consists of one 3 x 5 m limak raise capable of delivering 132 m³/s (280,000 cfm’s) of air. This intake raise was developed on the west side of the Area 2 pit with the raise collar in an area of minimal overburden. It is planned to extend the intake raise down with the main ramp to the Area 2 UG ore zone. Ventilation access drifts will be developed to connect the level development and ramp to the ventilation raises. Those drifts will be 15 m to 40 m long and will be developed at -15% gradients to reduce length of the raise. This system will be capable to meet the future needs of underground mining.

The design basis of the ventilation system at Minto underground operation was to adequately dilute exhaust gases produced by underground diesel equipment. Air volume was calculated on a factor of 0.06 m³/s per installed kW of diesel engine power (100 cfm per installed hp). The kW rating of each piece of underground equipment was determined and then utilization factors, representing the diesel equipment in use at any time, applied to estimate the amount of air required.

The expected diesel equipment fleet at Minto Mine for the 118 OB at full production is listed in the table below:

Table 7-1: Ventilation requirements Minto South Portal

<table>
<thead>
<tr>
<th></th>
<th>Fleet</th>
<th>HP</th>
<th>Canmet Vent Rate</th>
<th>Utilization</th>
<th>CFM Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 x Sandvik LH410</td>
<td>1</td>
<td>325</td>
<td>18800</td>
<td>70%</td>
<td>13160</td>
</tr>
<tr>
<td>1 x Sandvik Jumbo</td>
<td>1</td>
<td>147</td>
<td>10000</td>
<td>30%</td>
<td>3000</td>
</tr>
<tr>
<td>1 x Maclean 946 boltex</td>
<td>1</td>
<td>99.2</td>
<td>8800</td>
<td>30%</td>
<td>2640</td>
</tr>
<tr>
<td>1 x MT42 Haul Truck</td>
<td>2</td>
<td>520</td>
<td>50200</td>
<td>100%</td>
<td>100400</td>
</tr>
<tr>
<td>1 x Scissor Lift</td>
<td>1</td>
<td>85.7</td>
<td>7500</td>
<td>30%</td>
<td>2250</td>
</tr>
<tr>
<td>1 x utility</td>
<td>1</td>
<td>134</td>
<td>7300</td>
<td>30%</td>
<td>2190</td>
</tr>
<tr>
<td>1 x jeep</td>
<td>1</td>
<td>127</td>
<td>7300</td>
<td>30%</td>
<td>2190</td>
</tr>
<tr>
<td><strong>Subtotal Development</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>125830</strong></td>
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<tr>
<td>Stopes</td>
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<td></td>
</tr>
<tr>
<td>1 x Sandvik LH410</td>
<td>1</td>
<td>325</td>
<td>18800</td>
<td>70%</td>
<td>13160</td>
</tr>
<tr>
<td>1 x Sandvik Jumbo</td>
<td>1</td>
<td>147</td>
<td>10000</td>
<td>30%</td>
<td>3000</td>
</tr>
<tr>
<td>1 x Maclean 946 boltex</td>
<td>1</td>
<td>99.2</td>
<td>8800</td>
<td>30%</td>
<td>2640</td>
</tr>
<tr>
<td>1 x TH540 Haul Truck</td>
<td>1</td>
<td>543</td>
<td>31400</td>
<td>100%</td>
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<td>1 x utility</td>
<td>1</td>
<td>134</td>
<td>7300</td>
<td>30%</td>
<td>2190</td>
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<tr>
<td>1 x jeep</td>
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<td>127</td>
<td>7300</td>
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<td><strong>Subtotal Stoping</strong></td>
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<td><strong>54580</strong></td>
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<tr>
<td>Ramp</td>
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<td></td>
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<tr>
<td>1 x TH540 Haul Truck</td>
<td>1</td>
<td>543</td>
<td>31400</td>
<td>100%</td>
<td>31400</td>
</tr>
<tr>
<td><strong>Subtotal Ramp</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>31400</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>266390</strong></td>
</tr>
<tr>
<td>Leakage</td>
<td></td>
<td></td>
<td></td>
<td>5%</td>
<td><strong>13319.5</strong></td>
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<tr>
<td><strong>Total 118 OB</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>279709.5</strong></td>
</tr>
</tbody>
</table>

|                      |       |      |                  |             |              |
| **Total**            |       |      |                  |             | **280,000**  |

A maximum of two stoping and one development levels are anticipated during steady state production. The main ramp has been allocated 15 m³/s (32,000 cfm) of fresh air to accommodate the loading and haulage activities of an additional haul truck within the ramp.
Air movement to the stopes would be controlled by directing air flow with ventilation curtains and using the auxiliary ventilation fans. Ventilation regulators, doors, and bulkheads would also be used to control airflow in. As well, signage will be placed at the entrance of headings identifying the equipment allowed in the heading based on the permit cfm’s per piece of equipment.

The 150 HP fans are used to provide auxiliary ventilation in other development headings and production stopes.

7.1.2 M- Zone Ventilation

The M-Zone ventilation system, designed by Stantec Inc., is a positive or “push” system designed to deliver 80,000 cfm supplied by two 48 inch / 26° / 1800rpm / 150 hp fans, each pushing 40,000 cfm into separate 48” duct lines.

The 80,000 CFM requirement was calculated by “allocation” using the equipment and egress data shown in the table below.

Table 7-2: M-Zone Equipment Usage Underground

<table>
<thead>
<tr>
<th>Zone</th>
<th>Equipment</th>
<th>Fleet</th>
<th>HP</th>
<th>Canmet Vent Rate</th>
<th>Utilization</th>
<th>CFM Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>1 x Sandvik LH410</td>
<td>3</td>
<td>325</td>
<td>18800</td>
<td>100%</td>
<td>56400</td>
</tr>
<tr>
<td></td>
<td>Subtotal Stopping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>56400</td>
</tr>
<tr>
<td>Totals</td>
<td>Production</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>56400</td>
</tr>
<tr>
<td></td>
<td>Escapeway</td>
<td>1</td>
<td></td>
<td>10000</td>
<td></td>
<td>10000</td>
</tr>
<tr>
<td></td>
<td>Subtotal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>66400</td>
</tr>
<tr>
<td>Leakage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15%</td>
<td>9960</td>
</tr>
<tr>
<td>Total M-Zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>76360</td>
</tr>
</tbody>
</table>

Flexible 48 inch tees with dampers to control the direction and quantity of airflow will be installed at the entrance to each crosscut. From each tee outlet, crews will extend 48 inch flexible vent tubing into the crosscuts.

The distribution of air along the portal access ramp and mining horizon are controlled via the two main fans near the portal entrance and a regulator door located at the ventilation raise as shown in the figure below. Both fans are equipped with variable frequency drives to provide flexibility in the air flow. No underground fans are required to control distribution.
7.2 Mine Air Heating

7.2.1 Minto South Portal Air Heating

The intake raise mine air heating system is required to heat the mine air during the winter months (October to April). The heating system capacity is designed for a 27°C (80 °F) temperature rise to allow for heating of the mine air at extreme low temperatures (-40°C has been recorded in the area). The direct propane fired system includes 10MMBTUH burner capacity with a temperature rise of 27°C, common control room, valve trains, electrics, and the proposed Alphair 10150-AMF-5500 Full Blade 710 rpm with a 300 HP motor for the main fan. The mine air heater is automatically controlled with the temperature set points adjustable as required. Based on a maximum flow of 132 m³/s (280,000 cfm), a +3 degree C set point. The table below shows the estimated annual propane consumption.
7.2.2 M-Zone Portal Air Heating

The fresh air fans require mine air heating systems during the winter months. The heating system capacity is designed for a 50°C (+43°C to +7°C) temperature rise. Both fans connect to a direct propane-fired heating system comprised of a single 6.0 MBtu/hr heater, common control room, valve trains, electrics, and 150 HP variable frequency drives for the fan motors.

The target temperature for the fresh air supply is 3.0°C. At this temperature, 367,000 L of propane will be required to heat the M-zone in 2014 as shown in the table below. This assumes the full 80,000 cfm is supplied continuously; during initial decline development in January, the airflow was reduced to match the size and composition of the equipment fleet operating in the mine.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Temp (°C)</td>
<td>-27.4</td>
<td>-21.1</td>
<td>-11.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Propane Reqd (L)</td>
<td>161,000</td>
<td>119,000</td>
<td>75,000</td>
<td>13,000</td>
</tr>
</tbody>
</table>

Table 7-4: Average Temperature by Month and Propane consumption (M – Zone)

7.3 Underground Electrical Power

The major electrical power consumption in the mine will be from the following:

- Main and auxiliary ventilation fans;
- Drilling equipment;
- Mine dewatering pumps;
- Air compressors; and
- Maintenance shop

7.3.1 Minto South portal Electrical Power

High voltage cable (4160V) enters the mine via the decline and is distributed to electrical sub-stations located just below the portal collar. The power cables are suspended from the back of development headings. All equipment and cables are protected to prevent electrical hazards to personnel.
High voltage power is delivered at 4.16 kV and reduced to 600 V at electrical sub-stations. All power is three-phase. Lighting and convenience receptacles are single phase 120 V power.

7.3.2 M- Zone Electrical Power

The M-zone underground will be supplied with power by a connection to Minto’s power grid, which currently extends to the edge of the Area 2 pit.

Approximately 550m of 5kV Teck 2/0 cable will be run down the pit wall. From 811 to 788 m elevation, the cable will be placed along the overburden cut at the east corner of the pit, which is sloped at 30°. The cable will then drop down to the portal elevation (691m) via four drops of 18 to 24m along the bench faces of the pit highwall. The cable will cross the haul ramp twice through two lengths of buried 4” HDPE pipe at each crossing.

One of the two transformers used in the 118 zone underground rated at 750kVA will be installed at the south end of the pit, 95m from the portal.

7.4 Compressed Air

Minto currently has the following compressors:

- Two 350 CFM electrics (one M – Zone and one Minto South Portal)
- One 1000 CFM electric (M – Zone)
- One – 750 CFM diesel

The electric compressors are used to supply air underground, while the diesel supplies surface air as required. Portable electric compressors provide compressed air requirements on an as-needed basis.

The underground mobile drilling equipment such as jumbos, rockbolters and Emulsion / ANFO loaders are equipped with their own compressors. No reticulated compressed air system was envisioned to be required underground.

The electric compressors are utilized to satisfy compressed air consumption for miscellaneous underground operations, such as: jackleg and stoper drilling, Alimak raise development and pumping with pneumatic pumps.

7.5 Dewatering and Effluent Treatment

7.5.1 Water Supply

The major drilling equipment such as jumbos, rockbolters and exploration drills use run-of-mine water obtained from the active pit area, or from underground inflows into sumps. Currently, at the Minto South Portal, the supply water is placed into a 45,000 liter (10,000gal) heated storage tank just outside the portal. At approximately 125 meters down the ramp from the portal collar. Water is currently trucked to the 45,000 liter tank and is piped to the 227,000 liter (50,000 Gal) supply water storage drift.
7.5.2 Minto South Portal Dewatering

During development, ramp discharge water is pumped to a surface and then transported with a water truck and discharged into the main pit. Once water has been moved to the Main Pit, it will be subject to treatment with the existing onsite facilities. A permanent discharge water line, to the main pit, will be investigated to determine the economics of trucking water versus the pipeline.
The figure below shows the current dewatering system for Minto South Portal:

Figure 7-3: Minto South Portal Dewatering (current)
7.5.3 M- Zone Water Management

The portal is planned at 691m elevation while the bottom of the pit is at 676m elevation. After backfilling a laydown pad area, this leaves 30,000 m$^3$ of water storage capacity below the portal, providing a buffer against spring runoff, high precipitation events, and pump downtime. Inflows into the pit can be estimated from past experience: between freshet and early September 2013, the Area 2 pit was not pumped and accumulated 68,000 m$^3$ of water.

As part of the dewatering setup installed during open-pit mining, a 4” steel pipeline, insulated and heat-traced, was run to the bottom of the pit. This pipeline will continue to be used for dewatering the Area 2 pit. The M-zone fresh water supply is from an insulated tank adjacent to the portal, which is filled from the accumulated water in the Area 2 pit.

As the pit fills with water in the spring, an additional 8” non-insulated pipeline will be installed to convey water from the bottom of the pit to the 10x10m sump at the 715m elevation, and from there to the Main pit via Minto’s water conveyance network.

Underground dewatering will be achieved with two sumps as shown in the figure below. All development is graded to drain to these points and pumps from these locations will push water out of a heat traced line that discharges into the bottom of the Area 2 pit. See the figure below for the general arrangement of surface infrastructure.
7.5.4 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 licence for the Minto South portal access. A representative sample of underground inflows will be taken regularly, and flows will be monitored. The water pumped from the m-zone is considered to be Area 2 pit water and the sample station number is W45. Results of the monitoring work will be presented in the monthly WUL reports and summarised in the QML and WUL annual report.

7.6 Communications

A fiber optic communication system will be used as the communication system for mine and surface operations. The system will be a radio over IP and will provide communications, personal tagging and tracking as well as critical equipment control. Underground personnel (such as mobile mechanics, crew leaders, and shift bosses) and mobile equipment operators (such as loader, truck, and utility vehicle operators) will be supplied with an underground radio for contact with the fiber optics network.

7.7 Explosive Storage and Handling

Explosives are stored on surface in permanent magazines; detonation supplies (NONEL, electrical caps, detonating cords, etc.) are stored in a separate magazine.
Underground powder and cap magazines will be prepared in Minto South Portal. Day boxes are used as temporary storage for daily explosive consumption.

Anfo is used as the major explosive for mine development and production. Packaged emulsion is used as a primer and for loading lifter holes in the development headings. Smooth blasting techniques are used as required main access development headings.

All personnel underground would be required to be in a designated Safe Work Area during blasting. During production period, a central blast system would be used to initiate blasts for all loaded development headings and production stopes at the end of the shift. Safe work procedures that are currently being used at the mine are presented in Appendix C. Safe work procedures will be revised as required by the conditions in the mine.

### 7.8 Fuel Storage and Distribution

An average fuel consumption rate of approximately 5,000 l/d is estimated for the period of full production.

Haulage trucks, LHDs, and all auxiliary vehicles are fuelled at fuel stations on surface. An auxiliary tank used for the fuelling/lubing of drills and rock bolters. A 50,000 liter EnviroTank is installed on surface (Pad# 1).

All underground personnel are trained in site wide spill prevention and spill response protocols outlined in Minto Mine’s Spill Contingency Plan.
8 Mine safety

8.1 General Mine Safety

Minto Mine and the development contractor emphasize safety in all duties at the mine; this philosophy is shared by and with senior management, on site supervisors and daily operators.

This project will be undertaken with a dedicated focus on “Zero Harm”. All non-routine tasks will be assessed for risk to ensure suitable control measures are in place to better achieve “Zero Harm”.

All work will be performed within the strict guidelines of both Minto’s and Contractor’s safety programs. Both programs will comply with all required internal policies and procedures, as well as the Yukon Territory’s legislated requirements.

The Contractor will utilize its Safety and Training Program which includes risk assessments, job observations, workplace inspections and regular program audits. Any new work which is non-routine will be subjected to a full risk assessment which would then be used to develop new site specific work procedures. The Contractor will maintain detailed training records of every employee, both on-site and at their main office.

A key component of the Contractor’s commitment to “Zero Harm” is the use of the Zero Harm Safety System and associated safety card in the field, which is consistent with current on-site practices.

All safety concerns are documented, assigned responsibility, and tracked until rectified.

8.2 Emergency Response

Initially, when the working face is within 500 meters of the portal, emergency escape will be directly to the surface via the portal this is valid for Minto South and M-Zone. An Emergency Cache is located near the working face consisting of 6 – EBA 6.5 breathing apparatus, first aid supplies, Oxygen therapy unit, water, food, flashlights and blankets. Once the decline reaches 500 meters in length from the portal to the working face, a portable refuge station will be installed underground near the face. Portable refuge stations are maintained in locations of mine development to include refuge < 15 minute travel time by foot. All underground personnel will follow fresh air and escape to surface or take refuge in a refuge station during all emergencies that affect the underground. Refuge station posted “code of conduct” must be followed by everyone in the refuge station. The
portable refuge stations are designed to be equipped with compressed air/oxygen cylinders, potable water, and first aid equipment; they will also be supplied with a fixed telephone line and emergency lighting. During the initial development phase, one refuge station, capable of 72 hours and 15 men is utilized. As manpower and distance increase a second portable refuge station will be sourced. The portable refuge chambers will be moved to the new locations as the working areas advance, eliminating the need to construct permanent refuge stations.

Fire extinguishers will be provided and maintained in accordance with regulations and best practices at the underground electrical installations, pump stations and other strategic areas. Every vehicle will carry at least one fire extinguisher of adequate size and proper type. Underground heavy equipment will be equipped with automatic fire suppression systems.

All underground personnel will be required to carry Ocenco M-20 self-contained self-rescuer (SCSR) devices. The Ocenco M-20- SCSR isolates the user’s lungs from the surrounding atmosphere and utilizes compressed oxygen to provide respiratory protection. The M-20’s will provide 15 – 20 minutes of Performance duration and 32 minutes of Rest duration. In addition to the personal devices, six devices with longer performance durations of 60 minutes will also be supplied and kept near the ramp face during development; personal CO detectors will be made available to the development crews.

Fire extinguishers will be provided and maintained in accordance with regulations and best practices at the underground electrical installations, pump stations, fuelling stations, and other strategic areas. Every vehicle will carry at least one fire extinguisher of adequate size and proper type. Underground heavy equipment will be equipped with automatic fire suppression systems.

A mine-wide stench gas warning system is installed at the main intake raise to alert underground workers in the event of an emergency. During the initial development phase; prior to completion of the main fresh air raise, stench gas warning will be in the temporary fresh air system.

The main access decline would provide primary access and the ventilation raises with dedicated manway would be equipped with ladders and platforms providing the secondary exit in case of emergency. This secondary egress will be completed prior to production stoping.

The Emergency Response Team that is currently at Minto has both Surface and Underground competent responders working in coordination with defined mine rescue certified members and UG specialists within the contractor ranks.

Further information on mine safety for the underground mine is provided in the Emergency Response Plan in Appendix D.
8.3 Hours of Work

Minto requested and received an hours of work variance (presented in Appendix E), 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.

8.4 Industrial Hygiene an Fatigue Management Programs

An industrial hygiene (IH) consultant 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. The consultant will be involved throughout the development to conduct regular review of the program and testing results. The purpose of this plan is to develop process and procedures to ensure the highest possible air quality is maintained, (TLV levels), manage noise and to develop and implement a Fatigue Management Program. The Fatigue Management Plan has been presented in Appendix G. The IH consultant will also be utilized in the definition and calculation of adjusted TLV values.

Until such times that the IH data confirms that air quality exposure is below the adjusted TLV concentrations, respirators will be a mandatory piece of PPE equipment to all employees entering the underground workings.

The plan is that that prior to the completion of the 4500 meters of development to apply for a permanent variance to the hours of work. The IH data and programs for air quality, noise and fatigue will form the bases of this request.

8.5 Hours of Underground Exposure Monitoring

In order to ensure compliance with the requested hours of underground exposure, Minto Mine will utilize Smart Tags. Smart Tags are long range RFID (Radio Frequency Identification) to track employee’s underground exposure hours in real time. This system consists of an active RFID tag located on the employee, whether it is on their hard hat, safety belt pouch or inside the cap lamp; and a networked RFID reader located at the portal collar. Data is then sent to a central computer system which facilitates system control and monitoring though the Smart Tag software (or similar) in real time by employee.
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 Safety considerations in Underground Equipment / Materials

8.7.1 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.

8.7.2 Portable Compressors

The current plan calls for electric compressors underground, however, if the diesel is required, it will be equipped with the necessary fire suppression, CO monitor and shut off requirements.

8.7.3 Shotcrete

Shotcrete used in the underground workings will be restricted to “wet system” process only; this will eliminate the cement dust particulate associated with dry shotcrete application.

8.8 WCHSB Reporting

Quarterly update meetings are scheduled to be held with YWCSHB to review the following:
- IH Program data and Fatigue Management Plan progress
- Updated Mining Plan

The dates of the Quarterly Update Meeting should be set annually, with some latitude for mutually acceptable alternative dates.

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.

All aspects of the current surface health and safety program and compliment of Safety personnel in place at the Minto Mine will be extended to the underground operations during the initial development in cooperation with the contractor as we are considering this an additional department of our operation.
JOHSC worker representation will be extended to underground operations and will expand in conjunction with the size of the workforce associated to the underground operation.
9 Conclusion

This Underground Mine Development and Operating Plan incorporated the requirements outlined by the Quartz Mining Licence. Minto Mine recognizes that some changes to the mine plan and methods are likely as development and operation continue and more is learned about underground activities at the site. This plan will be updated as necessary to reflect newly acquired information and knowledge obtained from ongoing operation.
Appendix A – M-Zone Updated Geotechnical Assessment

TO: Minto Mine Technical

FROM: Kevin Cymbalisty

SUBJECT: M-Zone Updated Geotechnical Assessment

DATE: March 16, 2014

1.0 Introduction

M-Zone underground development has been underway since February 5, 2014. Development to date includes the following:

- A-Drift (main ramp) – 115 m
- I-Drift – 31 m (complete). Approximately 20m in ore.
- H-Drift – 35 m. Approximately 25m in ore.
- G-Drift – 14 m. Approximately 10m in ore.
- F-Drift – 3 m.

Geotechnical mapping has been carried out on the completed development to assess ground conditions and verify assumptions used in geotechnical design. The following sections summarize mapping information to date, compare rock properties to those used in the design, and update stability analyses previously completed. This document is primarily focused on the ore to consider stope and rib pillar stability, and in particular the initial stopes B to G. Stopes H and I are located in close proximity to the pit wall and will be considered in more detail as experienced is gained with ground performance and mining practices in the initial stopes. Analyses for stopes H and I will be presented under separate cover.

Previous analyses include the following:


2.0 Geotechnical Mapping

Approximately 80m of waste rock has been mapped for rock structures and 30m of ore has been mapped for rock structure and rock quality. Summaries are contained in Tables 1 and 2 below.
In general the rock quality of the ore exposed in the M-Zone has been good to very good, with little variability. Blasted drift profiles are very close to design, no major wedges are visible in the walls or
back, and it is reported that very little scaling is required. No major structures such as faults or shear zones have been intersected. Photos of typical conditions are shown in Figures 1 to 4.

Minor inflows are often encountered in the face and seeps are visible from the back in some places, however no significant inflows have been observed.

Figure 5: Right wall of I-Drift showing J6 joint set
Figure 6: Footwall contact in I-Drift right wall

Figure 7: Close up of footwall contact in I-Drift right wall
3.0 Comparison of Mapping to Nearby Diamond Drillholes

Geotechnical data is available for one diamond drillhole in the areas mapped in I and H drifts - 06SWC108, shown in Figure 5. The core was logged by BGC Engineering Inc. in 2006. No current personnel at Minto were here at the time of the logging so the quality of the logging is unknown. A comparison to the underground mapping data has been included here to assess the reliability of the logging data in this and other holes in the M-Zone.
Figure 9: Diamond Drillhole 06SWC108

Figure 10: 06SWC108 showing the depth of the I-Drift (157.58-163.68m)
Figure 11: 06SWC108 showing the depth of the I-Drift (157.58-163.68m)

Table 9-3: Comparison of Modelled vs Mapped Ore Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>06SWC108 (Depth 157.58-163.68m)</th>
<th>Mapped (I-Drift)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQD</td>
<td>56% to 75%</td>
<td>76% to 100%</td>
</tr>
<tr>
<td>Intact Rock Strength</td>
<td>R3 (25-50 MPa)</td>
<td>R5 (100-250 MPa)</td>
</tr>
<tr>
<td>Jn (Joint Sets)</td>
<td>3 to 6 (One joint set plus random to two joint sets plus random)</td>
<td>9 (Three joint sets)</td>
</tr>
<tr>
<td>Jr (Joint Roughness)</td>
<td>1.5 to 3 (Planar, rough to undulating, rough)</td>
<td>1 to 3 (Planar, smooth to undulating, rough)</td>
</tr>
<tr>
<td>Ja (Joint Alteration)</td>
<td>2 (slightly altered joint walls)</td>
<td>1 to 2 (unaltered to slightly altered joint walls)</td>
</tr>
<tr>
<td>Q’ (Average)</td>
<td>9.4 to 17.5</td>
<td>15.3 to 15.6</td>
</tr>
</tbody>
</table>
On average the rock quality ($Q'$) logging for the interval near the I/H Drift development is consistent with that mapped underground, both indicating a “good” rock quality. However, the input parameters are somewhat different:

- RQD is underestimated in the core logging – this is often the case due to drilling/handling induced breaks being included in the RQD measurement.
- Strength is underestimated in the core logging – higher strengths of high R4 to R5 have been confirmed in laboratory testing.
- Joint sets (Jn) are difficult to estimate in non-oriented core logging and are not typically relied upon.
- Joint conditions (Jr and Ja) are consistent between the logging and mapping.

Although only a very small sample size was considered, the results of the comparison indicate that M-Zone diamond drillhole data is reasonable to use for an estimate of rock quality in the planned stopes and pillars, and may be slightly conservative. Detailed geotechnical mapping will continue throughout the development to verify rock properties.

4.0 Comparison of Mapping to Modelled Properties

A comparison of the mapped ore properties to the estimated properties used in the numerical modelling described in “Three-Dimensional Numerical Simulation of the M-Zone at Minto Mine” (Itasca Consulting Group, Inc., January 10, 2014) is shown in Table 3. Rock properties estimated for the modelling were based on laboratory testing, drillhole data and experience in the Area 118 underground.

<table>
<thead>
<tr>
<th>Ore Parameter</th>
<th>Numerical Model</th>
<th>Mapped (average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intact Rock Strength</td>
<td>100 MPa</td>
<td>R5 (100-250 MPa)</td>
</tr>
<tr>
<td>RMR89</td>
<td>76</td>
<td>77</td>
</tr>
</tbody>
</table>
The rock properties used in the numerical models are nearly identical to those mapped on average in the M-Zone ore thus far. As such, it is unlikely that an update to the model will be required; however, mapping and verification will be continued throughout the remaining development.
5.0 Empirical Stope Stability Analysis

Empirical stope stability analysis was initially carried out in November, 2013 ("M-Zone Stope Stability Analysis", Kevin Cymbalisty, Minto Mine) as a basic verification that the planned stope sizes are within precedent. The analyses were updated based on the mapping data and more detailed stope geometry, summarized in Table 5.

Table 9-5: Stope Geometry

<table>
<thead>
<tr>
<th>Stope</th>
<th>Width (m)</th>
<th>Length (m)</th>
<th>Height (m) (floor of development drift to stope back)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>45</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>10</td>
<td>65</td>
<td>9</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>85</td>
<td>11</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
<td>90</td>
<td>11</td>
</tr>
<tr>
<td>F</td>
<td>10</td>
<td>115</td>
<td>15</td>
</tr>
<tr>
<td>G</td>
<td>10</td>
<td>115</td>
<td>18</td>
</tr>
<tr>
<td>H</td>
<td>10</td>
<td>105</td>
<td>14</td>
</tr>
<tr>
<td>I</td>
<td>10</td>
<td>25</td>
<td>14</td>
</tr>
<tr>
<td>Average</td>
<td>10</td>
<td>81</td>
<td>13</td>
</tr>
</tbody>
</table>

Results of stope stability analyses are summarized in Table 6 and Figures 9 to 11.

Table 9-6: Stope Stability Results

<table>
<thead>
<tr>
<th>Stope Size</th>
<th>Endwalls</th>
<th>Sidewalls</th>
<th>Backs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stability</td>
<td>Stability</td>
<td>Stability</td>
</tr>
<tr>
<td>Minimum</td>
<td>Stable</td>
<td>Stable</td>
<td>&lt;0.5m for average conditions</td>
</tr>
<tr>
<td></td>
<td>&lt;0.5</td>
<td>&lt;0.5</td>
<td>Stable for highest rock quality</td>
</tr>
</tbody>
</table>

February 2014
### Stability Graph Results

<table>
<thead>
<tr>
<th></th>
<th>Stable</th>
<th>&lt;0.5</th>
<th>Stable</th>
<th>&lt;0.5</th>
<th>Stable</th>
<th>&lt;0.5</th>
<th>Stable</th>
<th>&lt;0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>Stable</td>
<td>&lt;0.5</td>
<td>Stable</td>
<td>&lt;0.5</td>
<td>Stable</td>
<td>&lt;0.5</td>
<td>Stable</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Maximum</td>
<td>Stable</td>
<td>&lt;0.5</td>
<td>Stable</td>
<td>&lt;0.5</td>
<td>Stable</td>
<td>&lt;0.5</td>
<td>Stable</td>
<td>&lt;0.5</td>
</tr>
</tbody>
</table>

The stability graph results indicate the endwalls and sidewalls should be stable with overbreak less than 0.5 m, with the exception of the scenario of the poorest rock quality in the largest stope, which would result in overbreak of 0.5-1 m in the sidewalls. Note these results are not accurate for predicting rib pillar stability but provide a reasonable estimate of overbreak and are useful to complement the numerical modelling already completed.

The backs are predicted to be marginally stable (in the transition zone between stable and unstable), with overbreak on average of 1-2 m but up to 4 m in the poorest rock quality. This is consistent with observations in the surrounding waste rock in the pit and footwall development where the waste rock can be very blocky in some areas and is dominated by several continuous, consistent joint sets. Diamond drillholes indicate a skin of blocky, fractured waste rock is also common for approximately 5 m into the M-Zone hanging wall in some areas.

Further analysis to consider rock structure and kinematic stability is contained in Section 6.
Figure 12: Stability Graph for Minimum Stope Size
Figure 13: Stability Graph for Average Stope Size
Figure 14: Stability Graph for Maximum Stope Size

6.0 Kinematic Analysis
Kinematic analysis was performed using the software Unwedge to assess rock structure in the stope backs and walls. Results for the sidewalls and backs are contained in the following two sections, followed by a results summary table.

- **Sidewalls (Ore)**

The maximum possible unstable wedge in the sidewalls based on the structure sets in Table 2, and for the maximum stope size, is approximately 225 tonnes, with an apex height of 3.6 m, and occurs on the right (southeast) wall, shown in Figures 11 and 12.

![Figure 15: Maximum possible sidewall wedge - looking northeast into stope](image)

![Figure 16: Maximum possible sidewall wedge - looking west at stope wall](image)

- **Backs**
The maximum possible unstable wedge in the backs based on the structure sets in Table 2, and for the maximum stope size, is approximately 3100 tonnes, with an apex height of 7.5 m, shown in Figures 13 and 14.

Figure 17: Maximum possible back wedge - looking northeast into stope

Figure 18: Maximum possible back wedge - looking east
Results for the range of stope sizes, for each exposure, are presented in Table 7.

Table 9-7: Summary of Kinematic Analysis

<table>
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<tr>
<th>Exposure</th>
<th>Stope Size</th>
<th>Maximum Possible Unstable Wedge (based on Mapped Structure Sets)</th>
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<tr>
<td></td>
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<td>Tonnes</td>
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<tr>
<td>Sidewall (ore)</td>
<td>Min</td>
<td>8</td>
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<tr>
<td></td>
<td>Max</td>
<td>225</td>
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<tr>
<td></td>
<td>Avg</td>
<td>67</td>
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<tr>
<td>Endwall (ore)</td>
<td>Min</td>
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<td>Avg</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Back (waste)</td>
<td>Min</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>3125</td>
</tr>
<tr>
<td></td>
<td>Avg</td>
<td>1885</td>
</tr>
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</table>

Significant wedges are possible in the stope backs. This was expected given the experience in waste rock in the open pit and the A-drift access ramp. These wedges are not expected to influence large scale stability of the zone, but may impact pit wall stability for the stopes that are beside the wall (I Stope) and below the pit ramp switchback (H Stope). Because the stopes are non-entry, the possible wedges do not present a hazard to personnel, but do present a risk to LHD’s remote mucking the stopes. For back wedges, it is often the case that if unstable, they will release with the blast, and therefore would result in dilution but no risk to equipment. If back stability results in excessive dilution, or large wedges are releasing and presenting an unacceptable risk to equipment, a layer of ore could be left in the backs to prevent exposure of the waste rock.

Possible sideward wedges present a similar risk to equipment, but again do not present a hazard to personnel as the stopes are non-entry. However, if significant wedges release from the sidewalls it could impact pillar stability. Stope performance will be measured with cavity monitor surveys (CMS) as stopes progress. If excessive overbreak results in undersized pillars in places, the stope, or adjacent stope may need to be re-slotted in order to leave a pillar mid-stope for reinforcement of the damaged rib pillar.
7.0 Conclusion and Path Forward

The mapping completed to date indicates the properties used in numerical stress analyses completed by Itasca are reasonable and revisions to the models are not required. No major structures (faults, shear zones) have been intersected to date that should be modelled explicitly. Kinematic and empirical analyses indicate significant overbreak and wedges may occur in the stope backs. Because the stopes are non-entry this does not present a risk to personnel, however back performance will need to be closely monitored to ensure there is not unacceptable risk to remote equipment or excessive dilution.

The analyses completed are applicable to the initial stopes B to G, which are furthest from the pit wall and have been confirmed by numerical analyses to be stable and with minimal influence on the pit wall. Stopes H and I, which are in close proximity to the pit wall, will be reassessed separately as experience is gained with ground performance and mining practices in the initial stopes. Analyses for stopes H and I will be presented under separate cover.

The following measures will be taken to further verify the design as development and stoping proceeds:

- Mapping will be continued throughout the remaining development to collect more information on rock quality and structure and identify any zones of variability across the ore body.
- Cavity monitor surveys will be carried out to monitor wall and back performance during stoping. This will allow areas of excessive overbreak to be identified so that modifications to the adjacent stope, or remaining stope blasts can be designed if required.
- Cavity monitor surveys will be reconciled with stope designs to develop a site specific stability graph.
- Drilling accuracy and blasting practices will be critical to minimize overbreak, particularly in the pillars. Tolerance should be included in ring designs for the expected overbreak – this can be refined as experience is gained with drilling, blasting, and pillar performance.
- A detailed monitoring/instrumentation plan will be developed for the last two stopes near the pit wall, H and I, as experience is gained with the initial stopes.
Appendix B – Safe Work Procedure Blast Clearing M-Zone

Scope

This procedure pertains to all employees, client personnel, contractors, and visitors in the vicinity of the M Zone at Minto Mine site.

PURPOSE

To set out a safe method by which all underground personnel may be notified and cleared from the underground during underground blasting operations. Areas within that zone will be evacuated and guards will be positioned to prevent entry into that area during the blast.

RESPONSIBILITIES

Employer/Supervisor Responsibilities

To ensure all workers are accounted for and in a safe location during a blast.

Safety and Training Department Responsibilities

To assist in the blast clearing procedures and notify personnel affected by the blast.

Worker Responsibilities

To ensure they follow all instructions given by their supervisor and the safety department. Also, to notify their supervisor if there are any unsafe conditions present.

Blaster Responsibility

To inspect and review each blast for potential hazards that warrant special precautions to be taken when clearing for the blast. If for any reason there is a concern around the “safe zone”, the blaster may call for special consideration in clearing for a blast.

Special Considerations

This SOP also includes Special Considerations concerning DDH (Diamond Drill Holes) that are in the area of the M Zone Development. (See Pictures 1)
APPLICATION

Regulations pertaining:

- Guards will be posted as necessary to guard all possible access points to the danger area.
- The blaster shall instruct the guards as to their duties and responsibilities.
- Guards shall be posted at locations that are protected from flying material and other hazards resulting from the blast.
- Once assigned to a post by the blaster, guard shall prevent all persons from entering the danger area.
- Guards shall remain at their posts until:
  - The charge is detonated and the “All Clear” signal sounds, or
  - They are personally relieved by the blaster.
- For surface blasts a signalling device, having a distinctive sound audible within the proximity of the danger area, shall be used to sound a warning of a blast.
- After a blast is detonated no person shall enter a blasted area until:
  - The blaster has given permission for work to proceed, and
  - Any hazards shall be identified by the blaster and controlled before other work resumes in the blasted area.

Specific Procedures:

Notification:

1. No person, without explicit permission of the blaster, shall be in the U/G M Zone Development.
2. A standard driving layout/block plan shall be provided and indicate any diamond drill holes that are within the daily blast plan. Any DDH within the 10 meter radius of the driving layout will initiate the “Special Considerations Procedure” to this Safe Operating Procedure.
3. Other than Dumas personnel and any contractors within the blast zone, no additional clearing should be required unless indicated by the blaster or the blast is within the 10 meter diameter of a DDH.
Clearing Procedure for Regular Production Blast:

1. Dumas personnel and any visitors going to the Dumas work area (M Zone) will follow the Dumas Tag In/Tag Out Procedure. The M Zone Tag board is located in the Dumas Seacan at the pit bottom.
2. All non-essential personnel will clear the blast zone 30 minutes before scheduled blast.
3. The blaster will be blasting using a blast box installed at the Reefer van.
4. The blaster will place a guard in the proximity of the Reefer Van to visually guard the Portal opening.
5. When the guard is in place and has verified to the blaster that the area is clear of personnel, the blaster will communicate on channel 7 “Attention Attention there will be a blast in the M Zone in approximately 5 Mins” followed by 3 - 2 second air horn blast.
6. 10 Seconds before detonation. The blaster will give 1 – 3 second air horn blast.
7. After a blast is detonated no person shall enter a blasted area until the blaster has given permission for work to proceed, and any hazards shall be identified by the blaster and controlled before other work resumes in the blasted area.
8. Blaster will announce “All Clear for M Zone” on channel 7.

Clearing Procedure for 118 Pit Blast:

1. Pit Blast notification to be sent out as usual to notify Dumas personnel of the Pit Blast
2. Dumas Supervisor is to notify Blaster in Charge or designate if Dumas Crew has left the M Zone prior to Pit Blast.
3. In the event that Dumas Crews are still in the M Zone the Blaster in Charge or designate will travel to M Zone to ensure all Dumas Crews will remain in the U/G workings during the Pit Blast.
4. Other personnel in the M Zone will be cleared from the M Zone by the Blaster in Charge.
5. Dumas will ensure the 118 Portal is clear of personnel and the Tag Board in the Dumas office is clear.
6. A Dumas worker will be designated to guard the m-zone portal during the Blast. He will position himself 5 meters inside the portal with a Dumas Vehicle and radio.
7. Blaster in Charge will have Dumas Guard sign his form and clear the remainder of the M Zone on his way up to his post.
8. Dumas Guard will remain at his post until cleared from Blaster in Charge.
9. Dumas designate will sign Pelly form at the ERT & Mill as before.
Dumas Mine Planner/ or designate will notify Dumas Superintendent or designate when development is about to approach a DDH Area (24 hr notice)

1. Surveyor/Mine Technician will notify the group at the Minto morning meeting when a blast is expected to enter a 10m radius DDH Danger Zone. This will initiate the “DDH Special Consideration” portion of this blasting procedure and a site wide e-mail will be issued alerting all personnel and contractors who could possibly in the area of the M Zone Pit.
2. Only Dumas personnel will be allowed to remain INSIDE the Dumas Muster Station during the blast. The Blaster will be in the Reefer van during the blast. All other personnel are to leave the M Zone pit area 30 Mins before the blast.
3. The blaster will designate one guard to clear from the ramp bottom to the top and post himself as a guard at the “Entering M Zone” Call point sign.
4. Any vehicle or persons encountered in the ramp will be redirected to the top beyond the “Entering M Zone” sign.
5. The guard is to remain in the cover of his vehicle and will restrict all access to the ramp of the M Zone.
6. Guard at the top of the Pit will communicate with blaster to indicate all clear.
7. Blaster will initiate blast from inside the Reefer Van.
8. No one is to leave the Dumas Muster Station or Reefer Van for 1 minute after detonation.
9. No air horn blast required (all site personnel have been warned of a blast in the M Zone) in this situation.
Reviewed by:

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Minto Representatives:

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This controlled document will be regularly updated to reflect revisions.

Next scheduled update – March 2015

- Updated Emergency Response Plan (ERP) documents will be bound and distributed to all authorized personnel.
- All Minto Mine personnel must have ERP training and know where to gain access to the document in the event of an emergency.
## Authorized Distribution / Location List

### Minto Explorations Ltd. – Minto Mine:

#### Health and Safety Office

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<td>Mill Control Room</td>
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### Capstone Mining Corp

#### Capstone Mining Corp. Vancouver Office

#### Community:

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#### Government:

| Yukon Workers Compensation Health and Safety Board |

#### Primary Partners/On-site Contractors:

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### Contractor Specific Emergency Response Plans Related to Minto Site

- Dyno
- Pelly Construction Ltd
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Appendix A: Emergency Contact Information
Appendix B: Emergency Response and Mine Rescue Personnel
Appendix C: Emergency Response Equipment

Appendix D: Mutual Assistance Agreement for Underground Mine Rescue
1 PURPOSE

Minto Mine’s Emergency Response Plan (“ERP”, “Plan”) sets out the response protocol in the event of an Emergency, as defined in section 2.

It is intended for use as a quick reference guide for managers and supervisors. Incident reporting and investigating are also outlined.

In an emergency situation it is imperative that safety and due diligence are exercised, as well as discretion. The priorities are the protection of Life, Environment and Property – in that order.

It is also noted that the Minto Safety Department has internal Safe Work Practices and formal information specific to defined emergency response equipment and activities. The ERP is a document more utilized by the site population at large and thus does not contain detailed Emergency Responder Directives and Procedures.

• DEFINITIONS
  o “Emergency”

An “Emergency” is defined as any occurrence meeting one or more of the following criteria:

1. Any “serious injury” or “serious accident” as defined by the Yukon Occupational Health and Safety Act 30 (1).
2. Any incident requiring first aid or rescue response to the scene, depleting resources to respond to secondary emergency.
3. Any fire requiring more action than initial suppression deployment.
4. Landslide, earthquake, avalanche, forest fire or flooding where injury or property damage results or may result.
5. Major power failure.
7. Loss of life.

  o “Serious Injury” and “Serious Accident”
As defined by the Yukon Occupational Health and Safety Act 30 (1);

“Serious Injury” means:

a) an injury that results in death,
b) fracture of a major bone, including the skull, the spine, the pelvis, or the thighbone,
c) amputation other than of a finger or toe,
d) loss of sight of an eye,
e) internal bleeding,
f) full thickness (third degree) burns,
g) dysfunction that results from concussion, electrical contact, lack of oxygen, or poisoning, or
h) an injury that results in paralysis (permanent loss of function);

“Serious Accident” means:

a) an uncontrolled explosion,
b) failure of a safety device on a hoist, hoist mechanism, or hoist rope,
c) collapse or upset of a crane,
d) collapse or failure of a load-bearing component of a building or structure regardless of whether
the building or structure is complete or under construction,
e) collapse or failure of a temporary support structure,
f) an inrush of water in an underground working,
g) fire or explosion in an underground working,
h) collapse or cave-in, of a trench, excavation wall, underground working, or stockpile,
i) accidental release of a controlled product,
j) brake failure on mobile equipment that causes a runaway,
k) Any accident that likely would have caused serious injury but for safety precautions, rescue
measures, or chance. (As amended by SY 1988, c.22, s. 5; SY 1989, c. 19, s.6)

ERT Rescue refers to the Emergency Response Team that is compiled of full time Safety Department
personnel and a compliment of volunteers from across the departments including contractors that are
certified in one or more of the following: First Aid, Surface Mine Rescue, Underground Mine Rescue,
Hazardous Materials Response NFPA 472 and Industrial Fire Brigade NFPA 1801. There is also a
compliment of 12 Advanced First Aid Attendants certified to a minimum of OFA 3/EMR working in
coordination with the ERT.

- MINTO MINE SITE LAYOUT AND MUSTER STATIONS

Figure 3-1 provides a mine site layout and Figure 3-2 and Figure 3-3 illustrate the locations of the various
surface muster locations for surface and underground mine emergencies. More information regarding
the use of muster stations is detailed in subsequent sections of the ERP.
Figure 3-19: Minto Mine Site Layout
Figure 3-20: Mill and Camp layout with muster stations indicated
Figure 3-21: Active mine and Underground Mine surface muster locations
• INITIAL RESPONSE TO MINTO MINE EMERGENCY

All visitors, employees and contractors receive Emergency training as part of the Minto Mine orientation package. This training includes protocols in the event of a Medical, Fire, Safety or Environmental Emergency. This section details the initial emergency protocols that all individuals must follow at the mine in the event of one of the aforementioned emergencies. All references to Minto Mine personnel by position are defaulted to defined designate if position is vacant at the time of emergency.

  o Code One Protocol

The “Code One” protocol is almost always the first step in reporting all suspected mine emergencies, and is a critical tool for timely response by Emergency Response personnel and ensuring that all other workers at the mine are informed of a potential emergency taking place. Figure 3-1 illustrates the response diagram when an emergency or suspected emergency occurs, and outlines some of the responsibilities for key individuals involved in the emergency response.
Figure 4-22: Emergency “Code one” Protocol

Incident
Injury / Fire / Spill / Other

Discoverer
- Call “Code 1, Code 1, Code 1” on existing radio channel
- Call “Code 1, Code 1, Code 1” on emergency channel (Channel 1).
- Await Safety Co-ordinators response on channel 1

Safety Coordinator
- Reply to Discoverer and request the Nature of the Code 1.
- Direct Mill Control Room Operator to activate the ERT pagers and call Code 1 on all channels.
- Proceed to scene and assume Incident Command. Conduct initial assessment
- Designate an Incident Accountability Officer & establish incident accountability

Mine Rescue Emergency Response Team (ERT)
- Respond to ERT facility and don appropriate PPE.
- Captain assumes control of the ERT Team.
- Captain briefly team on tools and vehicles required.
- Team responds to scene as directed by IC. Captain reports to accountability

Safety Department Manager or Officer
- Conduct accountability
- Proceed to scene to provide Unified Incident Command support.
- Notify General Manager and area Manager of involved department to initiate ECC.
- Request additional assistance and resources as required.
- Equipment needs
For critical personnel & those involved in an emergency on surface, the following protocol will be observed.

1. Any employee witnessing an emergency will call out on their current radio channel “Code 1, Code 1, Code 1” and state the nature and location of the emergency. (In the event of an injury, a first aid certified worker in the area would be alerted to the incident and could respond directly to the scene) The employee immediately changes his radio to channel 1 (Emergency Channel) and calls out “Code 1, Code 1, Code 1” and states the nature and location of the emergency. Employee remains on Channel 1 for a response from Site Safety/Medic.

If underground, follow underground emergency protocols 5.1, 5.2. The following bullets detail underground Code 1 process as per the underground emergency protocols:

- Using wifi radio, depress PTT button, wait for the beep, and then announce: “Code1-Code1-Code1”

- Using wifi radio, contact the Mill Control Room Operator on the Emergency Line by pressing the following sequence of buttons on the key pad. There are 2 options:
  a. 9-1-1- or
  b. 1 – hold down for 3 seconds

Be prepared to answer the Control Room Operator when you are asked for your name, location and brief description of emergency

- For more detail see section 6.

2. Safety Coordinator/Medic will arrange for “Code 1, Code 1, Code 1” to be announced on all radio channels.

3. Safety Coordinator/Medic will respond to caller with “What is the nature and location of the Emergency?” on channel 1.

4. Employee will then state their name, the nature and location of the emergency.
5. Employee will then offer all available information and follow all instructions given to them by Safety Coordinator/Medic.

6. Safety Coordinator/Medic will coordinate the control room operator to send out a page for the ERT with nature and location of the emergency.

7. Critical personnel and/or equipment will proceed to Staging, as per Staging Protocol.

8. The Safety Coordinator/Medic will respond to the scene and conduct an initial scene assessment and assume command (IC) of the scene. Command will be declared on the radio and instructions are given to response team Captain including staging location. If the Safety Coordinator/Medic is required to treat patients, command is transferred to an alternate member of the Health and Safety Department or Mine Rescue Team Captain. Any transfer of command requires a detailed verbal report of the incident and activities conducted and underway, and a formal communication to all responders and on radio channel 1.

9. ERT will respond to ERT facility, don appropriate PPE and contact IC for response and staging instructions. Field ERT members will respond in a safe manner to ERT facility in light vehicles or supervisors can provide transportation for ERT members without LV access.

10. Unified Command Support will be initiated once the Health and Safety Manager, General Manager and Area Manager are on scene. Incidents involving an Environmental release will include the Environmental Lead in the Unified Command Support.

Unified Command Support is a cooperative effort for the purpose of support to the Safety Department Incident Command. If Unified Command Support is deemed not to be required on the scene, the support team will report to the Emergency Communications Center (ECC) to monitor radio and provide for support from the ECC location.

11. Only IC can clear, or designate Control Room Operator to clear, the Code One, by declaring an “all clear” for employees to return to regular work.
Code One Protocol – Uninvolved personnel

During a Code 1, personnel not involved in the emergency shall observe the following protocol.

1. Upon hearing a Code 1, all personnel will safely stop work and all equipment must be safely rendered to a down/safe idle condition.

   **Exception:** The crusher loader may continue to operate at a reduced speed, and Crusher Control Operator must reduce pan speed to less than 80%. The Loader Operator must stay in the loader unless it is unsafe to do so, for the sole purpose of feeding the crusher. No maintenance may be performed during a code 1. All other personnel must stay in their designated muster station.

2. All vehicles will safely pull over to the side of the road and stay there until an ‘All Clear’ is issued, or unless instructed otherwise by supervisor or departmental preplan. For the sole purpose of mustering or Code 1 communications, at the discretion of the supervisor or departmental preplan, light vehicles, including light underground vehicles, may drive directly to department muster station, or directly to notify and pick up co-worker/employee, then directly to muster station, at 2/3 normal speed. Vehicles mustering must be minimized through ride-sharing and must stay clear of incident scene.

3. Mill and assay lab and water treatment plant personnel will report to control rooms and lunch rooms, while the mill remains operational.

   **Exception:** two members of Mill Operations may conduct floor patrol of operating area, for the sole purpose of observing and reporting. No maintenance may be performed during a code 1. All other personnel must stay in their designated muster station.

4. Radio silence will be recognized on Channel 1 and any Channel of area of involvement until Code 1 has been cleared, except for the purpose of accountability, which includes supervisors calling workers to Muster Station or Staging Location. Radio silence can be broken for critical communication to IC from any party or to get authorization/permission for alternate radio channel use from Supervisors.
5. Only IC can clear, or designate the Control Room Operator to clear the Code One, by declaring an “all clear” for employees to return to regular work.
• Code One Procedure for Control Room Operator

1. When a Code 1 is called, the Control Room Operator (CRO) will listen for Site Safety to respond to the Code 1 on channel 1.

2. Once Site Safety has confirmed the details of the Code 1, they will direct the CRO to activate the ERT pagers and call “Code 1, Code 1, Code1” on simplex/duplex radio channels 5, 7, 8, 14, & 16, wifi radio channels 1 (Emergency) & 2 (U/G Main). CRO will also call Code 1 on the Telephone Paging System. To do so, they will pick up the receiver and dial 499, once one ring is heard the CRO will then announce the Code 1 as they would on the radio.

3. If no reply is heard from Site Safety, the CRO will activate the ERT pagers; announce event and location (if known), e.g.; “Code 1 –Medical emergency in kitchen”, call “Code1, Code1, Code1” on simplex/duplex radio channels 1, 5, 7, 8, 14, & 16, wifi radio channels 1 (U/G Emergency) & 2 (U/G Main), and then attempt to contact Site Safety on channel 1. Contractor UG mine rescue personnel will be called on radio channel 1 by Minto IC to Contractor UG Safety who will initiate the organization of Contractor UG team to the ERT facility if deemed necessary by IC.

4. The CRO will confirm that all Mill personnel are aware and have moved to the lunchrooms or muster station except required people as per this procedure. If safe to do so the CRO will remain in the control room, to provide for critical monitoring and controlled equipment shut down as required.

5. If the control room is deemed unsafe, the CRO will request permission from IC to relocate to the Tailings or Crusher control room to provide for critical monitoring and controlled equipment shut down as required. The CRO must take a radio and a satellite phone with them.

6. The CRO will confirm on all channels that the Code 1 has been heard by calling Code 1 a second time on simplex/duplex radio channels 5, 7, 8, 14, & 16, wifi radio channels 1 (U/G Emergency) & 2 (U/G Main), and the telephone paging system.
7. The CRO will monitor the radios during the Code 1 as emergency crews may use the control room as a communications resource. Emergency contact lists must be at hand in case external resources are required to be contacted.

8. The CRO will complete a time and event log of activity on the emergency ground to the best of their ability.

9. Site Safety will take responsibility for instruction to clear the Code 1 on all channels and the telephone paging system.
   - Control Room Procedure for Code One Calls from Underground

When a Code 1 call is made from the underground (UG) workings on the UG dedicated phone to the control room, the following procedures will be followed:

1. When a Code 1 call is received, the control room operator (CRO) will gather the following information immediately.
   a. What is the exact location of the emergency?
   b. What is the nature of the emergency? i.e. fire, first aid....if known the number of patients.

   The CRO will ask the person that if safe to do so, to keep an open line of communication.

   (This will be vital information in the event that communication is lost prior to Safety responding to the Code 1 call. If communication is broken up and not clearly understood, the CRO will not delay calling the code 1.)

2. The CRO will acknowledge to the UG caller that the Code 1 has been received and Code 1 procedures are being initiated.

3. “Code 1 Code 1 Code 1” will be called on Channel 1 and Safety will respond. When Safety responds, the CRO will relay the information gathered to Safety. The CRO will inform them of whether or not there is still an open line of communication with UG.

4. If safety does not respond, the CRO will repeat step 3.
5. Safety will then give instructions to the CRO to page out the ERT and to broadcast the Code 1 on all channels and the telephone paging system as per normal Code 1 procedure. UG/Contractor Mine Rescue personnel will be summoned by means of Radio Channel 1 to UG/Contractor Safety who initiates the organization of UG/Contractor team to the ERT facility.

6. Safety may request more information from UG which the control room operator will relay until such time that safety has direct communication with UG.

- Fire Alarm Procedures
  - Mill/Tailings/Water Treatment Plant (WTP) Fire Alarm Procedure
    1. Activation of “Code 1” protocol by Mill Control Room Personnel
    2. All non-control room personnel in Mill/Tailings/WTP are to proceed to nearest exit point and proceed to MUSTER STATION located at Mine Office complex.
    3. Control Room will advise Incident Command of Alarm location.
    4. Incident Command will advise Control Room personnel on whether or not to evacuate Control Room.
    5. Control room operator can request to be repositioned at either Tailings or Crusher Control room to provide for critical monitoring and controlled equipment shut down as required. Incident Command to allow based on safety of initial scene assessment.
    6. Once evacuated from the Mill, all personnel are to proceed to the MUSTER STATION.
    7. All personnel are to remain located at the MUSTER STATION unless advised by a Safety department designate.
    8. The ERT will operate under the direction of Incident Command. Team Captain is responsible for team tactical operation and direct accountability of team.
    9. No personnel are to block Emergency Response vehicles, Ambulance or Equipment.
    10. The Health and Safety Manager will request accountability report from all area supervisors responsible for work within the affected area.
    11. Only Incident Command can advise Control Room to disengage Fire Alarm after investigation of cause.
    12. No personnel will be allowed back into Mill or Tailings complex without authorization of Incident Command.
    13. Failure to evacuate Mill will result in disciplinary action, which may result in termination.
Camp Fire Alarm Procedure

1. Anyone hearing a bunkhouse fire alarm will proceed to the Muster Station and call Site Safety on radio channel 1, then stand by Muster Station and advise others arriving that Site Safety has been notified. Site Safety will investigate and determine if it is a general alarm - Code 1, or single detector.

2. All personnel in Camp affected by alarm are to don appropriate clothing, then proceed to nearest exit point, exit bunkhouse, and proceed to Muster Station.

3. If Muster Station is unsafe, ERT will direct personnel to alternate muster station.

4. Camp unit manager will bring accountability sheets to Muster Station and meet Health and Safety Manager to assist with roll call (roster sheets are updated daily and are located on the board just inside kitchen entrance). Area supervisors will assist as required and directed by camp unit manager or H&S Manager/Officer.

5. Employees working in camp (site services, Sodexo, maintenance) will report to muster station and be accounted for by their supervisor or most senior worker on their respective crew. The supervisors will advise H&S Manager/Officer of any missing people.

6. Health and Safety Manager will relay accountability information to Incident Commander (IC).

7. The ERT will respond to the ERT facility and don turnout gear and prepare SCBA. Once a sufficient number of team members are prepared, the ERT captain will contact IC on radio Channel 1 for response and staging instructions.

8. The ERT will respond to defined staging area with the fire truck and ambulance, in a safe manner.

9. IC will develop an Incident Action Plan, utilizing Bunkhouse Fire Preplans, as required.

10. The ERT Captain will utilize Incident Accountability tag board, maintaining control of the team.

11. The ERT Captain will report to IC for instructions.

12. The ERT members will take direction from the ERT Captain and/or Vice-Captain, as per Incident Command Structure.

13. The ERT captain will inform IC of standard benchmark fire ground activities such as entering building, time under air, smoke/fire found, victims located, fire stop, etc.

14. IC will delegate the documentation of a time and event log to the. Control room operator, ECC or an on scene ERT or other personnel.

15. All employees will remain at Muster Station until “All Clear” is given by Site Safety or instructed to move to an alternate location.

16. Failure to evacuate Camp will result in disciplinary action, which may result in termination.
Minto Incident Command Structure

- INCIDENT COMMAND/UNIFIED COMMAND
  - SAFETY OFFICER
  - PUBLIC INFO OFFICER
  - LIASON OFFICER

- OPERATIONS SECTION
  - STAGING
  - BRANCHES OF UNITS
    - ADDITIONAL RESOURCES
      - ENVIRO DEPT
      - ERT
      - SITE SERVICES
    - DIVISION/GROUPS
      - STRIKE TEAM
      - TASK FORCE
      - SINGLE RESOURCE

- PLANNING SECTION
  - RESOURCE UNIT
  - SITUATION UNIT
  - DEMOBILIZATION UNIT
  - DOCUMENTATION UNIT
  - TECHNICAL SUPPORT UNIT

- LOGISTICS SECTION
  - SUPPORT BRANCH
    - SUPPLY GROUP
    - FOOD GROUP
  - SERVICE BRANCH
    - GROUND SUPPORT GROUP
    - COMMUNICATIONS GROUP
    - MEDICAL GROUP
    - FACILITIES GROUP

- FINANCE SECTION
  - TIME UNIT
  - PROCUREMENT UNIT
  - CLAIMS UNIT
  - COST UNIT
Emergency Communications Centre

The Emergency Communications Centre (ECC) is a pre-designated location where offsite communications are managed in the event of an emergency.

- **Where?** - GM office or Health and Safety Manager Office if Mill involved. Phone, Lync, Radio, Sat Phone for use available to these locations.
- **Who?** – GM, H&S Superintendent, Manager of area involved (Planning), HR (Logistics), Manager of Administration (Finance), Manager of Environment (if not on scene)
- **What?** –
  - Maintains communication with IC during emergency, advise and support IC as required.
  - Control off-site communications including, but not limited to; as Capstone Mining Corp., regulators, support agencies, media, neighbors, etc.
  - Notify families when warranted.
  - Source materials, supplies, mutual aid, resources.
  - Arrange for evacuation and general transportation and logistics.
  - Develop business continuity plans.
  - Provides internal and external communication updates during emergency, if and when deemed necessary. This will be done by radio and/or phone/email.
  - Emergency Response Staging

The Main Staging area will be located at ERT building unless otherwise designated by IC.

Heavy Equipment Staging will be located at Water Treatment Plant unless otherwise designated by IC and arranged through the ECC.

Reporting to Staging during code 1

- All ERT members
- Designated Alternate medic
- Electrical Supervisor and, based on his/her experience, the crew & equipment necessary for the incident as requested by IC and/or ECC.
- Site Services Supervisor (SSS) and, based on his/her experience, the crew & equipment necessary for the incident. Exception: For bunkhouse alarm, SSS & crew will report to muster station as requested by IC and/or ECC.
- Enviro Lead and, based on his/her experience, the crew & equipment necessary for the incident as requested by IC and/or ECC.

The Designated Alternate Medic will fill the role of Staging Officer once ERT Captain and Vice-Captain have responded to scene. The Staging Officer will report to Incident Accountability upon taking the role, advise of available resources, and update as further resources arrive. If the Staging Officer is to be
distracted by other task, they will pass the role to an available resource, and update Incident Accountability of the change.

Personnel at Main Staging will remain on alert at the staging area and monitor radio channel 1 until re-assigned, or until stood down by Incident Command. This includes ERT members.

Heavy Equipment Operators will remain on alert at Water Treatment Plant and continue to monitor radio channel 14 until re-assigned or stood down by Supervisor.

- Incident Accountability
  1. At an emergency incident, the ERT/Fire Brigade will use the Incident Accountability System in conjunction with the Incident Command System, to identify individual members of a team, and to account for the assignment of teams.
  2. The Incident Commander, at an incident, must initiate and use the Incident Accountability System to account for responding personnel on scene. The Incident Commander will directly account for Captains and teams, within a direct span of control.
  3. Upon arrival at the emergency scene, responding personnel will report to the Incident Commander for assignment. Captains, Team Leaders, and individual responders are accountable for the safety of themselves and other members on their team. Team members must maintain a constant awareness of the position and function of all members working with them. Whenever possible, teams must remain intact and all members work in the same area.
  4. Team Leaders must know the location of all members in the team, at all times. There must be no transfer of members from one team to another, on the incident ground, without positive communication between the two Team Leaders, and the notification of the Incident Commander.
  5. If a team member is in trouble, the other member(s) of the team must take appropriate steps to provide direct help, call for help, or go for help.
  6. The Team Leader will supervise the maintenance and proper placement of accountability tags on the Incident Accountability board, at an emergency incident. Team Leaders are responsible for responders under their direct control.
  7. A Team Leader will forgo placement of accountability tags on the Incident Accountability board only if:
     a. They are the only unit at the incident.
     b. They are the committed first arriving unit at an incident before the establishment of a Command Post.
  8. When a Captain relieves a team of an assignment, the Captain must:
     a. Confirm with the Team Leader, that all team members are accounted for.
     b. Inform the Incident Commander that the team has been relieved and will be reporting to Incident Command for re-assignment.
     c. The Incident Commander will acknowledge relief of that team and confirm their arrival at the Command Post, with the relieving Captain.
  9. When the Incident Commander relieves a team of an assignment, or receives a team that has been relieved by a Captain, the Incident Commander must:
a. Confirm with the Team Leader, that all team members are accounted for.
b. Re-assign the team to another sector, ensure that the accountability tags are appropriately re-assigned, and inform the receiving Captain that the team has been directed to report to his sector. The receiving Captain will acknowledge and then confirm the arrival of the team in the sector.

10. Using the Incident Accountability board, an incident scene roll call must be conducted when:
   a. A Captain or Team Leader realizes that a team member is missing or possibly trapped. The Captain must start rescue efforts as quickly as possible, at the last known location, and advise the Incident Commander.
   b. There is change in incident strategy from the offensive to the defensive.
   c. There is a catastrophic change in the incident, such as a building collapse, explosion, backdraft, sudden flooding, release of vapour cloud, etc.
   d. There is an emergency evacuation at the scene
   e. The Incident Commander or Captain feels that there is a need for a roll call.

   o Communications Lock Out

**Purpose:** In the event of a site crisis requiring communication limitations, the following actions will be taken to restrict all non-critical communications.

1. IT will SSH into MIN-Clarke-R1 and enable a communication lock access-list. This will prevent anyone on the Guest, Camp_Inet and Production Networks from accessing the internet.

**Note:** IT is looking into an access-list that will give key personnel Internet access: “Safety / GM / HR Manager / HR Supervisor / IT”

2. IT will SSH into the phone router and enable an access-list that will deny all outside calls from all phones except for the following:
   
   Safety: 441,444 GM: 439 HR Manager: 448 IT: 692

**Note:** When we upgrade our phone system to Lync we will have the same access-list in place.

3. Site contractors will be required to restrict their connections. IT will:
   a. Contact **Dumas**, inform them that a communications lock is in effect, and they are required to power down their Internet Modem.

**Note:** Dumas has one modem located in their locked storage on the top floor.
b. Contact **Pelly Construction**, inform them that a communications lock is in effect, and they are required to power down their Internet Modems.

**Note**: Pelly has 3 modems located in their front office providing phones and internet. They are in the open and anyone can access them.

c. Contact **Dyno** via radio, inform them that a communications lock is in effect, and they are required to power down their Internet Modems.

**Note**: Dyno has one modem in their office. It is accessible by anyone.

d. Contact **Sodexo**, inform them that a communications lock is in effect, and they are required to power down the Internet Modems located in Pelly Manor.

**Note**: The exact locations have been mapped. Sodexo Camp Manager will pull the power cables in the event of a communications lockout.

4. In the unlikely event IT personnel are unable to perform these duties; A Human Resources leader will arrange the communications lockdown.
## Initial Incident Responsibility Matrix

<table>
<thead>
<tr>
<th>POSITION</th>
<th>RESPONSIBILITIES</th>
</tr>
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<tbody>
<tr>
<td>Safety Coordinator/Medic</td>
<td>- Initial scene assessment and Incident Command and Accountability&lt;br&gt;- Coordinate initial response&lt;br&gt;- Provide first aid treatment, if necessary&lt;br&gt;- Mobilize ambulance to scene, if required E.R.T. and specialized resources mobilization &amp; consultation&lt;br&gt;- Attend and coordinate response for all incidents involving “serious injury” and “serious accident”, as defined in Sec. 33, OHS Act&lt;br&gt;- Notify Area Supervisor, Health and Safety Manager&lt;br&gt;- Request additional external resources as necessary and provide history and assessment for medical evacuations</td>
</tr>
<tr>
<td>Mine Rescue Team</td>
<td>- Maintain team safety as priority&lt;br&gt;- Rescue and protect human life&lt;br&gt;- Protect and mitigate loss to mine property&lt;br&gt;- Assist with rehabilitation of mine property and equipment</td>
</tr>
<tr>
<td>Area Supervisor</td>
<td>- Coordinate evacuation of work area&lt;br&gt;- Account of workers under his/her responsibility&lt;br&gt;- Be available to Incident Command for information and assistance requests.&lt;br&gt;- Participate with Incident Investigation</td>
</tr>
<tr>
<td>Department Manager</td>
<td>- Respond to scene when summoned and provide Unified Command Support&lt;br&gt;- Attend at all incidents involving “serious injury” and “serious accident”, as defined in Sec. 33, OHS Act&lt;br&gt;- Coordinate and participate in incident investigation process&lt;br&gt;- Ensure follow up action is completed</td>
</tr>
<tr>
<td>Health &amp; Safety Manager</td>
<td>- Notify General Manager and Department Manager and provide follow up report of progress&lt;br&gt;- Assist with accountability&lt;br&gt;- Provide for unified incident command support&lt;br&gt;- Provide direction as required&lt;br&gt;- Provide 30 minute updates to control room</td>
</tr>
<tr>
<td>Role</td>
<td>Responsibilities</td>
</tr>
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<td>-------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
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| General Manager               | • Coordinate recovery and investigative activity  
|                               | • Ensure all government reporting has been completed  
|                               | • Provide follow up reports to regulatory bodies as required  
|                               | • Organize and conduct post-incident debriefings  
|                               | • Assist with Incident Investigation  
|                               | • Receive briefings on incident details  
|                               | • Provide for unified incident command support  
|                               | • Provide direction as required  
|                               | • Verify notification of regulatory agencies, government and Minto Explorations Ltd. corporate office as required  
|                               | • Verify scene remains secure until released by regulators (if applicable)  
|                               | • Verify compliance with standards and government regulatory requirements  
|                               | • Follow up communication to corporate and media  
|                               | • Responsible to authorize all off site communication  

Incident – Injury / Fire / Spill / Other

<table>
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<tr>
<th>Role</th>
<th>Responsibilities</th>
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</table>
| Health & Safety Manager       | • Maintain Scene Security at incident. Instruct ERT / Mine rescue of further requirements or stand down / all clear.  
|                               | • Notify Authorities.  
|                               | • Ensure legislative compliance.  
|                               | • Assist with site incident investigation and evidence gathering. Report progress to GM and  
|                               | • Department Manager.  
|                               | • Co-ordinate plan to get all rescue equipment back to a state of emergency preparedness.  
|                               | • Debrief rescue team.  
| Safety Co-ordinator / Medic    | • Roll out plan to ERT to get all rescue equipment back to a state of emergency preparedness.  
| Mine Rescue Team /            | • Support debrief of incident.  
|                               | • Ensure all rescue equipment is back to a state of emergency  

Follow up Responsibility Matrix
<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibilities</th>
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| ERT                      | • preparedness.  
|                          | • ERT complex clean up.  
|                          | • Captain to ensure that all team members are provided the time and assistance needed to recuperate from the response.  
|                          | • Captain to release the team upon completion.                                   |
| General Manager          | • Ensure necessary notifications are made to Capstone Mining Corporation / Yukon OH&S Mines Inspector / External Family / Media. |
| Department Manager       | • Organise and participate in the incident investigation and gathering of evidence. |
| Environmental Representative | • Ensure necessary notifications are made, if necessary, to Yukon Spill Response Line |
| Human Resources          | • Arrange for transportation and logistics of site personnel if required.         |

**UNDERGROUND EMERGENCIES**

- Underground Emergency – Other than Fire

Any person discovering an emergency shall:

1. Maintain his/her own safety as the first priority, by ensuring he/she is in, or moving towards, a safe location.
2. Using wifi radio, depress PTT button, wait for the beep, then announce: Code1-Code1-Code1
3. Using wifi radio, contact the Mill Control Room Operator on the Emergency Line by pressing the following sequence of buttons on the key pad. There are 2 options:
   a. 9-1-1- or
   b. 1 – hold down for 3 seconds
4. If safe to do so, try to rectify the situation with the tools you have at the scene.
5. Perform first aid, if safe to do so.
6. Rope off or barricade the area if possible.
7. Escape to the nearest refuge station (following up cast ventilation is the preferable route dependent on location) or out of the mine and warn all others along the way.
8. Report the emergency by calling the appropriate numbers from the Emergency Contact Number sheet located in the refuge station.

When reporting the incident it is of extreme importance that you include the following information:

• Who is calling and who is involved?
• What happened and what have you done?
• When did this happen?
• Where are you and where is the emergency?
• Who and what do you need for a response? First aid, rescue stench gas, other assistance?
• Stand by the phone and wait for further instructions.

o Underground Emergency - Fire:

Where a fire exists that may affect other personnel working in the area, evacuation procedures must be initiated:

Anyone discovering a fire shall:

1. Maintain his/her own safety as the first priority, by ensuring he/she is in, or moving towards, a safe location.
2. If safe to do so, activate fire suppression system, if fire is on equipment.
3. Using wifi radio, depress PTT button, wait for the beep, then announce: “Code 1-Code1-Code 1”
4. Using wifi radio, contact the Mill Control Room Operator on the Emergency Line by pressing the following sequence of buttons on the key pad. There are 2 options: 9-1-1- or 1 – hold down for 3 seconds
5. If safe to do so, use nearby fire extinguishers to extinguish the fire.
6. Warn all personnel in the immediate area (voice, radio, and phone) to evacuate to a safe location.
7. Initiate the Stench Warning System.
8. Do not expose yourself to unnecessary risk and keep a clear area of retreat behind you.
9. If the fire is too large to safely extinguish, do not hesitate, leave the area immediately and evacuate.
10. Proceed in up cast direction (preferable route dependent on location) to nearest refuge station, fresh air base or out of the mine, if safe to do so.
11. Utilize self-rescue device to protect from smoke exposure.
12. If unable to travel safely to refuge station, take refuge in heading and utilize any available material – vent tubing, clothing, etc. to construct a shield around yourself. Remain in the location until the mine rescue team arrives.
13. Once you have reached the refuge station or fresh air base follow refuge station protocols and provide for accountability.

1. Stop work immediately.
2. Note the time you received the warning.
3. Calmly proceed in an up cast direction (preferable route dependent on location) to the nearest refuge station or out of the mine.
4. Utilize self-rescue device at the first sign of smoke or fire.
5. Once safely at the refuge station or central muster location, follow the refuge station protocol and provide for accountability.
6. Review the refuge station emergency procedures posted inside the refuge chamber.
7. Check the mine phone for operation and call outside the mine. Report the following information:
   • Your name and name of others in refuge.
   • Refuge Chamber location.
   • Outside conditions.
   • That you are safe in refuge.
8. Remain in the refuge station, even if communication is cut off.
9. Stay calm, conserve energy and cap lamps, sit down on benches.
10. Have one person walk around room periodically to stir up the air.
11. Do not be tempted to wander about the mine seeking safe passage out.
12. Remain in the refuge until you are rescued by mine rescue personnel or contact is made declaring it safe to leave the refuge station by the mine official in charge of the emergency.
13. UG Mine Rescue will be activated by the Code 1 Procedure for Mill Control Room Operator (See section 4.1.3.)
14. All situations requiring the release of stench gas requires activation of Code 1 protocol.

o Underground Emergency Evacuation

Upon being notified of a mine emergency evacuation either by radio, phone or stench warning system:

o Refuge Stations
Portable refuge stations are maintained in locations of mine development to include refuge < 15 minute travel time by foot. All underground personnel will follow fresh air and escape to surface or take refuge in a refuge station during all emergencies that affect the underground. Refuge station posted “code of conduct” must be followed by everyone in the refuge station.

- **Main Ventilation Control in Event of a Fire**

In the event of an underground fire, efforts will be undertaken to ensure ventilation to the mine is maintained.

Operation of the main ventilation fans in will be guarded and monitored to ensure continuous operation of the fans at all times.

The effects of the alteration to the main ventilation fans shall be clearly understood before any changes are made.

During a mine fire:

There will be no alteration to the operation of the main fans without the authorization of the Mine Manager or Designate and Notification to the YWCHSB Safety Officer as defined under the regulations.

- **Underground Emergency Response**

  - **Underground Emergency – System of response**

  1. Initiate mine rescue/emergency response notification procedures as directed by UG Shift boss or designate.
  2. Upon completion of the emergency response notification procedure:
     a) Assign designate to initiate and maintain a log of events.
     b) Establish the EMERGENCY COMMUNICATION CENTER (ECC).
     c) Advise YWCHSB of activation UG mine rescue response.
     d) Keep all Communication Equipment on Standby.
     e) Direct operations personnel to ECC.
     f) Confirm Incident Command (IC) has been initiated.
     g) Complete the EMERGENCY DATA SHEET by obtaining the following information:
• Name of person reporting the emergency
• Nature and severity of injuries and/or incident
• Assistance required
• Location of emergency
• Number of people involved

3. Operations personnel will delegate a mine official in charge of the rescue operation and develop a preliminary plan.
4. Mine rescue team will respond to the mine rescue room
5. Mine rescue team captain will assume command of the team
6. Team will don all protective gear and bench test SCBA
7. Team will prepare all equipment needed to respond UG
8. Team will await instructions by Mine Rescue Coordinator (Safety Coordinator/Medic/Health and Safety Superintendent)
9. Team will be advised of plan
10. Back up Mine Rescue team respond to mine rescue room for briefing and preparation for back up assistance.
11. Tertiary back up mine rescue team(s) must be considered and depending on the initial assessment of situation contact needs to be made for mutual aid as soon as reasonably possible.

• EVACUATIONS
  o Medical Emergency Evacuations

Yukon Emergency Medical Services dispatch is a critical resource in the event of a medical evacuation. The Safety Coordinator/Medic will inform Yukon EMS dispatch every instance that there is a change to the site access such as barge removal, ice bridge closure, or the initiation of Ice Bridge or barge operation.

1. The Minto Mine Medic will control all medical / trauma emergencies.
2. Upon patient assessment, Medic will determine course of action, including return to work or further medical assessment and evacuation.
3. If medical evacuation is deemed necessary, the Medic will contact Yukon EMS Dispatch at 867-667-3333 and provide history and assessment findings. The EMS dispatch call is a two element call and the Medic will need to provide history and assessment twice. The first element dictates the triage of
the transfer and the second element is directly to a medical professional responsible for the transfer. These two elements should be available back to back. Yukon EMS Dispatch is responsible for transfer method decision.

<table>
<thead>
<tr>
<th></th>
<th>Phone Number</th>
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<tbody>
<tr>
<td>Yukon EMS Dispatch</td>
<td>(867) 667-3333</td>
</tr>
<tr>
<td>Pelly Crossing Nursing Station</td>
<td>(867) 537-4444</td>
</tr>
<tr>
<td>Carmacks Nursing Station</td>
<td>(867) 863-4444</td>
</tr>
<tr>
<td>Whitehorse General Hospital</td>
<td>(867) 393-8700</td>
</tr>
</tbody>
</table>

4. All Yukon EMS transfer by road, air or combination is provided with nursing and paramedic personnel. Air transport is provided with a flight nurse and a flight paramedic. Triage decisions will be made based on patient condition and other emergencies taking place in the area. Minto Mine is a high priority community, as deemed by Yukon EMS, and all efforts to supply our needs will be made. One hour plus flight time is the mandate for response by EMS, so the medic needs to consider that as part of the patient treatment and care. EMS dispatch provides all patch call information to receiving facilities if they are involved in the transfer in any way.

5. In the event that a transport decision is made without or outside of consultation with Yukon EMS Dispatch, they need to be notified as soon as reasonably possible to provide for additional transport from destination and/or to document transfer decisions made.

Other emergency contact numbers can be found in Appendix A.

- Non-Emergency Medical Transfers
  1. Non-Emergency Transfers when Ice Bridge or Minto Barge available
     1. Non-critical, stable patients that require further medical assessment and do not require medical attention during transfer will be taken off site by a designated driver at the first reasonably appropriate time.
     2. Non-critical, stable patients that require further assessment and medical attention during transfer must be taken off site via Ambulance. EMS dispatch must be contacted prior to departure to coordinate; the transfer, the receiving facility and the possibility of further transfer requirements. If EMS dispatch will not be involved in the actual transfer operation, a call to the receiving facility by the Minto Medic is required (patch). If EMS dispatch is involved in any way with the actual transfer, they will make the patch calls.
3. Emergency, unstable patients will be evacuated off site through coordination between the Minto Medic and Yukon EMS Dispatch. In cases of extreme weather that prevent aircraft landing at the Minto Mine Airstrip, the government airstrip may be utilized on the east side of the Yukon River.

Helicopter services may be utilized only after exhausting options through Yukon EMS dispatch.

- HeliDynamics: 867-668-3536
- TransNorth Helicopters: 867-668-2177 (Whitehorse) 867-863-5551 (Carmacks)
  o Site Evacuation
  o Camp Evacuation

In an event requiring partial or total evacuation of the mine site, several options are available and must be considered depending on the time of year and the availability of transportation.

With the exception of medical aid incidents, site evacuations (including evacuation arrangements and external resources) will be authorized by the General Manager or his designate. Travel arrangements should be coordinated through the travel department or HR and Purchasing department should be involved in all decisions that will result in costs being associated. The designated travel coordinator needs to begin arranging connecting flights or hotel accommodations as soon as an evacuation is suspected to be necessary.

Options for evacuation include road or air transportation, depending on the time of year and the availability of the barge or Ice Bridge. Air transportation is dependent on weather and availability of aircraft. Early communication with airlines is critical for the preparation of staff and aircraft.

Accurate weather assessment from site is critical to incoming aircraft; a designated person to provide this information must be arranged.

If road access available:

- Transportation by Coach (47 passengers/bus) – Whitehorse (Yukon Alaska Charters)

Yukon Tourist Tours - morris@yukonalaskatouristtours.com – 867 668 5944

or Takhini Transport takhini2001@northwestel.net 867 456 2745

- Transportation by onsite Van – Pelly Crossing
- Transportation by onsite bus – Carmacks (on site)

In the event hotel rooms are not available, staging of people will be arranged at Vanier Catholic Secondary School in their gymnasium until such time as staff can be put on flights out of Whitehorse.

Vanier Catholic Secondary School - 16 Duke Road – Whitehorse

Contact:
Minto will also have access to the School Kitchen to prepare food for evacuees.

- Transportation by air – Pelly Crossing/Carmacks/Whitehorse (Alkan Air, Air North, Combination)

  Air North – checkin@flyairnorth.com – Joe Muff – 867 668 2228 alt. 800 661 0407

  Alkan Air – alkandispatch@gmail.com – 867 668 2107 alt. 867 667 6117

- Transportation by air/road combination – Air to Carmacks and Air/Coach to Whitehorse. Fuel delivery to Carmacks may need to be arranged to refuel planes for multiple flights. The designated air agency will arrange for fuel transfer. Mackenzie Petroleum -867-668-4441 or 867-332-3755 cell, Pace Setter – 867-633-5908, North of 60 – 867-633-8820.

- Bus to river crossing and helicopter (Trans North Helicopters 867 668 2177) transfer across river to Coach (Yukon Alaska Charters or Takhini Transport).

In the event that Minto camp needs to be evacuated but the opportunity to keep our mill running exists, Minto has a solution to provide temporary housing for the personnel required to fulfill our production needs. Alaska Structures can be contacted to implement the rapid deployment of housing for between 40-160 employees. This would be set up at either our Minto airstrip or the government airstrip by the Yukon River.

Alaska Structures Contact: Dennis Taylor - 1.425.889.1205 – Office 1.425.802.4368 – Mobile dtaylor@aks.com
website: www.alaskastructures.com

The main point of contact in the event of an emergency relating to camp is T.J. Silliker(HR Manager) 403-836-6653- cell, 604-759-4648, email. TJS@mintomine.com

- MINE RESCUE
  - Onsite Mine Rescue

1. MINE RESCUE

Minto Mine will retain a compliment of trained surface and underground mine rescue personnel on site at all times. While area 118 is under care and maintenance and before M-Zone reaches two development crews, this will include one full UG teams and one Surface backup team as a minimum. A required second UG team would consist of a mutual aid response from YWCHSB and neighboring mines with a mutual aid agreement in place.
Once M-Zone reaches full production, Minto Mine will retain a full complement of trained surface and underground mine rescue personnel on site at all times. This will include two full UG teams as a minimum. A required third UG team would consist of a mutual aid response from YWCHSB and neighboring mines with a mutual aid agreement in place.

The UG mine rescue unit consists of a minimum of three UG mine rescue teams summoned to a mine disaster; if the operation extends beyond 6 to 8 hours, the additional third team must be called in. In order to reduce fatigue, the teams are rotated to allow one team at work, one team on hand as backup and the third team at rest.

A typical rotation for a three team unit is as follows:

Team Working/Backup Team/ Team at Rest (2 hour maximums)

A team/ B team/ C team

B team/C team/ A team

C team/A team/ B team

Teams have approximately 4 hours rest prior to working for 2 hours.

- BACK UP MINE RESCUE

If the operation extends beyond 6 to 8 hours, additional mine rescue teams must be called in. Mutual agreements are in place so that if more than 2 teams are required, additional team(s) will be provided by one or more of our mutual aid partners. YWCHSB must be notified of any instance of mutual aid requests.

For more detail, the mutual aid agreements can be found in Appendix D.

Mine Rescue Resource Contacts:

<table>
<thead>
<tr>
<th>Agency</th>
<th>Contact Personnel</th>
<th>Office Number</th>
<th>Contact</th>
<th>Home Contact Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>YWCHSB</td>
<td>Bruce Milligan</td>
<td>867-667-8739</td>
<td></td>
<td>1-800-661-0443 (toll free)</td>
</tr>
</tbody>
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Minto Explorations Ltd.
Minto Mine                2014 Emergency Response Plan

<table>
<thead>
<tr>
<th>Company</th>
<th>Status</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexco Resource Corp</td>
<td>formal plan in place</td>
<td>867-996-2330</td>
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<tr>
<td>Procon Mining</td>
<td>formal plan in place</td>
<td>604-291-8292</td>
</tr>
<tr>
<td>North American Tungsten</td>
<td>Draft awaiting</td>
<td>Jason Mackenzie</td>
</tr>
</tbody>
</table>

- **Underground Mine Safety Planning**
  - **Mine Safety Plan for 118 Zone**

The Minto Mine Underground 118 Zone consist of a 15% decline that goes from surface to 5700 elevation, Man way 5760 elevation to surface, 5740 and 5710 levels and 5720 Copper Keel advancement. The details are described in our Quartz Mining License QML-0001 Schedule C Plans and authorized Activities under section 14 Phase IV Mining Plan Item 6. See figure XXXXX The 118 Zone is currently under care and maintenance no mining / production activity are taking place in the Zone

- **Mine Safety Plan for M-Zone**

The M-Zone is a high grade lens accessible from a designed portal collared from the bottom of Area 2 Stage 2 pit. The ore lens will be mined by first establishing a decline from the bottom of the pit, then driving a series of crosscuts along the footwall of the ore zone at 15.0m spacing. The crosscuts are 6.0m wide. Starting ore extraction at the ends of these footwall crosscuts and progressing by retreat mining back along each stope undercut. Rings of up-holes will be drilled to the hanging wall contact using an ITH rig. These will be loaded with emulsion and blasted. The ore will be mucked via remotely operated LHD, thus eliminating any exposure of personnel to the open void left by the mining process. Details are described in our Quartz Mining License QML-0001 Schedule C Plans and authorized Activities under section 14 Phase IV Mining Plan Item 7 and 8. See figure below.
A safety bay in close proximity to the working face will be equipped with an industrial sized metal “Job Box “with emergency equipment inside. Basic contents;

- Six Ocenco EBA 6.5 Escape breathing apparatuses good for 1 hour each.
- Six spare Self Rescuers
- One level 3 first aid kit
- One oxygen therapy unit
- Splints, c-collar, six spare emergency blankets
- Five gallon jug of fresh water
- Mainstay Freeze dried dehydrated food bars (good for 5 years)
- Back up emergency lighting
- Toiletries as required.

A fully prepared and stocked basket stretcher with all required equipment to package a patient with spinal considerations and treat for shock will be located near the M Zone portal entrance at all times.

- Other Potential Emergencies Requiring Planned Response
  - Major Power Failure

1. In the event of a major power failure affecting any portion of the operating facilities at the mine, the employees within the working areas need to be aware of the hazards of unexpected loss of power and safely retreat to the nearest control room, lunch room or office to be accounted for by their supervisor.

2. Electrical supervisor needs to be contacted as soon as reasonably possible to assess the reason for the outage, provide alternate power if able and to contact YEC to report outage, if applicable. The mill control room has a satellite phone available for this reason.

3. Minimizing radio traffic is essential during a Power failure so the bulk of communication related to accountability should be done face to face.

4. Supervisors will attempt to locate and account for all workers under their control and be available to report the accountability check to Site Safety when requested for it.

5. When weather permits, ambulance and fire engine bay doors shall be manually opened by Safety department personnel.

6. Safety Department Personnel will make contact with area supervisor to confirm accountability of the respective workers.
7. Any missing or identified as injured workers will require search and rescue efforts. This would require initiation of Code 1.

8. Once all personnel are accounted for and it has been confirmed that there is no risk to life by the power outage, operating supervisors will be advised and work can continue or reassigned depending on the job and the location of power failure.

9. Once the power has been restored safe start up procedures must be followed and all work must be directed by the supervisor in charge of the affected areas.

10. If a major power failure occurs underground, all work stops and workers will report to refuge station or surface and report to the shift boss for accountability purposes.

11. UG workers will remain in the safe refuge locations until instructed to proceed back to work by shift boss.

12. Any coordination of emergency information related to the power failure will be provided to the UG shift boss by the Safety Department.

---

**Underground Mine Ventilation Loss Action Plan**

In the event of fan failure due to a malfunction, accident, power failure, or other such unplanned or unscheduled event, this action plan applies to all underground employees and contractors whose work areas are affected by the temporary interruption of the operation of the main or auxiliary fans in the mine.

**Main Ventilation Interruption Procedure:** In the event of interruption of main ventilation system, all work underground will cease and employees will exit the mine until main ventilation is re-established.

**Auxiliary ventilation Interruption Procedure:** In the event of interruption of auxiliary ventilation, mobile equipment operation in the area affected will stop. Workers in the area will assess the reason for the interruption and confirm that main ventilation is operational. If unable to determine cause for auxiliary ventilation interruption and reestablishment within 15 minutes, shift boss must be contacted to coordinate repair and gas testing during and after outage.

---

**Missing Person Action Plan**

Potential exists where persons may become lost on or traveling to and from the property. Such incidents can occur under the following circumstance:

- Employee or Contractor personnel engaged in surface exploration, travel or any other activities are overdue and cannot be located or contacted.

Upon notification that personnel are unaccounted for on the property you should:

1. Immediately advise the Area Supervisor, Safety Department Personnel and Area Manager
• Designate a mine official in charge of the search and communications/planning.
• Assess and determine the level of response required.
• Gather all available information about the missing persons including last known location.
• Advise the RCMP of the circumstances and request further assistance
• Designate ERT/Mine Rescue to stand-by and assist the RCMP in search efforts as directed
• Any search activity needs to be coordinated through the mine official in charge of the search. Search by vehicle should be conducted with two people in each vehicle, in coordination with RCMP and have effective communication and plan in place prior to conducting search.
• Survival gear, rescue tools, tow straps, fuel, etc. should all be considered and taken along during search activities.

1. Stand-by to provide further information and assistance as required.
2. Once search is complete follow up notification to all involved must be conducted including RCMP.
3. Provide for follow up investigation to identify contributing factors and recommend future prevention actions.
   o Outbreak of Sickness or Gastroenteritis Action Plan

Due to the remoteness and group living situation at the Mine Site, it is important to have a plan in place that outlines the appropriate actions to be taken in the event of an outbreak of sickness. This action plan has been developed using the *Yukon Center for Communicable Disease Guideline*.

- **Outbreak Identification and Definitions**

**Case Definition for Outbreak:**

- At least one of the following must be met: Two or more liquid or watery stools above what is normal for the person within a 24-hour period, OR
- Two or more episodes of vomiting in a 24-hour period, OR
- Both of the following: (a) lab confirmation of a known enteric pathogen and (b) At least one symptom compatible with gastrointestinal tract infection (i.e. nausea, vomiting, diarrhea, abdominal pain or tenderness)

**Outbreak definition:**

- Three or more cases of gastroenteritis infection (as defined above), potentially related, occurring within a four day period, within the facility.

**Case characteristics:**

- Abrupt onset of diarrhea and vomiting
Fatigue and occasional low-grade fever
Average duration 18-24 hours, rapid recovery

Suspected etiology:
Noro type virus. Confirmation by obtaining sample and sending in for analysis. Sample kit available in first aid and instructions are attached.

Response measures:

1. Sick bay and isolated washroom facilities needs to be provided. Minto Manor and Exterior Wash car need to be readied for service by Sodexo.
2. A second area made available for post-acute, recovering patients.
3. Communication to site informing of the situation and requesting people to report illness and use strict personal hygiene practices.
4. Cleaning of the quarantine areas undertaken by people informed of the risks and trained in the protection required. Food must be delivered, provisions for hydration need to be ensured. Electrolyte replacement fluids should be provided (“Squincher” is current warehouse stock.)
5. Cleaning of all other areas using Virox or bleach solution: 3 times per day bathrooms and corridors and common rooms.
6. Kitchen and dining areas are cleaned on a continual basis
7. Discontinue communal food dispensing (salads, etc.) All food portions individually wrapped.
8. Contact Yukon Communicable Disease Control to advise of outbreak.
9. Consider notification of offsite personnel that may be scheduled to come into camp during outbreak and decide on travel restrictions, interruptions during the period

- Recommendations for ongoing management of outbreak

If decline in case numbers to sporadic or nil:

- Laundering of all bedding: sheets, pillow cases, and quilts or blankets
- Laundering of all clothes used by or exposed to sick individuals.
- Cleaning of all surfaces with standard veridical disinfectants (bleach or Virox).
- Clothes that have been stored and unexposed to sick persons can be left in place
- Any drawers, shelves, etc. used by sick individuals should be cleaned.

If sporadic new cases (1 to 2 per day):

- Continue use of Sick Bay and isolation area
- Continue food preparation precautions
• Allow new staff in but with briefing on situation and need for vigilant personal hygiene

When no new cases reported for at least 48 hours:

• Terminal cleaning of isolation areas, cleaned as above with Virox or bleach solution. Designate and maintain a smaller isolation area for possible new cases over next 2 to 4 weeks
• Allow new staff to come in for normal tour of duty
• Return to normal food preparation

If continued high numbers (more than 3 new cases per day) or escalation of cases:

• Continue isolation/sick bay area with appropriate cleaning regimen
• Continue daily monitoring of new cases and their origin (bunk house)
• If more than one new case per bunk house, undertake intense cleaning of entire affected bunk.
• Close non-essential common areas
• Allow no in-rotation in of new personnel
• Consider camp closure according to demands on personnel

If continued high or increasing numbers despite measures in B. being followed:

• Close camp with clean out of entire camp: bunkhouses, food preparation and consumption areas, offices, common rooms and all non-industrial sites.
• Allow reopening of site following clean up.

If apparent cessation of outbreak followed by new cases after 48 hours or more:

• Follow recommendations as in B and C above.
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.

THE WORKERS COMPENSATION ACT AND THE OCCUPATIONAL HEALTH AND SAFETY ACT PROVIDE FOR APPEAL OF DECISIONS, ORDERS OR PENALTIES
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
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Introduction

This policy was developed in consultation with Minto Mine management, supervisors, workers and contractors. It is reflective of current research and knowledge of fatigue and safety management systems, with a focus on fatigue risk management. 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 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;
• establishing 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 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.

Minto Explorations Ltd. 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 incidents including reviewing fatigue factors, and developing effective and immediate preventative and remedial actions as needed.

______________________________
Sebastian Tolgyesi
Minto Mine Manager

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 on 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.


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.

The following standards and legislation were consulted in the preparation of this FRMP.
Minto Explorations Ltd.
Minto Mine                2014 Emergency Response Plan

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.

• Ensuring 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.

• Providing a proper sleep environment for workers when on duty at Minto Camp.

• 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.

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 both identify where fatigue is a hazard and to assess the level of risk that a given fatigue hazard represents.

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>
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<th>Capstone Risk Points</th>
<th>Total Factor Points</th>
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<td>Work Scheduling</td>
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</tr>
<tr>
<td>Totals and Average%</td>
<td>148</td>
<td>270</td>
<td>55%</td>
</tr>
</tbody>
</table>