

**EXPATRIATE RESOURCES LTD.**

**WOLVERINE ADVANCED EXPLORATION PROGRAM**

**ENVIRONMENTAL EFFECTS ASSESSMENT**

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# EXPATRIATE RESOURCES LTD. WOLVERINE ADVANCED EXPLORATION PROGRAM ENVIRONMENTAL EFFECTS ASSESSMENT

Expatriate Resources Ltd. is proposing, on behalf of the Yukon Silver-Zinc Project, an advanced exploration program for the Yukon Silver-Zinc Project property. This program includes underground development of the Wolverine deposit for the purposes of geotechnical assessment and collection of a bulk sample. This information is required to finalize mine and mill design for the final feasibility study and permitting submissions for developing the Wolverine deposit as an underground mine. The site is currently only accessible by air. The quantities and types of equipment needed for this program require that a temporary land access route be developed to the site.

The following is an environmental assessment of this proposed program, including all components. This assessment was carried out by first developing a matrix to identify project-environment interactions. A table was then developed to describe these potential interactions, propose possible mitigation measures and then describe residual environmental effects following implementation of mitigation and management plans.

## 1 Project Description

The proposed advanced exploration program is comprised of two principle components; the underground exploration development and a temporary winter access trail for mobilization of the 1000+ tonnes of equipment and materials required to carry out the program. The proposed access route (Figure 1a) will be a rehabilitation of approximately 34 km of trail used to access the Wolverine Property in 1995 and 1996. The program will utilize existing infrastructure (camp and roads) at the Wolverine Site to support the operations.

### 1.1 Project Location

The project is located on the watershed divide between Go Creek and Little Wolverine Creek (map sheet 105 G/8, -130.1 Lat, 61.4 Long.), approximately 20 km due west of the Robert Campbell Highway (200 km north of Watson Lake). Go Creek drains to Money Creek which flows to the Finlayson River (Liard Basin). Little Wolverine Creek flows to Wolverine Lake which drains also to the Finlayson River. The nearest community is Ross River, approximately 135 km north of the project area. The project location is shown on Figure 1a.

### 1.2 Underground Exploration

It is proposed that the underground access decline will be collared southeast of the deposit as shown on Figure 1. It will be driven approximately 665m at a -15% grade and will have dimensions of 4.5m wide by 5.0m high in cross section. From the Main Ramp, a 3.5m x 3.5m slope access decline will be driven approximately 235m to access

the 1225m elevation area in the upper portion of the Wolverine Zone (as shown on Figure 1). Development and ore quantities for the underground exploration phase are presented in Table 1, and are based on development estimates provided by Nilsson (November 2000). In total, approximately 78,000 tonnes (32,500 m<sup>3</sup>) of material will be brought to surface that includes approximately 56,000 tonnes of waste rock.

### **1.3 Waste Rock Storage**

Based on acid rock drainage (ARD) test work conducted at the Wolverine site, much of the development waste rock (excluding the ore) to be developed in the underground development does not have the potential to generate ARD and produce drainage with elevated metal levels. As a result, it will be necessary to temporarily manage the potentially acid generating materials in a manner that mitigates and minimizes production of ARD and limits the release of ARD from the site during the period of the underground development and up to the time of a “go/no go” decision to develop the mine.

The temporary containment facility will be constructed to store all of the material generated from the underground exploration as shown on Figure 2 and rendered in Photograph 1. The purpose of the facility will be to contain ARD in the short-term. Since the rock is proposed to be tested as it is placed in the facility it will be possible to separate the waste rock from the ore as shown in Figures 3 & 4. Further, it will be possible to locate specific volumes of potentially acid generating (PAG) waste rock within the structure and remove them at a later date if required. The facility is designed to drain to a seepage collection sump at its northwest corner. In the event that testing indicates poor water quality, the drainage will be treated to meet discharge standards.

### **1.4 Aggregate Borrow Area**

A mobile aggregate screening and wash plant will be used to process a small amount of local material for use as shotcrete aggregate that is required for development work. The operation will be located at the airstrip borrow/laydown area as shown on Figure 5. Based on the estimated aggregate quantity and useable size fraction of local materials, a borrow area of approximately 30m x 30m x 2m will be excavated (depending on actual site topography) and the excavated material will be stockpiled. Approximately two thirds of this volume will be placed back into the excavation after screening, and the area will be re-contoured on completion of the work.

Based on the particle size analysis, it is estimated that 5% (by weight) of the total borrow quantity will be washed from the screened product. The resulting 165 tonnes (estimated) of fines will be collected in a settling pond and fine solids allowed to settle prior to water being released from the pond. A basic settling pond 30mL x 5mW x 1mD (Figure 6) will provide 150m<sup>3</sup> of storage and could be established within the borrow excavation area itself and be reclaimed on closure.

### **1.5 Materials Storage**

The materials required to conduct the underground exploration program will be stored in two different laydown areas.

The airstrip laydown area will be located at the airstrip as shown on Figure 5 and will provide bulk storage for the required materials. It is anticipated that the size of this laydown area will be approximately 100m by 100m. Materials to be stored at the Wolverine airstrip laydown area include:

- Drilling supplies;
- Ground support materials; and
- Miscellaneous mining and development supplies.

It should be noted that the majority of the blasting supplies would also be stored at the airstrip. These materials will be stored in a separate area in an approved powder storage that will be kept locked at all times. The storage will be located at an acceptable distance from the airstrip itself. Borrow materials will also be screened and stockpiled at the airport site.

A second laydown area will be constructed adjacent to the portal area (as shown in Figure 2). The purpose of the second laydown will be to provide a staging area for the day-to-day mine development operations. It is anticipated that the size of this laydown area will also be approximately 60m by 100m. Materials to be stored in Laydown Area 2 include:

- A week of drilling supplies;
- A week of ground support materials;
- A week of miscellaneous mining and development supplies;
- All fuel and lubricants required for the underground exploration program (to be contained in approved storage and within spill containment structures or double walled 'enviro-tanks');
- Project management trailer;
- Underground mining equipment; and
- Spare parts and supplies for the mining equipment.

A small amount of blasting supplies, approximately a one-week supply, will also be stored in the vicinity of the portal area. These materials will also be stored in an approved powder magazine that will be kept locked at all times.

## **1.6 Access Route**

The proposed winter access trail connects the existing Wolverine Camp to the Robert Campbell Highway (Figure 3a) that will only be active during the winter months. This ice road will be used to haul equipment and supplies to the site and decommissioned after mobilization is completed. During the summer months, large aircraft will be used and land on the existing airstrip. The ice road/barge crossing will access the exploration road that currently exists on the east shore of the lake.

The temporary winter trail access would be developed to a similar standard as outlined in the permit from Highways and Public Works. The winter trail would be a single lane with turn-outs at appropriate locations. The maximum design parameters considered are:

- Design speed <20 km/h
- Design Vehicles: 5t trucks+20t sleighs and Bulldozer/Nodwells

- Lane Width existing width up to 5-6 m

The temporary winter trail access will be developed to the extent necessary to carry out the exploration program. Minimum development and disturbance techniques will be utilized to meet the specific requirements of hauling the equipment and materials to the Wolverine site. The Company will utilize winter trail access to the extent possible in carrying out the program.

## **1.7 Project Logistics**

### **1.7.1 Personnel Requirements**

Rehabilitation of the existing temporary winter trail access is expected to require a crew of less than ten persons and should be completed within two to three weeks of start-up in early January 2005.

Table 2 presents a list of the Expatriate technical staff, support staff, and contractor personnel required for the underground exploration program. The program will require a staff of 24 for the underground operations. Additional staff will be present during the underground development to support various mineral exploration and environmental programs; meaning up to 40 could be present on site for underground operations.

### **1.7.2 Equipment Requirements**

The types and numbers of equipment that would be anticipated to be used in the rehabilitation of the existing temporary winter trail access are:

- Bulldozers Caterpillars + sleighs
- Nodwells (with snow plow) + sleighs
- Tundra Buggy
- Water Truck
- Skidoos

Based on the proposed underground exploration program, major equipment that will need to be mobilized to site is summarized in Table 3. It is assumed this equipment is mobilized by road to the site. In total a minimum of 327 tonnes of equipment will need to be mobilized to the site over the proposed temporary access road.

### **1.7.3 Materials and Supplies**

The calculation of the materials and supplies required are estimates based on similar projects and on assumed productivity of equipment and excavation methods used. The estimates include no contingency or surplus and were calculated to assess the requirement for transport and storage of materials in advance of the start of development work.

The estimated materials and supplies required to carry out the underground exploration program are summarized in Table 4. Approximately 627 tonnes of materials will need to be mobilized to the site. In addition to these imported materials, the underground

exploration program will require approximately 863 tonnes of aggregate that will be produced on site.

#### **1.7.4 Schedule**

Existing winter trail access rehabilitation should be completed within two to three weeks of start-up. These activities will be timed around the needs of the underground development program

A schedule for the underground exploration program is provided in Table 5. The entire program is expected to take about 6 months to complete with additional time for follow-up and monitoring activities.

The schedule assumes typical advance rates for the decline mining and portal development. It also assumes that all equipment and materials are mobilized to site. A road will be constructed for the project prior to mobilizing the mining contractor to site. A four-week dewatering phase is included in the schedule and this may vary depending on the observed hydrogeologic conditions and the results of an underground water flow monitoring program after completing the decline to the ore zone.

Delays resulting from unexpected ground conditions, weather delays and availability of consumables may affect the schedule.

## **2 Closure and Reclamation**

Closure and reclamation of facilities and structures associated with the advanced exploration program may be necessary if:

- 1) there is a decision by the Company (Senior Management and Board of Directors) not to continue exploration or development in the area;
- 2) components of the exploration program are not advanced or used in further development plans (ability to raise funds, concentrate contracts, metal prices, permits).

Any future assessment or development plans will consider the use of existing facilities in order to mitigate cumulative environmental effects. From time to time however, certain components or facilities may outlive their usefulness and will need to be closed and reclaimed.

The following is a conceptual closure plan with possible closure techniques for the various facilities and structures associated with the advanced exploration proposal. This plan is subject to further refinement prior to its implementation. Site-specific experience will play an important role in the formulation of the final reclamation plan.

Following a decision to develop the Yukon Zinc Project, closure and reclamation plans for the Wolverine area will be re-examined. These closure plans will be included in the reapplication for a Type A Water Licence Applications for the Yukon Zinc Project which is planned to be submitted in early November 2004.

## **2.1 Access Route**

The principle objectives of temporary winter access trail closure and reclamation are to limit access and to facilitate the return of a natural appearance to the area.

The temporary winter access trail used for this program will be closed according to accepted operating practice. Surfaces will be scarified and temporary crossings removed and/or allowed to melt naturally. Stockpiled materials, including brush and trees, will be placed on the scarified surface in a random manner to create an uneven surface. Large boulders will be moved onto the road bed if they are available. These techniques will make passage on foot or with motorized vehicle difficult and limit access to the area. This technique also provides habitat for small mammals and a natural source of nutrients as the materials decompose over time.

Stream crossing areas will be contoured only if necessary and seeded to minimize streambank erosion and potential sedimentation of streams. If necessary, stream banks will be fortified with rip-rap or available boulder materials to ensure bank stability.

The scarified trail surface will only be seeded in the Spring (post-winter trail use) in those areas where ground stability or potential stream sedimentation is a concern. Most portions of the trail will be allowed to naturally revegetate. The close proximity to natural seed sources (trailside vegetation) will allow for relatively rapid replacement of vegetation and will result in a more natural appearance of the reclaimed area.

## **2.2 Underground Workings**

### **2.2.1 Care and Maintenance**

Following completion of underground exploration, there will be a period of assessment and planning that will be followed by a development decision. During this period, the underground workings will be allowed to flood to their natural levels. Management of flooded workings will depend on a production decision and on the acid generating characteristics of the waste rock stored on surface. If a decision is made to go to production, the underground will be dewatered and the mine water treated (if necessary) and released. If a decision is made to permanently close the site, the underground workings may be used as a storage location for waste rock. Closure planning for this scenario is presented below.

### **2.2.2 Permanent Closure**

The underground workings will be used as the storage area for the potentially acid generating waste rock materials if permanent closure of the workings is required. In this case, waste rock material with acid generating potential will be moved back underground. The mine will be dewatered to the extent that potentially acid generating material can be moved to an area of the mine that will be permanently flooded under natural conditions. Potentially acid-generating materials will be moved back underground and the mine workings allowed to flood back to their natural levels. This approach will ensure a permanent water cover for potentially acid generating waste rock.

## **2.3 Temporary Waste Rock Storage Facility**

### **2.3.1 Care and Maintenance**

During the post-exploration phase, the waste rock will be capped with a till cover to minimize infiltration and the cap seeded to promote stability and reduce the potential for erosion. The drainage system installed during construction will terminate in a settling sump at the end of the facility. Any water draining to this sump will be sampled *in-situ* and a treatment decision made based on the results of analysis.

This care and maintenance plan will continue until a decision is made regarding the development of a producing mine.

### **2.3.2 Permanent Closure**

Under the permanent closure plan, potentially acid-generating materials will be moved underground and permanently flooded. A certain amount of waste rock (approximately 40%) will have to remain on surface due to expansion of the excavated materials. The permanent closure of this remaining stockpile will depend on the acid generating characteristics of the waste rock. If the remaining material is considered acid generating, a permanent closure facility will be located and designed. This facility will include liners if necessary. If the remaining material is not acid generating, it will remain in the stockpile location. A till cover will be used to promote runoff and limit seepage to the stockpile. The stockpile will be revegetated.

## **2.4 Buildings and Support Facilities**

### **2.4.1 Care and Maintenance**

During the post-exploration phase, a watchman will be at the work site on an as needed basis during the year if there are no active exploration programs based out of the Wolverine Camp. The buildings and facilities at the site may continue to be used from time to time for regional exploration purposes. The watchman will have the responsibility of opening and closing the camp and facilities and maintaining it while it is in use. The camp and facilities will be winterized and shutdown during the winter months unless work activity is planned during this time.

### **2.4.2 Permanent Closure**

If the work area is permanently closed, all buildings and facilities will be removed. Disturbed areas will be contoured and reseeded as appropriate.

## **3 Potential Environmental Effects and Proposed Mitigation**

The environmental data available for the project area is extensive and described in detail in other documents and locations (Expatriate Resources Ltd., Finlayson Project Description Report; Cominco Ltd., Kudz Ze Kayah IEE & Water Licence Application, YTG Renewable Resources, Finlayson Caribou Herd database). The following assessment is based on the information available from these sources. For a detailed description of baseline conditions in the project area, the reader is referred to the previously mentioned sources.

This assessment focuses on the potential effects of the project on the environment. The total project, including lead-in and follow-up activities, is expected to last less than a year. The potential for events such as earthquakes, severe storms, wildfires, and flooding to occur during the project is very low given the short duration and small geographic extent of the project. These potential effects of the environment on the project are not considered further in this assessment.

The assessment focuses on those issues and environmental concerns that have been raised in past consultation activities; either through the Kudz Ze Kayah review process or during Expatriate's stakeholder consultation regarding the advanced exploration program. The following areas were identified as potential concerns:

- Changes to the landscape
- Water quantity
- Water quality
- Fisheries and aquatic resources
- Wildlife
- Heritage resources including archaeological sites and traditional use areas

### **3.1 Environmental Effects Assessment**

#### **3.1.1 Project – Environment Interactions**

A matrix has been developed to identify potential interactions between project components and environmental attributes (Table 6).

The possible environmental effects of the identified interactions are then described and mitigation circumstances and measures selected to minimize the potential effects.

| Interaction                       | Potential Environmental Effect  | Mitigation Measures or Circumstances   | Residual Environmental Effect   |
|-----------------------------------|---|--|---|
| Landscape + Aggregate Borrow Area | The borrow area will require a moderate change to the landscape appearance. An area of 900 m <sup>2</sup> will be cleared of vegetation and organic material and excavated to a moderate depth (2 m). | Approximately 2/3 of borrow volume will be returned to the excavation for closure of the facility. Recontouring and revegetation at closure and natural revegetation of the area.  | Noticeable landscape feature for a period of years during activity and following reclamation. No permanent effect to the appearance of the landscape. |
| Landscape + Waste Rock Stockpile  | Slight change to landscape appearance with addition of stockpile. The stockpile will cover an area of 7500 m <sup>2</sup> and be 3 m in height.   | Stockpile has been designed as a low profile structure (3 m in height) on an existing ridge. Till cover and revegetation at closure will make it largely indistinguishable from the surrounding terrain.   | Noticeable landscape feature for a period of years during activity and following reclamation. Slight effect to the appearance of the landscape.       |
| Landscape + Laydown Areas         | Slight change to landscape appearance from clearing and levelling of work areas. Total clearing is approximately 2200 m <sup>2</sup> , including staging areas for barge operations.                  | Recontouring and revegetation at closure. Areas will be reclaimed as per standard operating procedures (rough microtopography, replacement of available organic material including brush and trees). Revegetation with appropriate vegetation species.   | Noticeable landscape feature for a period of years during operation and following reclamation. No permanent effect to landscape appearance.           |
| Landscape + Access Trail          | Access trail will appear as linear feature on landscape. The open terrain will make it a visible feature from a distance.   | The replacement of available organic materials and scarification of the trail surface at closure will make it less distinguishable as a landscape feature. Placement of natural materials (deadfall, cleared brush, boulders) on the trail surface will further camouflage its appearance. Over time, natural revegetation of the trailway will make it difficult to distinguish as a landscape feature. | Noticeable landscape feature for a period of years during activity and following reclamation. No permanent effect to the appearance of the landscape. |

| <b>Interaction</b>                            | <b>Potential Environmental Effect</b>  | <b>Mitigation Measures or Circumstances</b>  | <b>Residual Environmental Effect</b>   |
|---|--|--|--|
| Hydrogeology + Underground Development        | Decline in the groundwater levels in the vicinity of the underground development as workings are dewatered for safety and logistical reasons. Possible Change in ground water movement in the vicinity of the underground workings (workings will act as a conduit or sink for surrounding groundwater). | No active mitigation measures. Allow the natural replenishment of aquifer and return to natural groundwater conditions.  | Some effects to groundwater movement are likely to occur as a result of the underground workings that will be an area of high hydraulic conductivity in the surrounding aquifer. These effects are unlikely to have an influence on environmental conditions on the surface. No measurable changes in surface flow conditions are expected as a result of these effects. |
| Groundwater Quality + Underground Development | Changes to groundwater quality may result from acid generation and metals leaching from mine walls.  | Waste characterization studies of hanging wall rocks indicate acid generating potential with a slow reaction time. Humidity cells remained neutral after 26 weeks. Shotcrete application to mine walls throughout the development of the underground will minimize exposure time for mineralized surfaces and limit acid generation. Shotcrete will provide some neutralizing capacity for generated acid. | Possibility of slight effects to groundwater quality. Higher metals concentrations in Little Wolverine Creek indicate natural groundwater contamination. This influence does not appear to negatively effect the surface environment and stream biota are naturally adapted to metal concentrations.   |

| Interaction                                 | Potential Environmental Effect   | Mitigation Measures or Circumstances  | Residual Environmental Effect  |
|---|--|---|--|
| Groundwater Quality + Waste Rock Stockpiles | Acid generation and seepage in the waste rock stockpile could move to groundwater and affect groundwater quality under the stockpile | <p>Waste characterization during the development will identify potentially acid generating materials within the stockpile. These materials will be placed in permanent storage, either in the subaqueous environment of the Wolverine underground tailings facility or in a permanent design facility including liners if necessary.</p> <p>The stockpile is located on a well-drained ridge top, minimizing the potential for groundwater infiltration to the stockpile and interception of surface runoff. Infiltration of direct precipitation will be limited by a sloped till cover. The base of the stockpile will be designed to direct any seepage towards a collection sump where it can be tested and treated if necessary.</p> | The waste rock stockpile is not expected to have any short-term or long-term effects on groundwater. |
| Surface Hydrology + Underground Development | Potential increases in local stream flows from addition of groundwater during dewatering activity.                                   | No active mitigation. Dewatering is necessary to carry out the underground exploration activity.  | Increases in stream flows are expected to be very small (see Appendix A for models and predictions)  |
| Surface Hydrology + Aggregate Borrow Area   | Water use from local streams for washing of aggregate may reduce surface flows.  | The aggregate wash is expected to use about 34 m <sup>3</sup> /day or 0.4 L/s. Monthly average low flows in Go Creek (February) are about 26 L/s, therefore water withdrawals will not noticeably affect surface flows. The aggregate wash settling pond will be set up as a recycling facility, reducing the requirement for freshwater withdrawals from Go Creek  | No noticeable effects to surface flows should occur from this activity.                              |

| <b>Interaction</b>                              | <b>Potential Environmental Effect</b>   | <b>Mitigation Measures or Circumstances</b>  | <b>Residual Environmental Effect</b>  |
|---|---|--|---|
| Surface Water Quality + Underground Development | Dewatering of groundwater may result in elevated suspended solids and metals concentrations in the receiving environment. | Groundwater discharged during underground exploration program is expected to be within accepted discharge guidelines for metals and blasting residue. Groundwater will be discharged to natural channel with no measurable surface flow and the occasional runoff pool and wet, swampy area. It is expected that the conditions in this channel will serve to physically and chemically attenuate groundwater discharge before it enters Go Creek. Discharge and receiving environment will be monitored throughout the operation and dewatering will be controlled to protect water quality in the receiving environment. | Water quality in the receiving environment is expected to remain within CCME water quality guidelines for the protection of aquatic life. |

| Interaction                                     | Potential Environmental Effect   | Mitigation Measures or Circumstances  | Residual Environmental Effect  |
|---|--|---|--|
| Surface Water Quality + Underground Development | Long term drainage from the adit may contribute poor quality water to downstream receiving waters. | <p>All development in the ore zone will take place about 125 m below the elevation of the portal. The stratigraphy of the host rock dips away from the mine entrance, reducing the potential for artesian flow at the portal. Since the area around the mine will be dewatered during the underground operation, any passive drainage that did occur would be limited to the recharge rates of the affected aquifer. Given the low precipitation values in the region, this is likely to be a relatively slow process. Water quality of this drainage should be similar to water quality encountered during the dewatering exercise, although it may be influenced by the combination of wall rock geochemistry and the alkaline properties of the shotcrete on the mine walls. Humidity cell testing of composite hanging wall material indicated slow reaction time and average quality within MMLER guidelines.</p> <p>Should passive drainage occur following the underground exploration program, it would be allowed to flow naturally into the wetland area at the base of the hill. This area feeds Little Wolverine Creek, a stream with naturally elevated levels of cadmium, selenium, and zinc and no fish. The wetland area would provide attenuation capacity for metals in the drainage. Any metals in the drainage that pass the wetland filter are unlikely to influence the biota of the stream since they are naturally adapted to high metals concentrations.</p> | <p>The potential for long term, passive drainage from the underground workings is unlikely to be an environmental concern. Long term seepage volumes are expected to be low, based on mine plan configuration (portal approximately 125 m above ore zone workings), perceived aquifer recharge rates, and local stratigraphy trends.</p> <p>Seepage quality is expected to be acceptable for release. Water quality data from local streams during winter low flows (predominately groundwater) indicates acceptable water quality in local aquifers. Waste characterization test results were within MMLER limits.</p> <p>Based on these conditions and conditions of the receiving environment, adverse environmental effects are considered unlikely.</p> |

| <b>Interaction</b>  | <b>Potential Environmental Effect</b>  | <b>Mitigation Measures or Circumstances</b>  | <b>Residual Environmental Effect</b>  |
|---|--|--|---|
| Surface Water Quality + Aggregate Borrow Area                     | Runoff and wash water from the aggregate facility could contribute sediment to the receiving environment.            | The aggregate wash settling pond will be developed with sufficient capacity to settle solids to acceptable levels before discharge. Water will be recycled to minimize potential discharge volumes from this facility.   | Increases in suspended sediments in the receiving environment are expected to be small and within acceptable limits.                              |
| Surface Water Quality + Waste Rock Stockpile                      | Seepage from the waste rock stockpile could contribute metals and acid to the receiving environment.                 | Seepage will be treated (if necessary) to meet MMLER discharge criteria. Any seepage will pass through 500 m of channel/wetland area before entering Go Creek. Available dilution in Go Creek is estimated to be greater than 1500:1 for waste rock seepage.   | No impacts to surface water quality will occur as a result of waste rock seepage.   |
| Aquatic Resources + Underground Development, Waste Rock Stockpile | Acid mine drainage could lead to poor water quality in the receiving environment may affect local aquatic resources. | Streams potentially affected by water releases have low fish habitat capability. Biota in Little Wolverine Creek are naturally adapted to elevated metals concentrations. Seepage from the underground development or the waste rock stockpile will pass through natural wetland areas before entering a flowing stream. These wetlands will provide attenuation of metals in the potential seepage. | Receiving water quality is not expected to be adversely affected by water from the operations area. No effects to aquatic resources are expected. |
| Aquatic Resources + Access Trail                                  | Trail construction could result in destruction of fish habitat at stream crossings.                                  | The trails road alignment does not cross any large streams. The small drainages crossed by the road are not likely to host fish, but every care will be taken to mitigate any harmful effects to any watercourse through the application of all safety and health protocols in the Company's Spill Management Plan.  | No adverse effects to aquatic resources are expected as a result of the access trail.   |

| <b>Interaction</b>                     | <b>Potential Environmental Effect</b>  | <b>Mitigation Measures or Circumstances</b>   | <b>Residual Environmental Effect</b>  |
|--|--|---|---|
| Vegetation + Aggregate Borrow Area     | Vegetation in the borrow and settling pond area will be cleared. An area of 1050 m <sup>2</sup> (settling pond and borrow area) of shrub and grass type vegetation will be cleared.  | Reclamation at the end of operations will include revegetation as necessary.  | Temporary loss of 1050 m <sup>2</sup> of shrub and grass vegetation cover. No long term effects expected after reclamation.     |
| Vegetation + Waste Rock Stockpile      | Vegetation in the stockpile area will be cleared. Approximately 7500 m <sup>2</sup> will be cleared of low shrubs and grass.   | Reclamation of the area will include revegetation as necessary  | Loss of 7500 m <sup>2</sup> of shrub and grass vegetation cover is temporary.   |
| Vegetation + Laydown and Staging Areas | Vegetation in these areas will be cleared. Approximately 2200 m <sup>2</sup> of shrubs, grass, and scrub spruce will be cleared.   | Reclamation of the area will include revegetation as necessary.   | Loss of 2200 m <sup>2</sup> of shrub, grass and scrub spruce vegetation cover is temporary.                                     |
| Vegetation + Access Trail              | Vegetation in these areas will be cleared. Approximately 108000 m <sup>2</sup> of shrubs, grass, and scrub spruce will be cleared; noting this material is likely natural revegetation and regrowth since original use of winter trail in 1996 | Reclamation of the area will include revegetation as necessary.   | Loss of 108000 m <sup>2</sup> of shrub, grass and scrub spruce vegetation cover is temporary.                                   |
| Wildlife + Cumulative Project Activity | Advanced exploration work will result in direct and functional habitat loss for local wildlife populations   | An independent review of wildlife issues related to the advanced exploration program was conducted and is attached under separate cover (Appendix D). Mitigation and management measures are proposed | Some temporary direct and functional habitat loss can be expected. These effects are not likely to have population level effect |

|  |  |          |   |
|--|--|----------|---|
|  |  | therein. | on local wildlife. Higher levels of activity have occurred in the region (i.e. mid-90's staking rush) with no apparent long-term effects. |
|--|--|----------|---|

| Interaction   | Potential Environmental Effect   | Mitigation Measures or Circumstances   | Residual Environmental Effect                         |
|---|--|--|---|
| Heritage Resources + Aggregate Borrow Area, Waste Rock Stockpile, Laydown and Staging Areas, and Access Trail | Site clearing may affect archaeological sites or areas of traditional use. | The Company will conduct ground truthing investigations to identify archaeological and traditional use sites in proposed work areas. Clearing plans will be modified to avoid sites identified through these investigations. | No adverse effects to heritage resources are expected |

### **3.1.2 Residual Effects of the Advanced Exploration Project**

The advanced exploration program can be expected to result in the temporary loss of approximately 12.0 hectares of shrub and grass type vegetation cover. These losses will be spread out over approximately 35 km (linear direction) with the largest single clearing being less than 11.2 hectares. This will result from the temporary winter trail access that is approximately 32 km long and approximately 3.5m wide (up to 6m locally).

The vegetation clearing will result in landscape appearance changes for several years following completion of the program. Changes in landscape appearance may make the area less appealing for wilderness enthusiasts and hunters who occasionally visit the area.

Changes to groundwater will be limited to localized changes to groundwater movement in the vicinity of the underground development where the underground will act as an area of high hydraulic conductivity. Slight changes to groundwater quality in the areas “downstream” of the underground can be expected from groundwater passing through the workings to the surrounding aquifer. These changes are not expected to have a noticeable effect of surface water quality or surface flows in Go Creek or Little Wolverine Creek.

Changes to surface water flows will result in Go Creek near the Wolverine airstrip. In the first months of the program, aggregate development may require a maximum withdrawal of 0.4 L/s from Go Creek. This will amount to less than 1.5% decrease in surface flows under “worst case” conditions of minimum stream flow and maximum water requirement. It is expected that most of the water required for aggregate processing can be recycled from the settling pond and very little make-up water will be required for the aggregate wash. During underground dewatering slight increases in surface flow (up to 2%) in Go Creek can be expected. This will last for the duration of the dewatering program, approximately one month. These effects will most likely be unnoticeable in the receiving environment within meters from the point of withdrawal/discharge.

Changes to surface water quality could potentially occur in Go Creek near the Wolverine airstrip and in Little Wolverine Creek down hill from the portal. Go Creek may experience slight increases in dissolved solids during the underground development period (approximately six month duration) and slight increases in suspended solids during draining of the aggregate wash facility pond (approximately one day duration). Average water quality in Go Creek will likely remain within CCME guidelines for the protection of aquatic life. Effects to water quality in Go Creek will have a small geographic extent.

Little Wolverine Creek may experience slight increases in dissolved solids from possible portal drainage after completion of the exploration program. Any portal drainage that does occur will likely be on a seasonal basis over an extended period of time. Given the characteristics of the receiving environment and the anticipated quality and quantity of portal drainage, this is not expected to result in adverse effects to aquatic resources in downstream areas. Water quality effects will likely be unnoticeable in the lower reaches of Little Wolverine Creek.

A detailed assessment of potential effects to water quality and surface flows is presented in Appendix A.

Vegetation losses and human activity in the area will result in short-term habitat loss for local wildlife. Direct loss will result from clearing of work areas and functional habitat loss will occur for those species that avoid the work areas. The area of direct loss is equal to the total area of clearing (<12.0 hectares). This direct loss will extend for a period of several years following completion of the program as cleared areas are revegetated. The area of functional loss is variable depending on the species and larger than the area of direct habitat loss. Functional habitat loss will be short term, lasting the duration of the exploration program (approximately 1 year including, lead-in and follow-up activities). A detailed assessment of potential effects to wildlife is presented in Appendix D. Both functional and direct habitat losses are not expected to result in population level effects to regional wildlife. Higher levels of activity have occurred in the region in the past without noticeable effect (i.e. staking rush in the mid-90's).

Potential effects in the areas of fish habitat and heritage resources (including archaeological sites and traditional use areas) will be addressed through ground truthing studies that will be completed prior to access road construction. The Company intends to complete a heritage resources study of the potential route in cooperation with the Kaska Nation to identify areas of traditional importance. Fisheries habitat investigations will be completed for potential stream crossing locations along the proposed access road. The final location of work areas and the access road will take into account the findings of these studies to implement suitable mitigation and avoidance planning and to limit potential effects in these areas.

### **3.2 Cumulative Effects**

Cumulative effects of this program in combination with other regional activities were identified through comparison of the cumulative, residual effects of the proposed program (Section 3.1.2) and potential or known effects of present, past, and future activities in the region. The spatial scope of the assessment was limited by the Robert Campbell Highway to the north and the extent of regional mineral exploration to the south, east and west (Figure 7). These were selected as limiting parameters because they define the geographic extent of human activity on a regional level. The total area selected is approximately 800 km<sup>2</sup>.

Activities in the region within this area were identified as;

- The Wolverine Advanced Exploration Program.
- The Robert Campbell Highway
- The Yukon Zinc-Silver Project
- Ongoing regional mineral exploration
- Guide outfitter and recreational hunting.

Effects currently evident from past activity and the potential temporal extent of the Wolverine Advanced Exploration Program defined the temporal scope. Since potential effects to water resources and landscape appearance could extend for several years following completion of the program, this was considered to the temporal extent of the assessment.

It is important to note that the Wolverine Advanced Exploration Program necessarily precedes the Yukon Silver-Zinc Project and thus they cannot occur concurrently. In addition, surface disturbance from the advanced exploration will likely be incorporated into the Yukon Silver-Zinc Project. As such, the effects of these two activities will not be spatially cumulative; however, there may be temporal accumulation of effects. All other regional activities are considered to have both spatial and temporal overlap with the proposed exploration program.

A matrix was developed to identify potential areas of cumulative effect (Table 7). For those areas in which the Wolverine Advanced Exploration Program could potentially contribute to regional cumulative effects, the regional effects are described and quantified where possible.

### *3.2.1.1 Topography and Landscape Appearance*

Wolverine Advanced Exploration Program – The principle landscape effect of this program is temporary effect of cleared work areas (approximately 12.0 hectares in total). The most obvious will be the rehabilitation of the existing temporary access trail that will appear as a linear corridor 32 km long and 3.5 m wide (up to 6m locally).

Robert Campbell Highway – Within the described spatial area of this assessment, the principle landscape effect of this access trail is the rehabilitation clearing of approximately < 6 m of forested area along a linear corridor of 32 km (< 12 hectares in total). No topography changes are anticipated to result from trail rehabilitation including grading of steep hills and infilling of gully areas, as the trail is again pre-existing.

Yukon Zinc-Silver Project - The Yukon Zinc-Silver Project will result in minor changes to the landscape appearance in the Wolverine area. Local topography will be altered with the addition of waste rock dumps, tailings storage facility, and underground portal site. An area of 0.5 hectares will be cleared and altered in the process of mine operations. Ore and concentrate haul routes will result in the development of linear corridors of cleared areas with slight modifications to topography.

Mineral Exploration and Development – Landscape changes resulting from mineral exploration include the rehabilitation of the existing Wolverine temporary winter trail access (11.2 hectares of packed area with minor modifications to topography), exploration roads at Wolverine (6 hectares of cleared area with minor modifications to topography), cut lines on prospective areas (estimated at approximately 27.5 hectares) and cleared drill pads (estimated at approximately 0.6 hectares). The total cleared area from this activity is 44.3 hectares. The rate of clearing for mineral exploration is approximately 8 hectares/year on average in the region.

### *3.2.1.2 Hydrogeology*

Wolverine Advanced Exploration – Effects to hydrogeology include localized changes to groundwater movement in the vicinity of the underground development (as previously outlined).

Yukon Silver-Zinc Project – Effects to hydrogeology include minor changes to groundwater movement in the vicinity of the underground development at Wolverine.

Cumulative changes to hydrogeology are localized and no regional scale, cumulative effects to groundwater are expected.

### **3.2.1.3 Groundwater Quality**

Wolverine Advanced Exploration – Effects to groundwater quality include potential localized changes in the vicinity of the underground development (as previously outlined).

Cumulative changes to hydrogeology are localized and no regional scale, cumulative effects to groundwater are expected.

### **3.2.1.4 Surface Water Quality**

Wolverine Advanced Exploration Program – The potential effects to surface water quality from the advanced exploration program have been estimated (Appendix A) Conclusions indicate that adverse effects to surface water quality are unlikely.

There is no indicated potential cumulative effects to water quality from the Wolverine Advanced Exploration Program.

### **3.2.1.5 Vegetation**

As outlined above, the total cumulative effect of all activities in the region constitutes approximately 44.3 hectares of vegetation clearing at a maximum. This is less than approximately 0.00008% of the total regional area.

### **3.2.1.6 Wildlife**

Cumulative effects to wildlife can occur since all activities in the region have the potential to affect wildlife. The Company has contracted an independent review of potential effects to wildlife. This report is presented under separate cover and accompanies this document (Appendix D).

## **3.3 Accidents and Malfunctions**

The principle concern for environmental effects related to accidents and malfunctions is the potential for fuel spills during operations. The Company has developed the following management plans to reduce this risk and limit potential environmental effects.

- Fuel will be stored as per regulation with all caches over 4000 L having secondary containment (double-walled envirotanks or lined berms)
- A fuel spill and emergency response plan has been developed (provided as Appendix B) and will be available to exploration development groups.
- Spill containment supplies will be available at fuel transfer and storage sites.
- No fuel will be stored with 30 m of water bodies and/or stream.
- Contractors will be required to have spill plans and coordinate emergency response plans with the Company.

With a spill plan in place, the potential for environmental effects from fuel spills is limited.

### **3.4 Assessment of Alternatives**

#### **3.4.1 Alternatives to the Project**

For the stated purpose of assessing the geotechnical conditions and final feasibility of the underground mining at the Wolverine Deposit, there is no alternative to the Wolverine Advanced Exploration Program. Accurate assessment of underground mining costs require the development of an underground exploration program.

#### **3.4.2 Alternative Means of Carrying Out the Project**

The principle consideration in assessing project alternatives is site access. The Company considered various alternatives for site access and program support. The potential environmental effects of these alternatives are qualitatively described.

##### **3.4.2.1 Air Support**

The Company reviewed the possibility of supporting the exploration program using the existing Wolverine airstrip. The volume of materials and size of equipment required for the program makes this option economically prohibitive; however, every attempt to use larger fixed-wing aircraft will be made when economically feasible, hence the reason for the current expansion of the size of the existing airstrip. The health and safety risk to the underground development crew is increased without the possibility of ground mobilization to the site. The most significant potential environmental effect associated with this option is disruption of wildlife from intense air traffic in the region and ground disturbance from airstrip expansion.

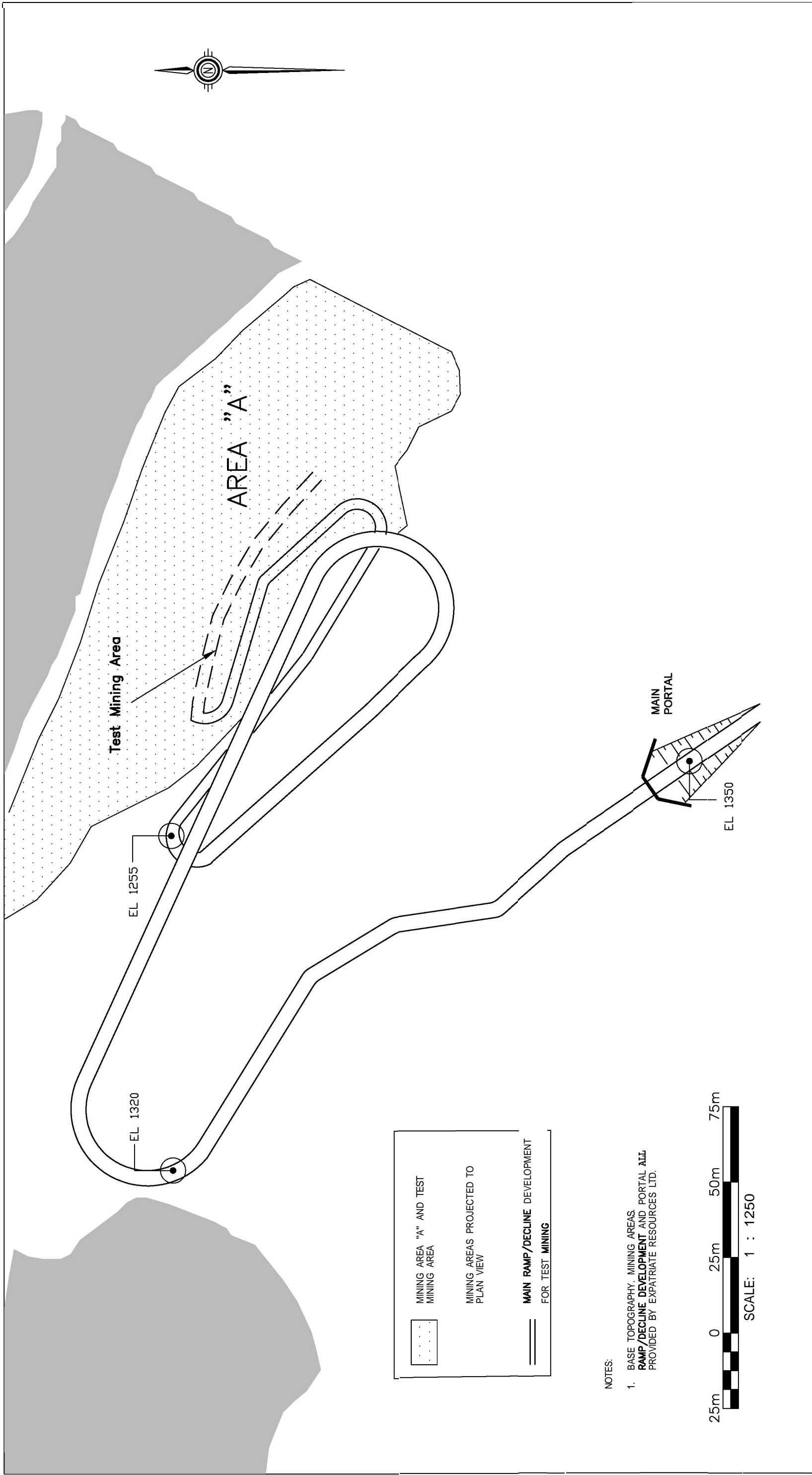
##### **3.4.2.2 Exclusive Winter Trail**




The window of opportunity for use of an existing winter trail for access is 4 to 8 weeks between the beginning of February and the beginning of April and/or Spring break-up. The exploration program is anticipated to run for about 6 months, not including lead-in and follow-up activities. Having a limited opportunity for ground access to the site means that the equipment would be captive at the site for the entire year. This approach leaves little opportunity for contingencies and severely restricts the flexibility of the program. These limitations place significant risk on the successful implementation of the program. The potential health and safety risk to the underground development crew is increased without the possibility of ground access to the site. Reclamation and closure options for the site and implementation of management plans would be restricted in the future without available ground access. Environmental effects of this option include clearing of vegetation in forested areas and temporary functional habitat loss for wildlife avoiding the winter trail.

##### **3.4.2.3 All Season Roads**

Given the limitations of exclusive temporary winter access and air support, it was concluded that a multi-season access route to the Wolverine area would be required at some point in the future after a positive production decision late in 2005 or early 2006. The Company has assessed various access route alternatives; however, further consultation with stakeholders and regulators is required. In the past, stakeholders have express concerns about increased access to the project areas and its effects on wildlife. A consultation program has been carried out to determine a preferred route from the

perspective of local stakeholders. The results of this consultation program are presented as Appendix C.



|   |   |
|---|---|
|    | MINING AREA "A" AND TEST MINING AREA          |
|   | MINING AREAS PROJECTED TO PLAN VIEW           |
|  | MAIN RAMP/DECLINE DEVELOPMENT FOR TEST MINING |

NOTES:  
 1. BASE TOPOGRAPHY, MINING AREAS, RAMP/DECLINE DEVELOPMENT AND PORTAL ALL PROVIDED BY EXPATRIATE RESOURCES LTD.



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| DATE:     | APR 2001 |
| DRAWN:    | GEJ      |
| DESIGNED: | SB       |
| CHECKED:  |          |
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| PROJECT     | WOLVERINE TEST MINING PROGRAM |
| TITLE       | TEST MINE DEVELOPMENT         |
| PROJECT No. | 0263-002-01                   |
| DWG. No.    | FIGURE 1                      |
| REV.        | 0                             |

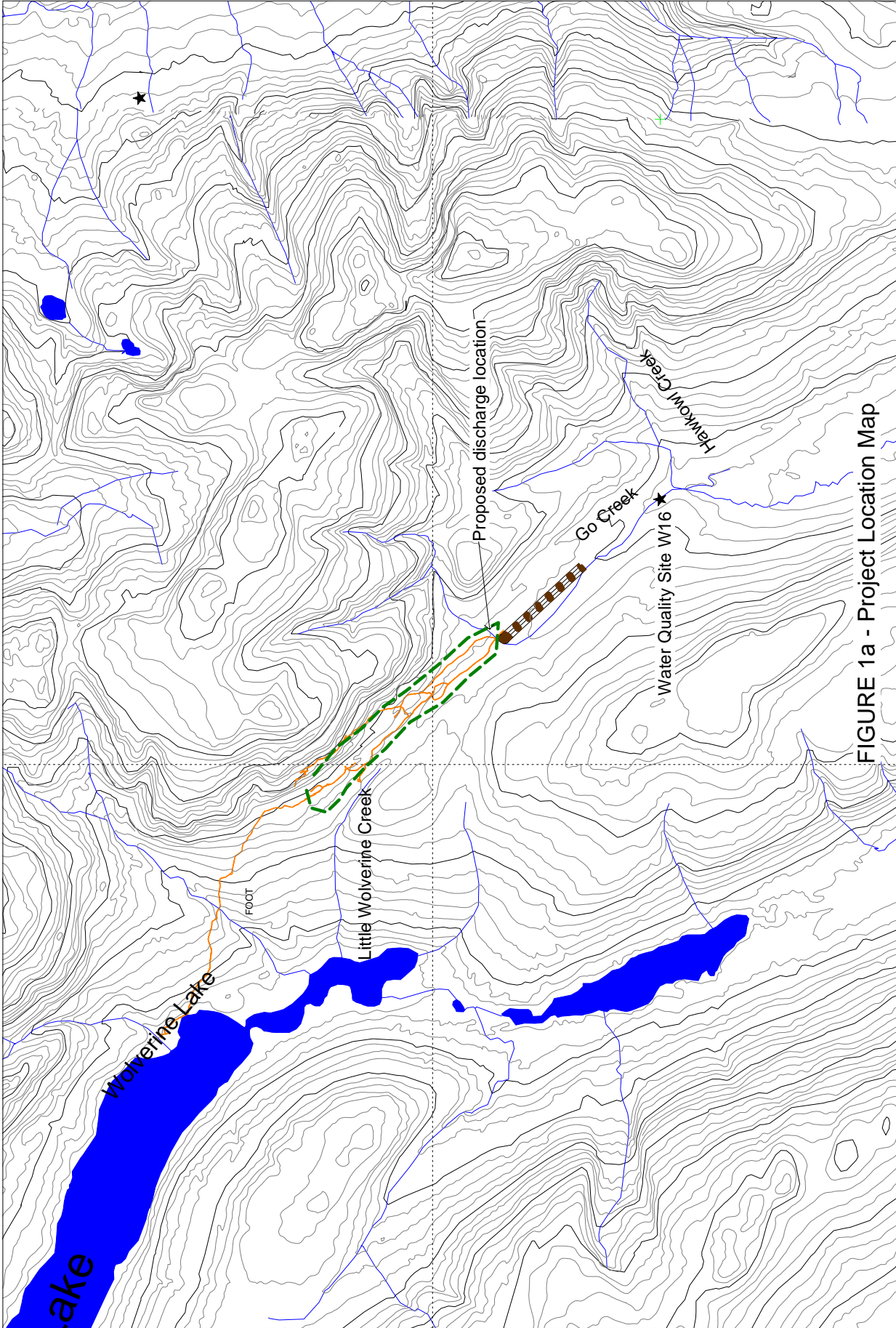
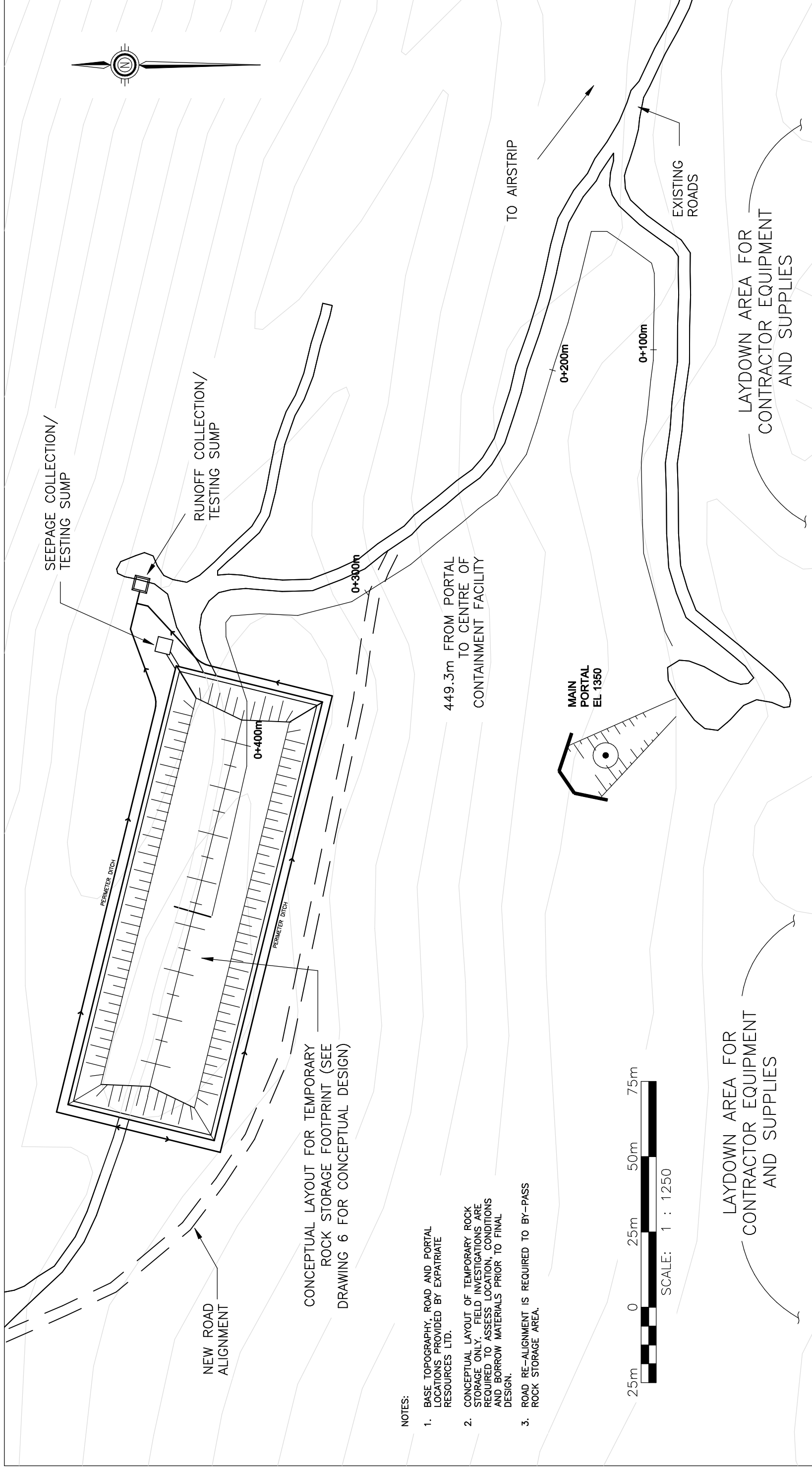


FIGURE 1a - Project Location Map

Scale: 1:50,000



Contour Interval: 20m



**NOTES:**

1. BASE TOPOGRAPHY, ROAD AND PORTAL LOCATIONS PROVIDED BY EXPATRIATE RESOURCES LTD.
2. CONCEPTUAL LAYOUT OF TEMPORARY ROCK STORAGE ONLY. FIELD INVESTIGATIONS ARE REQUIRED TO ASSESS LOCATION, CONDITIONS AND BORROW MATERIALS PRIOR TO FINAL DESIGN.
3. ROAD RE-ALIGNMENT IS REQUIRED TO BY-PASS ROCK STORAGE AREA.

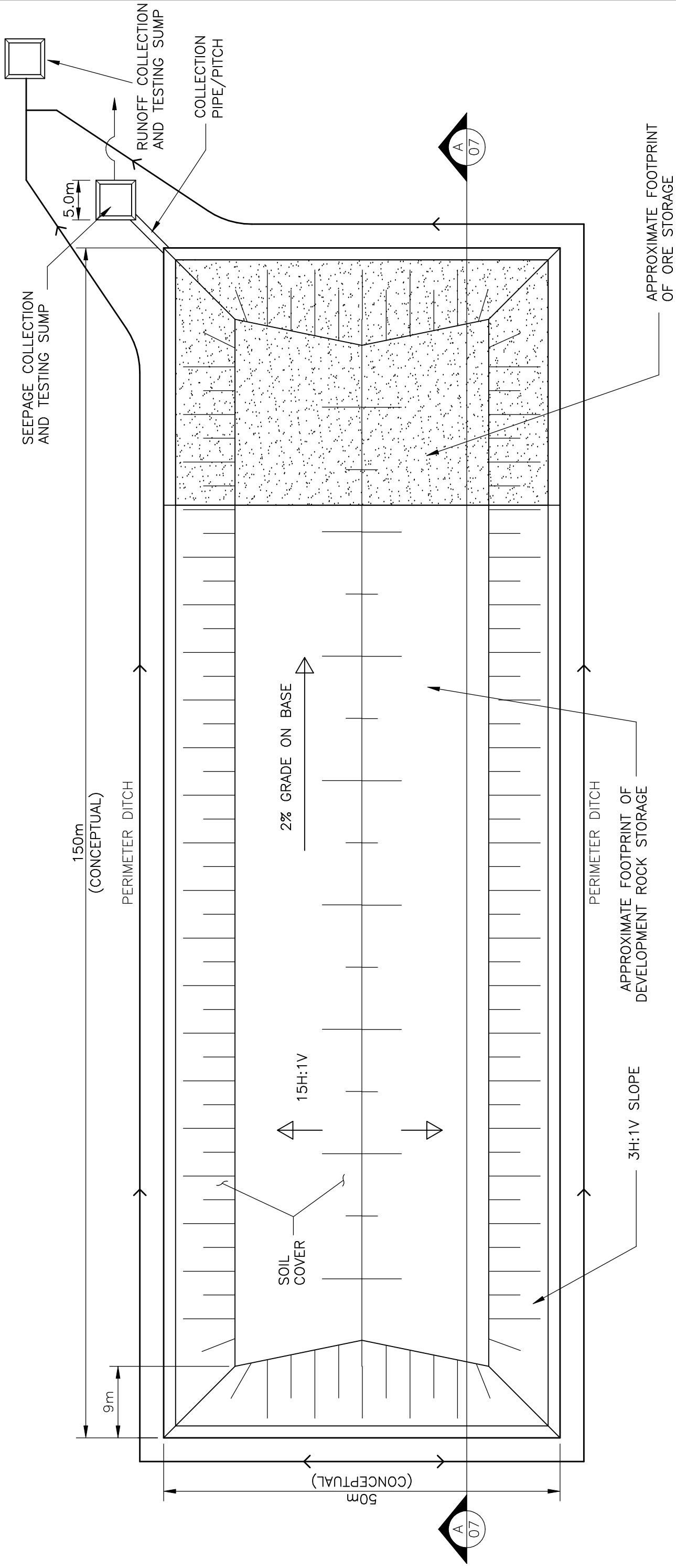
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|-------------|-------------------------------|
| PROJECT     | WOLVERINE TEST MINING PROGRAM |
| TITLE       | SURFACE FACILITIES            |
| PROJECT No. | 0263-002-01                   |
| DWG. No.    | FIGURE 2                      |
| REV.        | 0                             |



**NOTES:**

1. THIS IS A CONCEPTUAL ROCK STORAGE FACILITY ONLY. FINAL DESIGN AND SITE ISSUES NEED TO BE ASSESSED BEFORE CONSTRUCTION.
2. INVESTIGATIONS ARE REQUIRED TO CONFIRM AND ASSESS FOUNDATION CONDITIONS, CONTRACTABILITY AND SEEPAGE POTENTIAL. A LINER MAY BE REQUIRED TO PREVENT SEEPAGE.

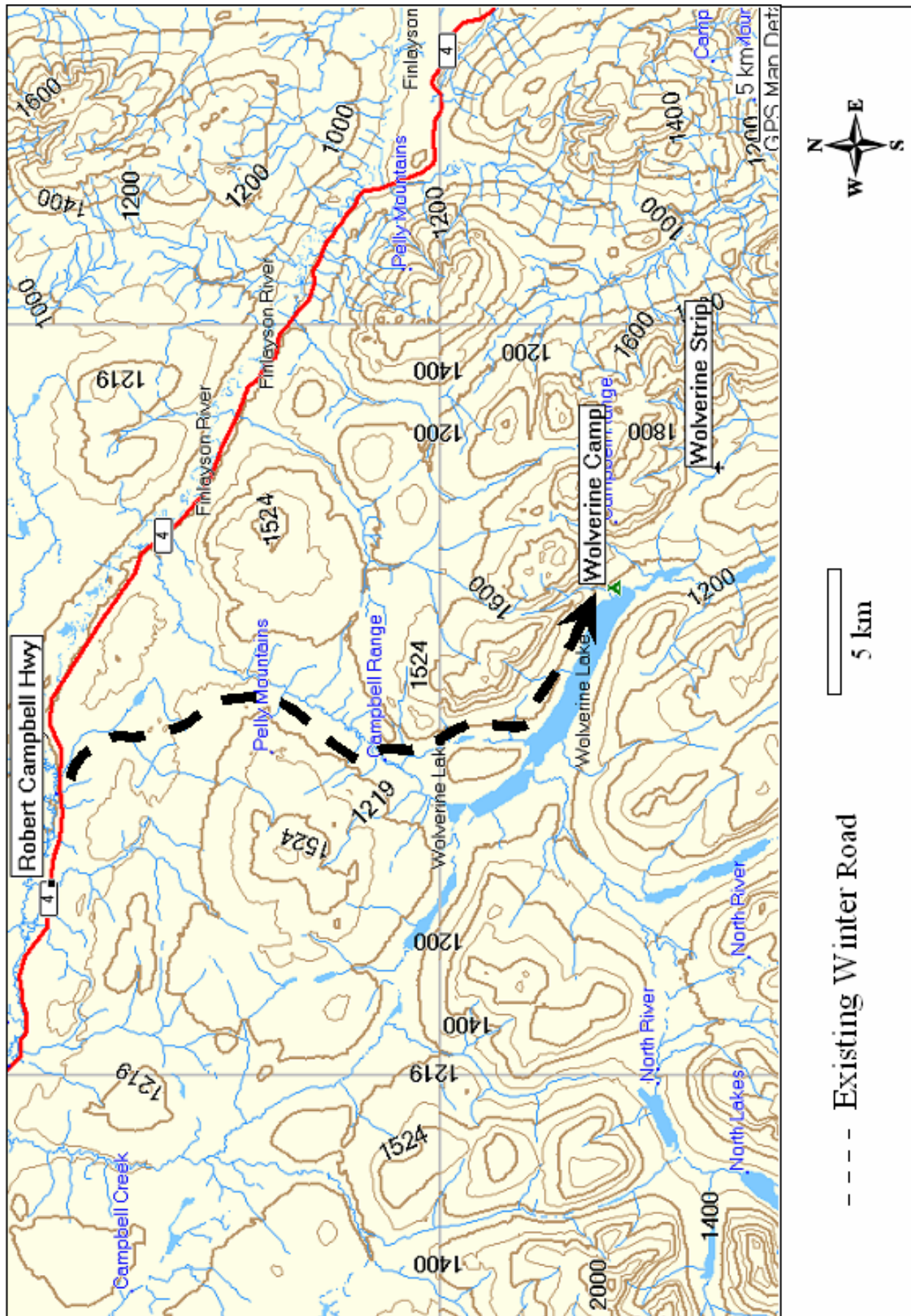
3. SEEPAGE COLLECTION SUMP, RUNOFF COLLECTION SUMP AND ASSOCIATED DITCHES ARE CONCEPTUAL ONLY. DETAILED DESIGN IS REQUIRED TO ENSURE PERFORMANCE DURING STORM/RUNOFF EVENTS.

4. PROPOSED SOIL COVER IS COMPOSED OF WEATHERED RHYOLITE FOUNDATION ROCK. TESTS TO ASSESS IT'S SUITABILITY IN THIS APPLICATION ARE REQUIRED.

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|  |      | DATE: MARCH 2001 | TITLE: CONCEPTUAL DESIGN               |
|  |      | DRAWN: KB        | PROJECT No. 0263-002-01                |
|  |      | DESIGNED: SB     | DWG. No. FIGURE 3                      |
|  |      | CHECKED:         | PROJECT No. 0263-002-01                |
|  |      | APPROVED:        | REV. 0                                 |
| REV.   | DATE | REVISION         |  |

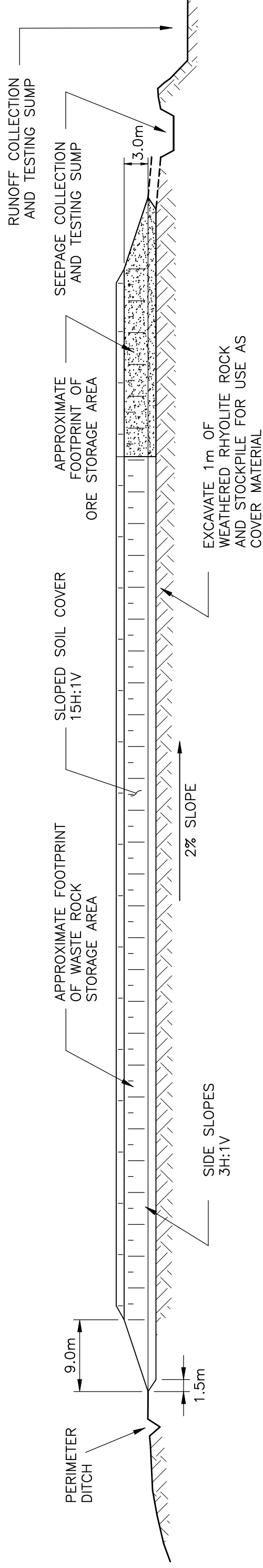
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**Figure 3a**

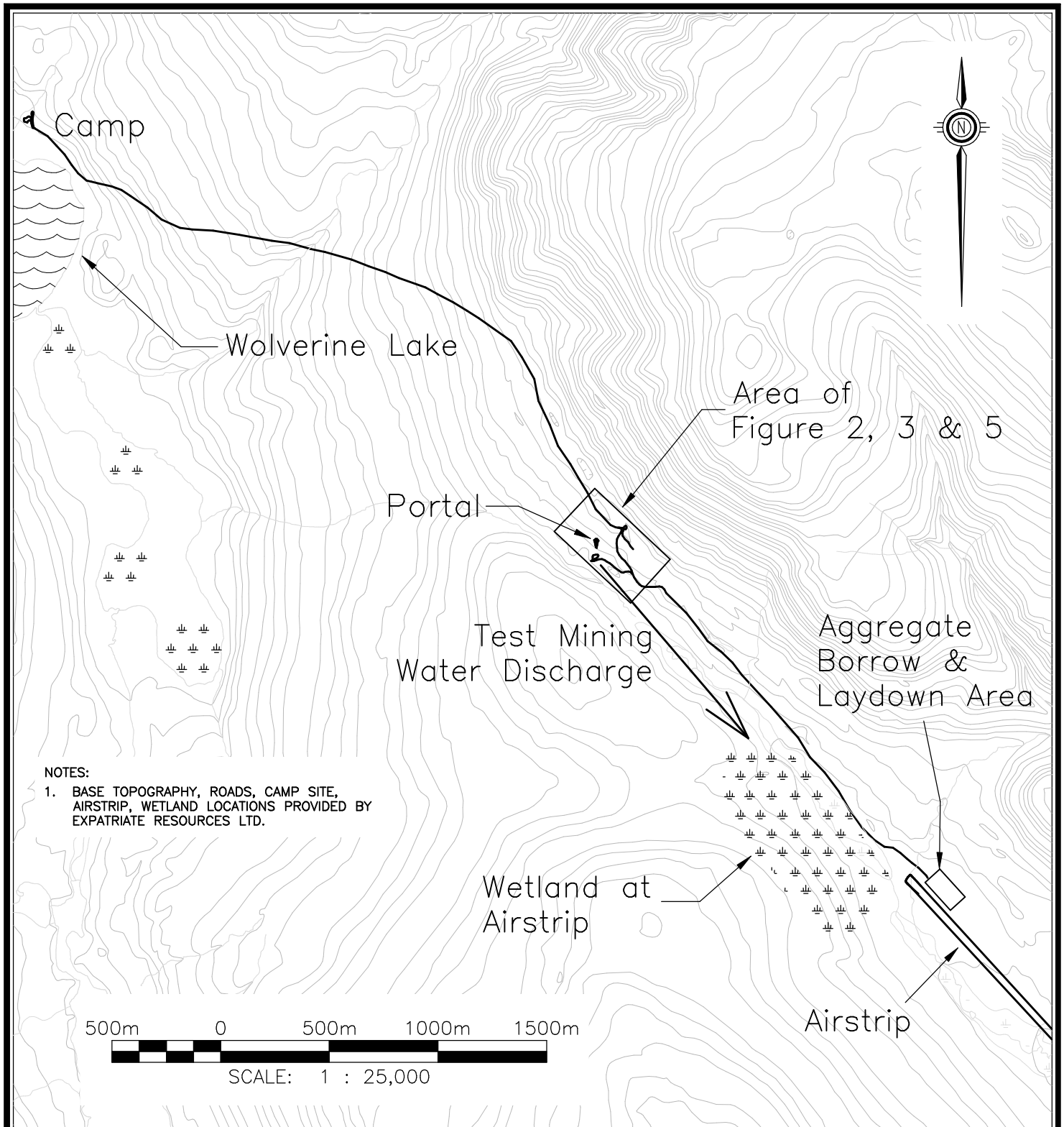
SECTION A  
6



**NOTES:**

1. THIS IS A CONCEPTUAL ROCK STORAGE FACILITY ONLY. FINAL DESIGN AND SITE ISSUES NEED TO BE ASSESSED BEFORE CONSTRUCTION.
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4. PROPOSED SOIL COVER IS COMPOSED OF WEATHERED RHYOLITE FOUNDATION ROCK. TESTS TO ASSESS IT'S SUITABILITY IN THIS APPLICATION ARE REQUIRED.

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| <b>BGC ENGINEERING INC.</b><br>AN APPLIED EARTH SCIENCES COMPANY<br>Vancouver, B.C. Phone: (604) 684 5900  |  | PROJECT<br><b>WOLVERINE TEST MINING PROGRAM</b>                            |  |
| SCALE: 1:500<br>DATE: MARCH 2001<br>DRAWN: KB<br>DESIGNED: SB<br>CHECKED:<br>APPROVED:   |  | TITLE<br><b>CONCEPTUAL DESIGN<br/>         OF TEMPORARY ROCK STORAGE 2</b> |  |
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| DRAWN<br><input type="checkbox"/> DRAWN<br><input type="checkbox"/> CHECKED<br><input type="checkbox"/> APPROVED   |  | DWG. No.<br><b>FIGURE 4</b>  |  |
| CLIENT:<br><b>EXPATRIATE RESOURCES LTD.</b>  |  | REV.<br><b>0</b>   |  |



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PROJECT WOLVERINE TEST MINING PROGRAM

TITLE SURFACE FACILITIES AND EXISTING ROADS

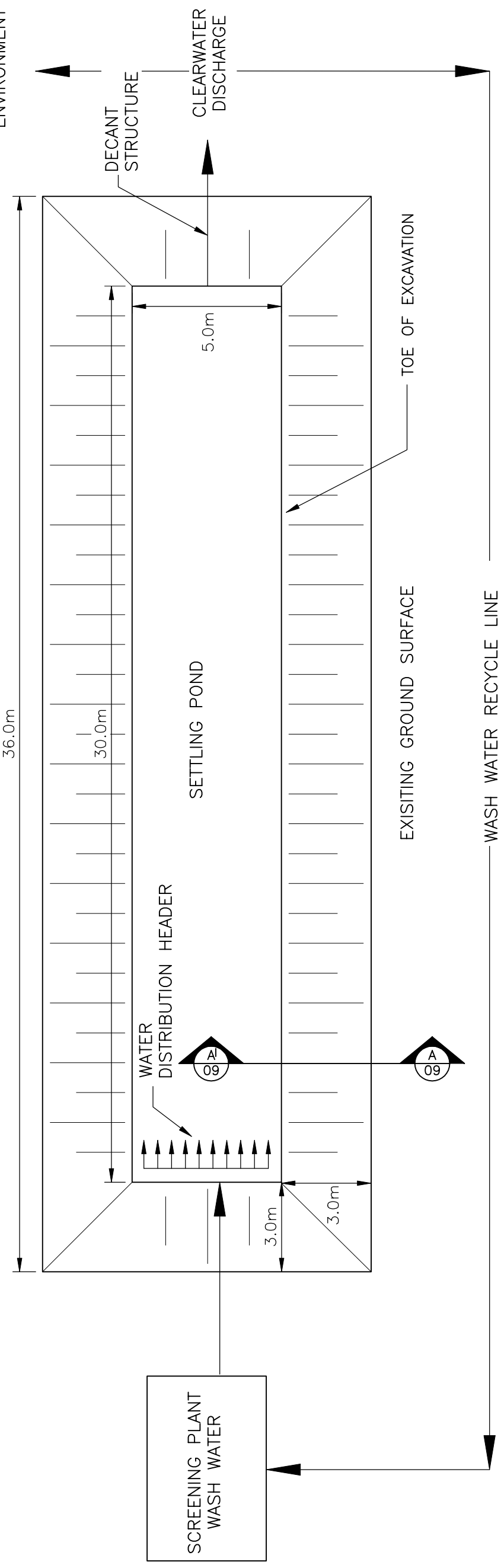
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PROJECT No. 0263-002-01

DWG. No. FIGURE 5

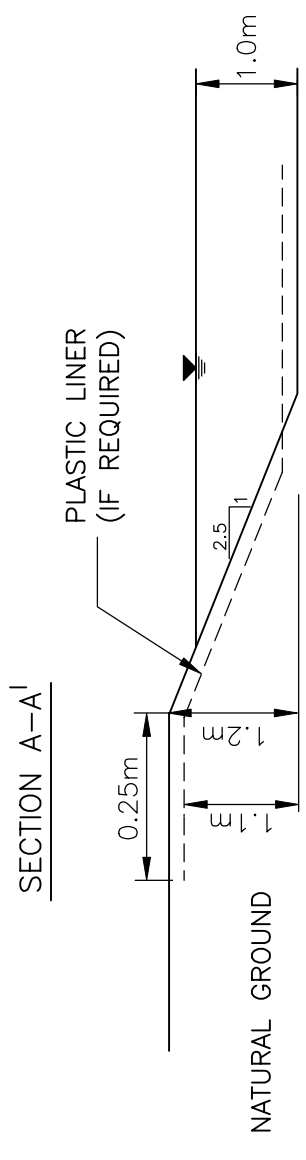
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RECEIVING ENVIRONMENT



DRAFT

- NOTES:
1. BERM CREST ELEVATION = 1.2m
  2. LINER ELEVATION = 1.1m
  3. POND OPERATING LEVEL = 1.0m



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|------------------------|--|---------------------------------------|--|
| PROJECT                |  | WOLVERINE TEST MINING PROGRAM         |  |
| TITLE                  |  | SURFACE FACILITIES                    |  |
| PROJECT No.            |  | 0263-002-01                           |  |
| CLIENT:                |  | EXPATRIATE RESOURCES LTD.             |  |
| DRAWN                  |  | CHECKED/APPROVED                      |  |
| DATE                   |  | REVISION                              |  |
| DRAWING DESCRIPTION    |  | FIGURE 6                              |  |
| REFERENCED DRAWING No. |  | REV.                                  |  |
| SCALE: AS SHOWN        |  | DWG. No.                              |  |
| DATE: APR 2001         |  | PROJECT                               |  |
| DRAWN: KB              |  | WOLVERINE TEST MINING PROGRAM         |  |
| DESIGNED: SB           |  | SURFACE FACILITIES                    |  |
| CHECKED: -             |  | AGGREGATE WASH PLANT SETTLING POND    |  |
| APPROVED: -            |  | AN APPLIED EARTH SCIENCES COMPANY     |  |
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|                        |  | BRUCE GEOTECHNICAL CONSULTANTS INC.   |  |
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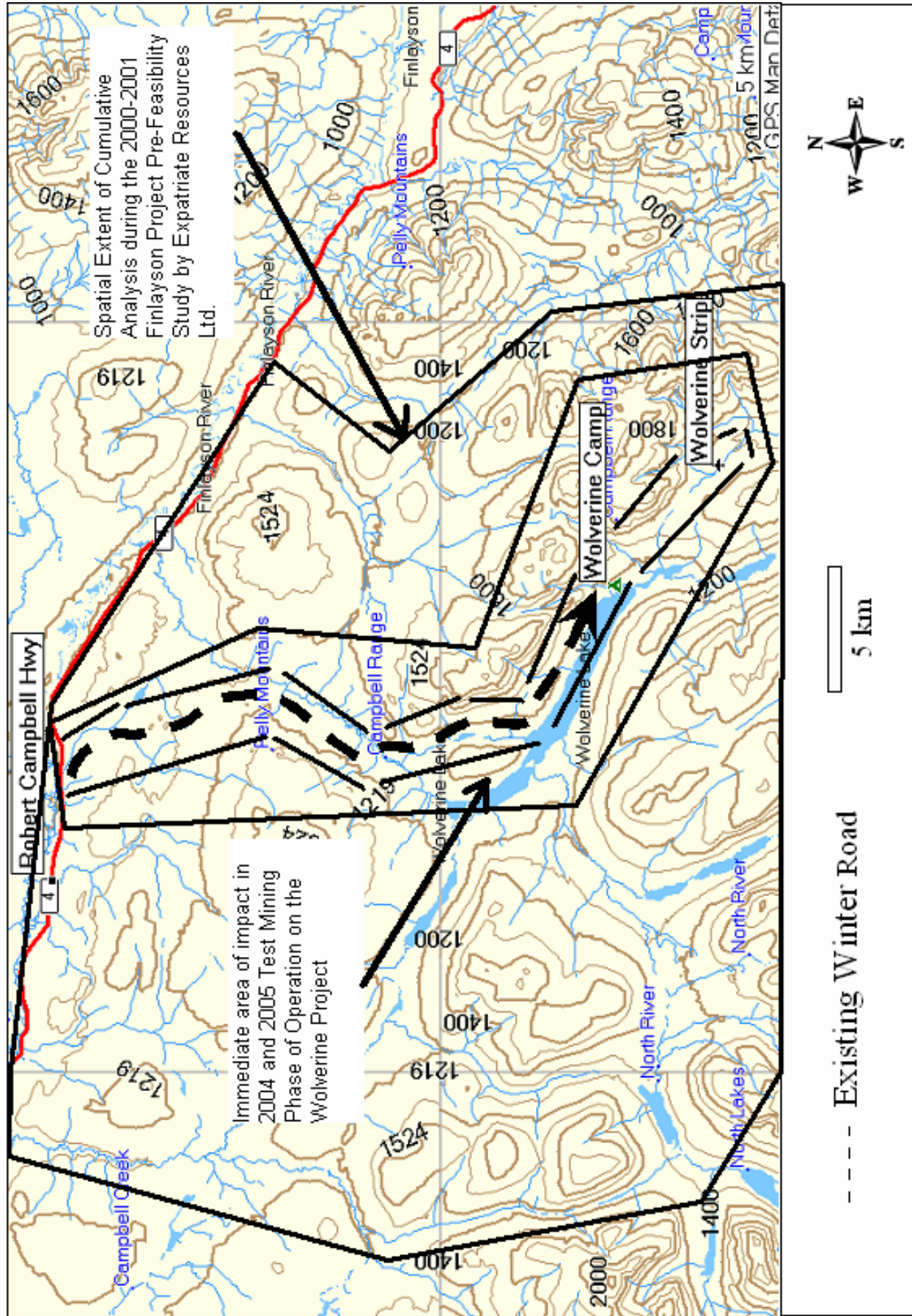
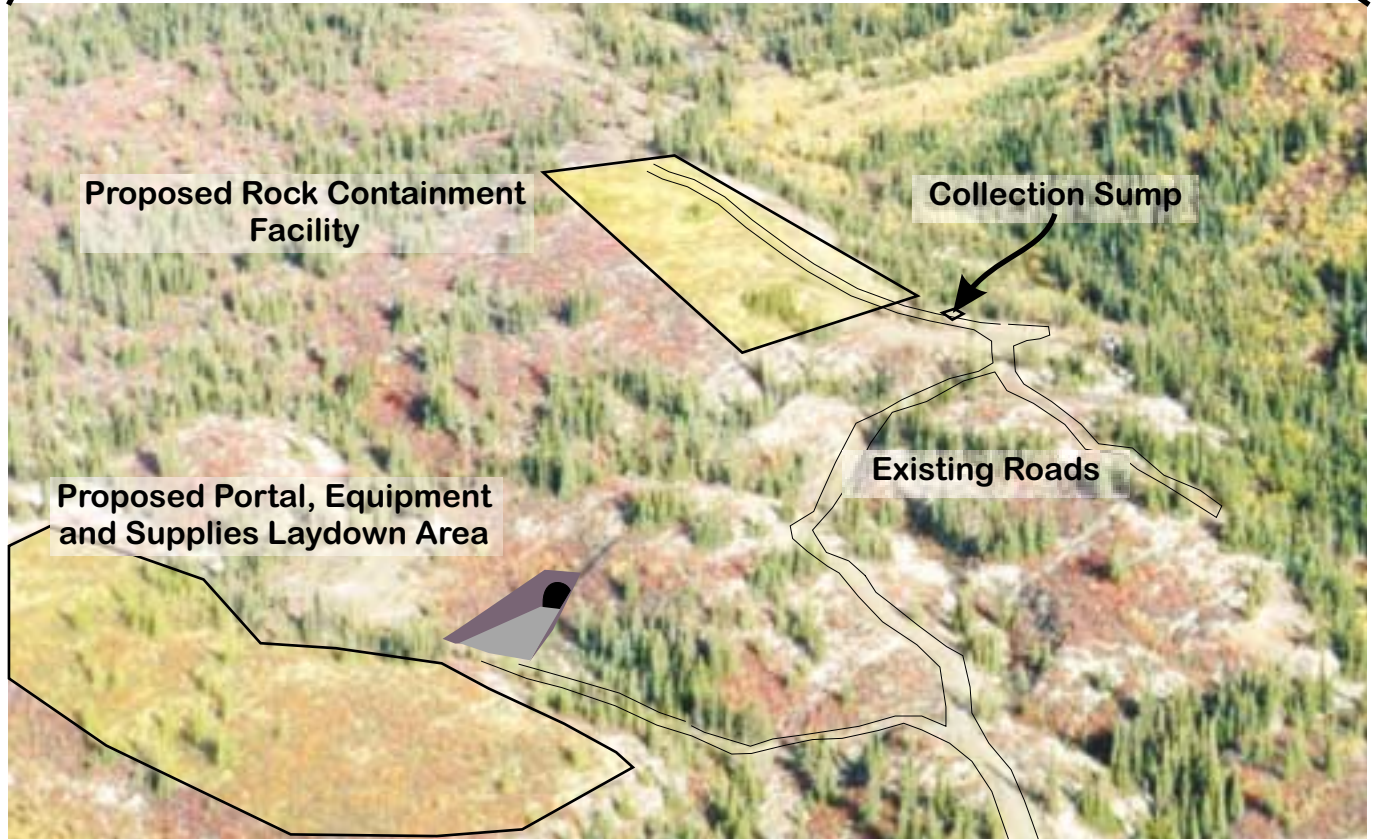
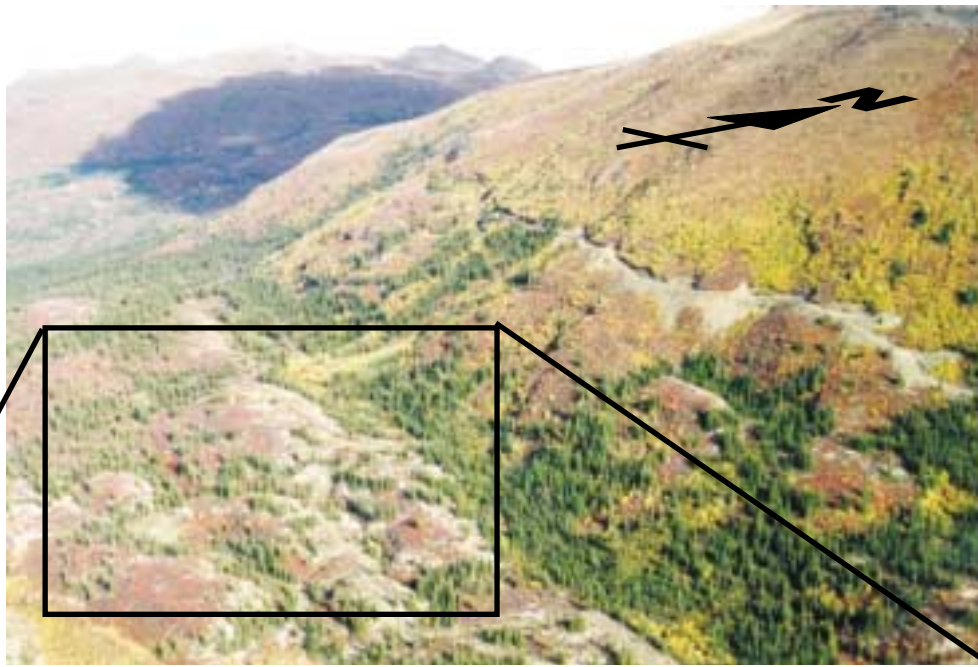


Figure 7



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Expatriate Resources Ltd.

Wolverine Test Mining Program  
Surface Facilities Rendering

Drawn: SEB

March, 2001

**Expatriate**  
Resources Ltd.

Photo 1

**EXPATRIATE RESOURCES LTD.  
WOLVERINE ADVANCED EXPLORATION PROGRAM**

**Table 1 – Estimated Test-mining Waste and Ore Quantities**

|   | Length (m)   | Area (m <sup>2</sup> ) | SG(t/m <sup>3</sup> ) | Tonnes        | Loose (m <sup>3</sup> ) |
|---|--------------|------------------------|-----------------------|---------------|-------------------------|
| Main Ramp (Waste)                                 | 625          | 20.3                   | 2.9                   | 36,800        | 17,800                  |
| Decline From Main Ramp<br>to Wolverine Zone (Ore) | 335          | 12.25                  | 4.09                  | 16,700        | 5,745                   |
| 9x5 Stope Drift in Ore                            | 125          | 45                     | 4.09                  | 13,800        | 4,747                   |
| 4x4 Stope Drift in Ore                            | 75           | 16                     | 4.09                  | 8,180         | 2,813                   |
| Re-Muck Stations                                  | 50           | 20.3                   | 2.9                   | <u>2,900</u>  | <u>1,421</u>            |
| <b>Total</b>                                      | <b>1,220</b> |                        |                       | <b>78,380</b> | <b>32,526</b>           |

**EXPATRIATE RESOURCES LTD.  
WOLVERINE ADVANCED EXPLORATION PROGRAM**

**Table 2 - Test-mining Personnel Requirements**

| <b>EXR Staff</b>                 |           |
|----------------------------------|-----------|
| Project Manager (Mine Engineer)  | 1         |
| Geotechnical Engineer            | 1         |
| Mine Technician/Surveyor         | 1         |
| Geologist/Sampler                | 2         |
| Cook                             | 1         |
| Cook's Helper                    | 2         |
| Camp Maintenance Man/Dry         | 1         |
| <b>Contractor</b>                |           |
| Shiftboss                        | 2         |
| Drillers                         | 2         |
| LHD/Truck Operators/Loading Crew | 7         |
| Maintenance                      | 3         |
| Electrician                      | <u>1</u>  |
| <b>TOTAL</b>                     | <b>24</b> |

**EXPATRIATE RESOURCES LTD.  
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**Table 3 - Major Mining Equipment for Test-mining**

| Major Equipment                                  | Qty | Estimated Weight (Tonnes) | Total Weight (Tonnes) | Shipping Dimensions |      |      | Estimated Number of Trailers |
|--|-----|---------------------------|-----------------------|---------------------|------|------|------------------------------|
|  |     |                           |                       | H(m)                | W(m) | L(m) |                              |
| <b>Mobile Equipment</b>                          |     |                           |                       |                     |      |      |                              |
| 2-boom Jumbo                                     | 1   | 17                        | 17                    | 3                   | 2    | 13   | 1                            |
| Bolting Jumbo (or scissor lift)                  | 1   | 22                        | 22                    | 2                   | 2    | 9    | 1                            |
| 6 yd LHD   | 2   | 34                        | 68                    | 3                   | 3    | 10   | 3                            |
| 30 tonne Trucks                                  | 2   | 38                        | 76                    | 3                   | 3    | 10   | 4                            |
| 2.5 yd LHD                                       | 1   | 16                        | 16                    | 2.5                 | 2    | 8    | 0.5                          |
| Front End Loader (5yd)                           | 1   | 28                        | 28                    | 4                   | 3.5  | 9    | 1                            |
| Mixer Truck                                      | 1   | 16                        | 16                    | 4                   | 3    | 6    | 0.5                          |
| Wet Mix Pump and Boom Machine                    | 1   | 16                        | 16                    | 4                   | 3    | 6    | 0.5                          |
| Backhoe  | 1   | 9                         | 9                     | 3                   | 2.5  | 4    | 0.5                          |
| <b>Stationary Equipment</b>                      |     |                           |                       |                     |      |      |                              |
| Maintenance Shop (containers)                    | 4   | 5                         | 20                    | 3                   | 3    | 10   | 4                            |
| U/G Transformer Stations                         | 1   | 5                         | 5                     | 2                   | 2    | 3    | 0.25                         |
| Gen Sets   | 2   | 5                         | 10                    | 2                   | 2    | 3    | 1                            |
| Explosives Magazine (container for Anfo storage) | 1   | 5                         | 5                     | 3                   | 3    | 10   | 1                            |
| Detonator Magazine                               | 1   | 3                         | 3                     | 3                   | 3    | 5    | 0.25                         |
| 48 inch Ventilation Fans                         | 3   | 1                         | 3                     | 1                   | 1    | 1.5  | 0.5                          |
| Screen and Wash Plant – Shotcrete Aggregate      | 1   | 25                        | 25                    | 3                   | 3    | 13   | 1                            |
| Screen Conveyor                                  | 1   | 4                         | 4                     | 1                   | 1    | 13   | 0.5                          |
| Weigh Hopper                                     | 1   | 10                        | 10                    | 3                   | 3    | 4    | 0.5                          |
| Weigh Hopper Conveyor to Feed Mixer truck        | 1   | 4                         | 4                     | 1                   | 1    | 10   | 0.5                          |

**Total Weight (tonnes) = 357                      Total trailers (rounded) = 22**

**EXPATRIATE RESOURCES LTD.  
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**Table 4 - Estimated Schedule of Materials**

| ITEM                       | Units          | 3.5 m x 3.5 m Decline<br>235 m |        | 4.5 W x 5 H Decline<br>675 m |        | 9 x5 m Stope Drift<br>75 m |        | 3 m x 5H max Stope Drift<br>125 m |        | Total<br>Amount         | Shipping<br>Weight<br>(tonnes) |
|----------------------------|----------------|--------------------------------|--------|------------------------------|--------|----------------------------|--------|-----------------------------------|--------|-------------------------|--------------------------------|
|                            |                | Units/m                        | Amount | Units/m                      | Amount | Units/m                    | Amount | Units/m                           | Amount |                         |                                |
| <b>Blasting</b>            |                |                                |        |                              |        |                            |        |                                   |        |                         |                                |
| ANFO, kg                   | kg             | 41                             | 9,635  | 62                           | 41,850 | 214                        | 16,020 | 50                                | 6,211  | 73,716 kg               | 74                             |
| Packaged Emulsion          | kg             | 10                             | 2,421  | 16                           | 10,800 | 53                         | 4,005  | 12                                | 1,553  | 18,778 kg               | 19                             |
| Nonel 4m,                  | m              | 9                              | 2,155  | 15                           | 9,855  | 24                         | 1,770  | 11                                | 1,389  | 15,169 each             | 1                              |
| Detonating Cord, m         | m              | 2                              | 456    | 2                            | 1,310  | 5                          | 395    | 2                                 | 243    | 2,403 m                 | 1                              |
| <b>Drilling</b>            |                |                                |        |                              |        |                            |        |                                   |        |                         |                                |
| Jumbo Steel                | each           | 0                              | 28     | 0                            | 128    | 0                          | 18     | 0                                 | 15     | 189 each                | 5                              |
| Jumbo Bits                 | each           | 0                              | 89     | 1                            | 412    | 1                          | 59     | 0                                 | 48     | 607 each                | 1                              |
| Jumbo Reaming Bits         | each           | 0                              | 4      | 0                            | 11     | 0                          | 1      | 0                                 | 2      | 18 each                 | 0                              |
| Rock Bolter Steel          | each           | 0                              | 5      | 0                            | 23     | 0                          | 2      | 0                                 | 4      | 33 each                 | 1                              |
| Rock Bolter Bits           | each           | 0                              | 10     | 0                            | 16     | 0                          | 5      | 0                                 | 7      | 38 each                 | 0                              |
| <b>Ground Support</b>      |                |                                |        |                              |        |                            |        |                                   |        |                         |                                |
| 2.4 m Rebar                | each           | 6                              | 1,410  | 8                            | 5,400  | 3                          | 208    |                                   |        | 7,018 each              | 53                             |
| 1.8 m Rebar                | each           |                                |        |                              |        |                            |        | 6                                 | 750    | 750 each                | 4                              |
| Resin                      | kg             | 12                             | 2,820  | 16                           | 10,800 | 6                          | 413    | 12                                | 1,500  | 15,533 kg               | 16                             |
| Wire Mesh , 100mm, sq m    | m <sup>2</sup> | -                              | -      | -                            | -      | -                          | -      | 5                                 | 625    | 625 m2                  | 2                              |
| <b>Shotcrete</b>           |                |                                |        |                              |        |                            |        |                                   |        |                         |                                |
| Aggregate <sup>1</sup>     | tonnes         |                                | 114    |                              | 749    |                            |        |                                   |        | 863 tonnes <sup>1</sup> | note 1                         |
| Cement                     | tonnes         |                                | 26     |                              | 168    |                            |        |                                   |        | 194 tonnes              | 194                            |
| Silica Fume                | tonnes         |                                | 3      |                              | 19     |                            |        |                                   |        | 22 tonnes               | 22                             |
| Steel Fibre                | tonnes         |                                | 4      |                              | 24     |                            |        |                                   |        | 28 tonnes               | 28                             |
| <b>Supplies</b>            |                |                                |        |                              |        |                            |        |                                   |        |                         |                                |
| Power Cable                | m              | 1                              | 235    | 1                            | 675    | -                          | -      | -                                 | -      | 910 m                   | 5                              |
| Pump Discharge Line        | m              | 1                              | 235    | 1                            | 675    | -                          | -      | -                                 | -      | 910 m                   | 14                             |
| 8 inch coupling            | each           | 0                              | 38     | 0                            | 108    | -                          | -      | -                                 | -      | 146 each                | 1                              |
| 2 inch water line          | m              | 1                              | 235    | 1                            | 675    | 1                          | 75     | 1                                 | 125    | 1,110 m                 | 2                              |
| 2 inch coupling            | each           | 0                              | 38     | 0                            | 108    | 0                          | 12     | 0                                 | 20     | 178 each                | 0                              |
| messenger cable            | m              | 1                              | 235    | 1                            | 675    | 1                          | 75     | 1                                 | 125    | 1,110 m                 | 0                              |
| Ventilation tubing         | m              | 1                              | 235    | 1                            | 675    | 1                          | 75     | 1                                 | 125    | 1,110 m                 | 6                              |
| J Bolts                    | each           | 1                              | 155    | 1                            | 446    | 1                          | 50     | 1                                 | 83     | 733 each                | 1                              |
| Chain                      | m              | 1                              | 179    | 1                            | 513    | 1                          | 57     | 1                                 | 95     | 844 m                   | 1                              |
| <b>Fuel and Lubricants</b> |                |                                |        |                              |        |                            |        |                                   |        |                         |                                |
| Diesel                     | L              |                                |        |                              |        |                            |        |                                   |        | 183,420 L               | 156                            |
| Hydraulic Fluid/Lubricants | L              |                                |        |                              |        |                            |        |                                   |        | 9,171 L                 | 9                              |
| Gasoline                   | L              |                                |        |                              |        |                            |        |                                   |        | 19,200 L                | 14                             |

|  |            |
|--|------------|
| <b>Total Estimated Shipping Weight (tonnes)</b>        | <b>627</b> |
| <b>Total Estimated Trailer Loads @20tonnes/trailer</b> | <b>31</b>  |

Notes:

1. Produced on site
2. No surplus or contingency applied

**EXPATRIATE RESOURCES LTD.  
WOLVERINE ADVANCED EXPLORATION PROGRAM**

**Table 5 - Test-Mining Schedule**

| Task                                    | Month 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---------|---|---|---|---|---|---|---|
| <b>Collar Portal</b>                    |         |   |   |   |   |   |   |   |
| Stripping                               |         |   |   |   |   |   |   |   |
| Bolting / Shotcrete                     |         |   |   |   |   |   |   |   |
| Excavation                              |         |   |   |   |   |   |   |   |
| <b>Decline Development</b>              |         |   |   |   |   |   |   |   |
| 675m Decline (10.5m/d)                  |         |   |   |   |   |   |   |   |
| 330m Decline<br>(Main Ramp to Ore Zone) |         |   |   |   |   |   |   |   |
| Dewatering Period (1)                   |         |   |   |   |   |   |   |   |
| <b>Test Stopping</b>                    |         |   |   |   |   |   |   |   |
| 125m along HW Contact                   |         |   |   |   |   |   |   |   |
| 75m within Ore zone                     |         |   |   |   |   |   |   |   |
| Instrumentation                         |         |   |   |   |   |   |   |   |
| Monitor Geomech (2)                     |         |   |   |   |   |   |   |   |

Note: (1) Dewatering period may be reduced if flows can be demonstrated to be reduced – may also be longer if monitoring shows that significant reduction can be achieved over additional time.

(2) Monitoring of Geomech instruments and water inflows to continue as long as possible during trial period.

**EXPATRIATE RESOURCES LTD.  
WOLVERINE ADVANCED EXPLORATION PROPOSAL**

**Table 6  
Potential Project - Environment Interactions**

| Project Component/Activity | Potential Project - Environment Interactions |              |                     |                   |                       |                   |            |          |                    |
|----------------------------|--|--------------|---------------------|-------------------|-----------------------|-------------------|------------|----------|--------------------|
|                            | Topography and Landscape Appearance          | Hydrogeology | Groundwater Quality | Surface Hydrology | Surface Water Quality | Aquatic Resources | Vegetation | Wildlife | Heritage Resources |
| Cumulative Project         |  |              |                     |                   |                       |                   |            |          |                    |
| Underground development    |  | X            | X                   | X                 | X                     | X                 |            | X        |                    |
| Aggregate borrow area      | X  |              |                     | X                 | X                     | X                 | X          |          | X                  |
| Waste rock stockpiles      | X  |              | X                   |                   | X                     | X                 | X          |          | X                  |
| Laydown and staging areas  | X  |              |                     |                   |                       |                   | X          |          | X                  |
| Access road                | X  |              |                     |                   |                       |                   | X          |          | X                  |

**EXPATRIATE RESOURCES LTD.  
WOLVERINE ADVANCED EXPLORATION PROPOSAL**

**Table 7  
Potential Areas of Cumulative Effect**

|                                | Topography and Landscape Appearance | Hydrogeology | Groundwater Quality | Surface Hydrology | Surface Water Quality | Aquatic Resources | Vegetation | Wildlife | Heritage Resources |
|--------------------------------|-------------------------------------|--------------|---------------------|-------------------|-----------------------|-------------------|------------|----------|--------------------|
| <b>Regional Activity</b>       |                                     |              |                     |                   |                       |                   |            |          |                    |
| Wolverine Advanced Exploration | X                                   | X            | X                   |                   | X                     |                   | X          | X        |                    |
| Robert Campbell Highway        | X                                   |              |                     |                   |                       |                   | X          | X        |                    |
| Finlayson Project              | X                                   | X            | X                   | X                 | X                     | X                 | X          | X        | X                  |
| Mineral Exploration            | X                                   |              |                     |                   |                       |                   | X          | X        | X                  |
| Guide outfitters and hunting   |                                     |              |                     |                   |                       |                   |            | X        |                    |

# **APPENDIX A WATER QUALITY EFFECTS**

**EXPATRIATE RESOURCES LTD.**  
**WOLVERINE ADVANCED EXPLORATION PROGRAM**  
**WATER QUALITY EFFECTS ASSESSMENT**

## **1 Discharge Locations**

Waste rock seepage and groundwater from underground exploration dewatering will be discharged to a naturally contained channel that shows no signs of surface flow. Shallow depressions along its length capture runoff from the hillsides above it, creating isolated puddles and small ponds (Photograph 1). The natural drainage direction of this channel is towards Go Creek, approximately 500 m away (Figure 1). Some discharged water is anticipated to return to groundwater before it reaches Go Creek. Expatriate cannot be assured that 100% of the discharged groundwater will return to groundwater before reaching the creek and is therefore applying for a licence to discharge this water.

Aggregate wash facility settling pond – water will be discharged to Go Creek near the Wolverine Airstrip.

## **2 Discharge Rates, Timing, and Frequency**

The maximum rate of discharge from the underground exploration is unknown at this time. Timing of the groundwater discharges will be governed by the operations schedule and progress of the underground development. This development schedule is estimated to take six months and groundwater discharges can be expected to occur as needed throughout the development phase. Mass balance models and monitoring data (as outlined below) will be used to calculate allowable discharge for the protection of the receiving environment.

The potential rate, timing, and frequency of discharge from the waste rock stockpile is presented in Table 1. This discharge is based on worst case conditions. The model assumes that all runoff reports as seepage from the stockpile. The annual average seepage is estimated at 0.08 L/s with a maximum of 0.27 L/s in the month of June.

The settling pond at the aggregate wash facility will be drained after sufficient aggregate has been developed to support the underground operations. Approximately 34 m<sup>3</sup> will be released. This will take about a day to complete. With an average discharge of 0.4 L/s, no downstream erosion or fish habitat disruption is anticipated from draining of the settling pond.

### **3 Discharge Duration**

Groundwater from the underground development – Groundwater will likely be intercepted throughout the development and will need to be discharged as it is intercepted. Approximately 6 months of groundwater discharges can be expected, concurrent with the development schedule. This may be extended, based on the groundwater conditions encountered during the operations.

Seepage from the waste rock stockpile - Seepage from the waste rock stockpile will continue until a decision is made regarding the permanent disposal of this material. The timeframe for these decisions will be established as part of the Company's Land Use Approvals under the Quartz Mining Act, which have a maximum life of 5 years.

Aggregate wash facility settling pond – this will be a one time release which will take about a day to complete.

### **4 Discharge Quality**

#### ***4.1 Groundwater from the Underground Development***

The groundwater intercepted by the underground workings is expected to be similar in quality to the surrounding streams. Since most of the development will be above the elevation of the ore body, groundwater infiltrating to the workings will not be influenced by the metal-rich conditions of the mineralized zone.

The low-flow (winter season) water quality data from Little Wolverine Creek was selected as a conservative estimate of water quality from the underground workings. This stream has higher levels of metals and dissolved solids than other creeks in the area, indicating a potential influence from the ore zone. Low flow samples were selected since these samples are likely to contain the largest relative proportion of groundwater (as compared to samples collected during freshet or summer periods). This “worst case” water quality is presented in Table 2. Concentrations of cadmium, copper, selenium, and zinc periodically exceed CCME Water Quality Objectives for the protection of aquatic life. All water quality parameters are within the MMLER discharge limits.

#### ***4.2 Waste Rock Seepage***

The decline and resulting waste rock will be developed mostly within the hanging wall of the deposit. Static tests on the wall rock indicate potential for acid generation. Two composite samples of hanging wall materials (rhyolites and argillites) were subjected to a 26 week humidity cell tests to determine the potential quality of seepage and runoff from this material. The results of these tests are presented in Table 3. Average concentrations from the two samples are presented as the predicted quality of waste rock seepage (Table 3). Based on these results, seepage may have elevated concentrations of aluminium, manganese, strontium, and zinc. Average concentrations are predicted to be within MMLER discharge criteria.

After 26 weeks, the column did not generate acid (pH 6.4). Static test results (Table 3) on this material indicate a potential for this material to generate acid given sufficient exposure time.

### **4.3 Aggregate Wash Facility Settling Pond**

This facility will utilize water from nearby Go Creek. Water quality of the discharge will be similar quality to the receiving environment. Aggregate wash is not expected to mobilize heavy metals and suspended solids will be removed to an acceptable level before the pond is drained.

## **5 Effects to Receiving Water Quality and Hydrology**

### **5.1 Aggregate Wash Facility Settling Pond**

The draining of this settling pond is unlikely to have a noticeable effect on the receiving environment. Water quality in the pond will be similar to water quality in Go Creek since this is the original source. Suspended solids will be removed to an acceptable level and the pond will be emptied to Go Creek over a one day period.

### **5.2 Waste Rock Seepage and Underground Development Dewatering**

Potential effects to waterways as result of this activity include alterations to natural hydrological regime and changes to water quality. Impacts to water quality were modelled using a simple arithmetic model that theoretically superimposes discharge quality and quantity on the background environment. The following parameters were used in construction of the model:

Groundwater quality ( $G_Q$ ) – assumed to be equivalent to low flow water quality in Wolverine Creek. This is a conservative assumption since water in Wolverine Creek shows signs of being influenced by the ore body (elevated zinc and selenium) and the groundwater to be discharged from the mine will be from above the ore zone and therefore not influenced by it.

Waste rock seepage quality ( $S_Q$ ) – assumed to be the average quality of hanging wall composite humidity cell tests.

Waste rock seepage volume ( $S_F$ ) – as presented in Table 1 this was calculated using the surface area of the stockpile and regional runoff distribution estimates (Gartner Lee Ltd., 2001). This is a conservative estimate since it does not consider the effects of the till cover proposed for the stockpile.

Receiving environment water quality ( $B_Q$ ) – based on the water quality database for site W16, Go Creek above Hawkowl Creek. This is assumed to be a reasonable estimate of water quality near the discharge point. There are no tributaries to Go Creek between the discharge point and this sample station.

Receiving environment flow volume ( $B_F$ ) – based on a regional hydrological assessment prepared by Gartner Lee Ltd. (2001). Site W16 was selected as the most appropriate location for an estimate of receiving environment flows.

Initially, waste rock seepage was superimposed on the receiving environment using the following model:

$$B_Q' = ((S_F \times S_Q) + (B_F \times B_Q)) / (B_F + S_F)$$

Where  $B_Q'$  is the water quality of the receiving environment (Go Creek) following mixing with waste rock seepage. The results of this model are presented in Table 4. Based on this model, waste rock seepage is unlikely to result in measurable changes to water quality in Go Creek. Flows in Go Creek are, on average, 1500 times the predicted seepage volumes. Cadmium concentrations are reported to naturally exceed the CCME guidelines in Go Creek and therefore exceeded also in the results of the model. However, this is an artefact of the detection limits in the database. Cadmium has never been detected in the Go Creek samples and detection limits have been as low as 0.00005 mg/L. In addition, one of the humidity cells also showed no detectable cadmium concentrations in 26 weeks of sampling.

This model is extremely conservative as it does not consider the effects of the till cover on the waste rock dump or the attenuation of seepage as it moves 500 m through a naturally dry channel before entering Go Creek.

The resulting background water quality ( $B_Q'$ ) was then input to the following model:

$$G_F = ((E_Q \times B_F) - (B_Q' \times B_F)) / (G_Q - E_Q)$$

Where  $G_F$  is the groundwater that could be discharged from the underground workings to Go Creek (including waste rock seepage) without exceeding CCME water quality guidelines for protection of aquatic life ("maximum discharge"). The model was applied to copper, lead, selenium, and zinc since these metals were reported to exceed CCME guidelines in the "worst case" groundwater quality. The results of this model are shown in Table 5. This model indicates that groundwater discharges from the underground workings could average 400 m<sup>3</sup>/day in February and as high as 7220 m<sup>3</sup>/day in June without exceeding CCME water quality guidelines for selenium. The assimilative capacity of the receiving environment is higher for other metals; a minimum of 578 m<sup>3</sup>/day for zinc, over 1000 m<sup>3</sup>/day for lead and 2500 m<sup>3</sup>/day for copper. It is unlikely that dewatering operations at Wolverine will exceed these volumes.

Because CCME guidelines for cadmium are lower than the detection limits available when the water samples were analyzed, the water quality database shows the receiving environment as exceeding CCME guidelines. For this reason, the model presented above could not be applied to cadmium. To estimate the "maximum discharge" for protection of the cadmium guideline, a dilution ratio of 65:1 was calculated based on the "worst case" groundwater quality data. This assumes that there is no measurable level of cadmium in the receiving environment. This model indicates a "maximum discharge" of 35 m<sup>3</sup>/day during the winter months and up to 628 m<sup>3</sup>/day during freshet would protect the cadmium guideline. The basis for limitation to dewatering based on cadmium concentrations in groundwater will be investigated. This model assumes an average concentration of 0.013 mg/L in discharged groundwater. It is unlikely that the groundwater in the dewatering will have these levels since it will come primarily from outside the influence of the ore zone.

The “maximum discharge” values estimated by these models are conservative in that they assume “worst case” groundwater quality and do not consider potential physical and chemical attenuation of the discharged groundwater as it travels the 500m channel before entering Go Creek.

Impacts to the hydrological regime were modelled by superimposing maximum discharge from the underground (Table 5) on the average stream flows at the discharge point (Gartner Lee, 2001). The results of this model are shown in Table 5. If maximum discharge to limit cadmium were required during any month of the dewatering program, flows in Go Creek above Hawkowl Creek would increase by 2%. If maximum discharge to limit selenium were required during any month of the dewatering program, flows in Go Creek above Hawkowl Creek would increase by 18%. This is very conservative estimate since it is unlikely that a maximum discharge would be required during the program.

In conclusion, impacts to water quality in Go Creek resulting from waste rock seepage are not likely to be detectable. Stream flows in Go Creek are predicted to be 1500 times the maximum seepage volumes from the waste rock stockpile. Dewatering operations are not likely to result in negative effects to water quality in Go Creek. During the winter low flow period, up to 35 m<sup>3</sup>/day can be discharged from the workings without exceeding CCME water quality criteria for cadmium and up 400 m<sup>3</sup>/day without exceeding the guideline for selenium in the receiving environment (Go Creek). This “maximum discharge” is considerably higher during the summer months when there is more flow in Go Creek. Any potential effects to water quality in Go Creek from a “maximum discharge” would be spatially isolated since Hawkowl Creek (approximately 2 km from the discharge point) increases the flow in Go Creek by almost 100%, thereby doubling the assimilative capacity of the stream.

### **5.3 *Blasting Residues***

During consultation, regulators expressed concerns regarding the potential for contamination of the receiving environment with blasting residues. Studies have shown that the undetonated ammonium nitrate has the potential to contaminate mine discharges with nitrogen. Undetonated material is present due to one of the following conditions (Cominco, 1997. Kudz Ze Kayah Water Licence Application):

- Waste - This is normally the largest source of nitrate loss and is the easiest to control. The personnel handling the ammonium nitrate based explosives must be trained to take care to prevent spillage during the loading operation
- Improper selection - If a dry product such as ANFO is used in a wet hole, the product will readily dissolve in the water resulting in loss of nitrate to the rock or groundwater.
- Site peculiarities - Rock conditions can have an effect on the migration of explosives into cracks surrounding the bore holes. This explosive may not detonate nor burn if it is too detached from the loaded column. This residual explosive may remain with the blasted rock, harmless as an explosive, but still a contributor to nitrate load in waste rock and tailings.

Good explosive handling and selection practices will provide the best opportunity for minimizing ammonium nitrate loss. The mining contractor will assume primary responsibility for maintaining good management practices.

Expatriate developed a model to assess the risk of ammonia contamination, based on work by Ferguson and Leask (1988). The results of this model are presented in Table 6. This same approach was used by Cominco (1997) in the Kudz Ze Kayah Water Licence Application

Ferguson and Leask (1988) developed a model of nitrogen loss from explosives based on studies of nitrogen loss from coal mines in south-eastern British Columbia. The Ferguson and Leask model assumes that for mines using >20% slurry, the nitrogen loss is 0.94% for ANFO and 5.1% for slurry.

Since the completion of Ferguson and Leask's studies, "slurry" explosives have been replaced with emulsions. Emulsions are used under the wet conditions where slurry formerly was used. Therefore, the rate of nitrogen loss from emulsion is assumed similar to the nitrogen loss rate from slurry. Based on information from the manufacturer, emulsion contains 21.7% nitrogen and ANFO contains 34.6% nitrogen.

Explosive consumption for the Wolverine advanced exploration program is expected to be approximately 73,700 kg of ANFO and 18,800 kg of emulsion (BGC, 2001). Based on this consumption, nitrogen losses are expected to be approximately 240 kg from ANFO and 208 kg from emulsion. These losses were distributed evenly over the 21 weeks of active mining anticipated during the program, resulting in an estimated loss of approximately 3 kg/day. Three kilograms of nitrogen per day reporting directly to Go Creek during low flows (February) would result in an increase of 0.135 mg/L in nitrogen species in the Creek. This is a very conservative estimate since it does not consider the potential attenuation of nitrogen species in the discharge channel before entering Go Creek. Including average nitrogen levels in the receiving environment (0.078 mg/L) cumulative nitrogen loadings are estimated at 0.214 mg/L, well below the CCME guideline for ammonia of 1.37 mg/L. Based on this analysis, the risk of measurable blasting residue contamination in the receiving environment is very low.

#### ***5.4 Long Term Drainage from the Mine Adit***

The potential for long term, passive drainage from the mine workings is unlikely to be an environmental concern. All mine development will take place about 125 m below the elevation of the portal. The stratigraphy of the host rock dips away from the mine entrance, decreasing the potential for artesian flows at the portal. Since the area around the mine will be dewatered during the underground exploration program, any passive drainage that did occur would be limited to the recharge rates of the affected aquifer. Given the low precipitation values in the region, this is likely to be a relatively slow process. Water quality of this drainage should be similar to water quality encountered during the dewatering exercise, although it may be influenced by the combination of wall rock geochemistry and the alkaline properties of the shotcrete on the mine walls. Humidity cell testwork (Table 3) indicates slow reaction time for sulphide minerals in the hanging wall. Shotcrete application during the underground development program will limit the exposure time of wall rock and therefore the potential for acid generation. These humidity cells also showed that after 26 weeks of exposure, average test water quality was within MMLER limits.

Should passive drainage occur following the underground exploration program, it would be allowed to flow naturally into the wetland area at the base of the hill. This area feeds Little Wolverine Creek, a stream with naturally elevated levels of cadmium, zinc, and

selenium and no fish. The wetland area would provide attenuation capacity for heavy metals in the drainage. Any metals in the drainage that pass the wetland filter are unlikely to influence the biota of the stream since they are naturally adapted to high metals concentrations.

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**Table 1 - Worst case seepage volumes from waste rock stockpile**

| Surface area of stockpile (m <sup>2</sup> )                    | 7500  |       |       |       |       |       |       |       |       |       |       |       |              |                |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------|----------------|
|  | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Annual Total |                |
| Runoff distribution (mm) *                                     | 7.9   | 6.1   | 6.1   | 6.1   | 7.3   | 47.8  | 93.2  | 59.0  | 32.3  | 27.7  | 24.3  | 13.7  | 10.0         | 335.2          |
| Worst case discharge volumes from waste rock stockpile** (L/s) | 0.023 | 0.017 | 0.017 | 0.021 | 0.136 | 0.265 | 0.168 | 0.092 | 0.079 | 0.069 | 0.039 | 0.028 | 0.080        | Annual Average |

\*Gartner Lee, 2001

\*\* This model assumes no till cover for the waste rock stockpile, all runoff results as seepage from the stockpile.

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**Table 2 - "Worst Case" water quality of groundwater discharged from the underground**

| Date                       | 95/10/3 | 96/03/25 | 96/11/26 | 97/05/28 | 01/01/14 | Ave           | Max           | Min           | CCME Objectives* | MMLER Discharge Criteria** |
|----------------------------|---------|----------|----------|----------|----------|---------------|---------------|---------------|------------------|----------------------------|
| Total Dissolved Solids     | 161     | 173      | 138      | 128      | 167      | 153           | 173           | 128           |                  |                            |
| Hardness CaCO3             | 121     |          | 129      | 110      | 143      | 126           | 143           | 110           |                  |                            |
| pH                         | 8.2     | 7.4      | 7.9      | 7.67     | 8.25     | 7.88          | 8.25          | 7.40          |                  | 6.00                       |
| Total Suspended Solids     |         |          |          | <1       | <3       | N.D.          |               |               |                  |                            |
| Turbidity (NTU)            | <1      |          | 13.5     | 0.6      | 0.2      | 4.8           | 13.5          | 0.2           |                  |                            |
| Alkalinity-Total CaCO3     | 112     | 93       | 108      | 88       | 108      | 102           | 112           | 88            |                  |                            |
| Chloride Cl                |         | < 0.5    | <0.5     | <0.5     | <0.5     | N.D.          |               |               |                  |                            |
| Fluoride F                 |         | < 1.     | 0.11     | 0.11     | 0.09     | 0.10          | 0.11          | 0.09          |                  |                            |
| Sulphate SO4               | 28.2    | 35       | 30       | 27       | 32       | 30            | 35            | 27            |                  |                            |
| Ammonia Nitrogen N         | <0.05   |          |          |          | <0.005   | N.D.          |               |               |                  |                            |
| Nitrate Nitrogen N         | <0.2    | 0.3      | 0.169    | 0.136    | 0.2      | 0.20          | 0.30          | 0.14          |                  |                            |
| Nitrite Nitrogen N         | <0.003  | < 0.5    | <0.001   | 0.001    | <0.001   | 0.001         | 0.001         | 0.001         |                  |                            |
| Nitrite/Nitrate Nitrogen N |         |          |          | 0.137    |          | 0.137         | 0.137         | 0.137         |                  |                            |
| <b>Total Metals</b>        |         |          |          |          |          |               |               |               |                  |                            |
| Aluminum T-Al              | 0.06    | < 0.01   | 0.057    | 0.02     | <0.005   | 0.046         | 0.060         | 0.020         | 0.100            |                            |
| Antimony T-Sb              | <0.02   | < 0.02   | 0.0002   | 0.00018  | 0.0001   | 0.0002        | 0.0002        | 0.0001        |                  |                            |
| Arsenic T-As               | <0.02   | < 0.02   | 0.0003   | 0.00023  | 0.0002   | 0.0002        | 0.0003        | 0.0002        | 0.005            | 0.5                        |
| Barium T-Ba                | 0.126   | 0.133    | 0.12     | 0.116    | 0.13     | 0.13          | 0.13          | 0.12          |                  |                            |
| Beryllium T-Be             | <0.0002 | < 0.0002 | <0.005   | <0.0005  | <0.001   | N.D.          |               |               |                  |                            |
| Bismuth T-Bi               | <0.02   | < 0.02   | <0.1     | <0.0005  | <0.1     | N.D.          |               |               |                  |                            |
| Boron T-B                  |         |          | <0.1     | <0.001   | <0.1     | N.D.          |               |               |                  |                            |
| Cadmium T-Cd               | 0.0013  | 0.0011   | 0.0016   | 0.00129  | 0.00124  | <b>0.0013</b> | <b>0.0016</b> | <b>0.0011</b> | 0.00004          |                            |
| Calcium T-Ca               | 36.9    | 37.9     | 38.6     | 31.4     | 43.8     | 37.7          | 43.8          | 31.4          |                  |                            |
| Chromium T-Cr              | 0.001   | < 0.001  | <0.001   | <0.0001  | <0.0005  | 0.001         | 0.001         | 0.001         | 0.009            |                            |
| Cobalt T-Co                | <0.001  | < 0.001  | <0.001   | <0.0001  | <0.0001  | N.D.          |               |               |                  |                            |
| Copper T-Cu                | 0.006   | < 0.002  | 0.002    | 0.0022   | 0.0005   | 0.0027        | <b>0.0060</b> | 0.0005        | 0.003            | 0.3                        |
| Iron T-Fe                  | 0.024   | 0.008    | 0.17     | 0.03     | <0.03    | 0.058         | 0.170         | 0.008         |                  |                            |
| Lead T-Pb                  | 0.006   | < 0.005  | <0.001   | <0.00005 | <0.00005 |               | <b>0.006</b>  | N.D.          | 0.004            | 0.2                        |
| Lithium T-Li               | 0.005   | < 0.002  | <0.01    | <0.001   |          | 0.005         | 0.005         | 0.005         |                  |                            |
| Magnesium T-Mg             | 7.81    | 8.11     | 8.92     | 7.23     | 9.2      | 8.25          | 9.20          | 7.23          |                  |                            |
| Manganese T-Mn             | 0.0015  | 0.0041   | 0.021    | 0.00264  | <0.005   | 0.0073        | 0.0210        | 0.0015        |                  |                            |
| Mercury T-Hg               | <0.001  |          | <0.00005 | <0.00005 | <0.00002 | N.D.          |               |               | 0.0001           |                            |
| Molybdenum T-Mo            | <0.005  | < 0.005  | <0.001   | 0.00069  | <0.03    | 0.0007        | 0.0007        | 0.0007        | 0.0730           |                            |
| Nickel T-Ni                | 0.005   | < 0.002  | 0.004    | 0.0048   | 0.002    | 0.0040        | 0.0050        | 0.0020        | 0.110            | 0.5                        |
| Phosphorus T-P             | <0.06   | < 0.06   | <0.3     | <0.3     |          | N.D.          |               |               |                  |                            |
| Potassium T-K              | 1       | 0.6      | 0.86     | <2       | <2       | 0.82          | 1.00          | 0.60          |                  |                            |
| Selenium T-Se              | <0.02   | < 0.02   | 0.0032   | 0.004    | 0.004    | <b>0.004</b>  | <b>0.004</b>  | <b>0.003</b>  | 0.001            |                            |
| Silicon T-Si               | 3.75    | 3.74     | 3.12     | 2.94     | 2.97     | 3.30          | 3.75          | 2.94          |                  |                            |
| Silver T-Ag                | <0.01   | < 0.001  | <0.0001  | <0.00001 | <0.00001 | N.D.          |               |               | 0.0001           |                            |
| Sodium T-Na                | 0.83    | 0.82     | 0.73     | <2       | <2       | 0.79          | 0.83          | 0.73          |                  |                            |
| Strontium T-Sr             | 0.11    | 0.117    | 0.122    | 0.101    | 0.132    | 0.12          | 0.13          | 0.10          |                  |                            |
| Thallium T-Tl              | <0.005  |          | <0.1     | <0.00005 | <0.00005 | N.D.          |               |               | 0.0008           |                            |
| Tin T-Sn                   | <0.005  | < 0.005  | <0.03    | <0.0001  |          | N.D.          |               |               |                  |                            |
| Titanium T-Ti              | <0.001  | < 0.001  | <0.01    | <0.01    | <0.01    | N.D.          |               |               |                  |                            |
| Uranium T-U                | <0.06   | < 0.06   |          | 0.00118  | 0.0016   | 0.0014        | 0.0016        | 0.0012        |                  |                            |
| Vanadium T-V               | 0.004   | < 0.002  | <0.03    | <0.001   | <0.03    | 0.004         | 0.004         | 0.004         |                  |                            |
| Zinc T-Zn                  | 0.113   | 0.055    | 0.143    | 0.158    | 0.109    | <b>0.131</b>  | <b>0.158</b>  | <b>0.109</b>  | 0.030            | 0.5                        |

**Note: all concentrations in mg/L unless otherwise noted.**

\* Canadian Council of Ministers of the Environment, 1999. Canadian Environmental Quality Guidelines

\*\* Metal Mining Liquid Effluent Regulations.

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**Table 3 - Results of Hanging Wall Humidity Cell Waste Characterization Testwork**

|              | Cell HC-1 |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        | Average of Humidity Cell Tests* | MMLER Criteria (average concentration) |
|--------------|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------------------------|--|
|              | 0.18      | 0.11   | 0.08   | 0.10   | 0.06   | 0.12   | 0.07   | 0.05   | <0.05  | 0.11   | 0.15   | 0.12   | 0.07   | 0.12   | 0.12   | 0.12   | 0.07   | 0.12   | 0.12   | 0.07   | 0.12   |                                 |  |
| Al           | <0.05     | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  |                                 |  |
| Sb           | <0.03     | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  | <0.03  |                                 |  |
| As           | 0.063     | 0.028  | 0.021  | 0.018  | 0.017  | 0.016  | 0.013  | 0.013  | 0.012  | 0.011  | 0.012  | 0.011  | 0.008  | 0.011  | 0.010  | 0.020  |        |        |        |        |        |                                 |  |
| Ba           | <0.001    | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |                                 |  |
| Be           | <0.1      | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   |                                 |  |
| Bi           | 0.24      | 0.30   | 0.26   | 0.36   | 0.35   | 0.39   | 0.28   | 0.28   | 0.38   | 0.31   | 0.41   | 0.30   | 0.34   | 0.22   | 0.36   | 0.308  |        |        |        |        |        |                                 |  |
| B            | <0.005    | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |                                 |  |
| Cd           | 37.79     | 26.72  | 21.54  | 19.17  | 17.63  | 17.08  | 14.25  | 14.47  | 13.52  | 13.13  | 13.50  | 14.21  | 9.64   | 12.79  | 11.78  | 18.672 |        |        |        |        |        |                                 |  |
| Ca           | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Cr           | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Co           | <0.01     | <0.01  | 0.02   | 0.02   | 0.02   | 0.02   | 0.01   | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Cu           | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Fe           | <0.05     | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  |                                 |  |
| Pb           | <0.02     | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  |                                 |  |
| Li           | 2.8       | 1.8    | 1.7    | 1.6    | 1.5    | 1.5    | 1.7    | 1.6    | 1.2    | 0.9    | 1.3    | 1.4    | 1.0    | 0.9    | 0.9    | 2.753  |        |        |        |        |        |                                 |  |
| Mg           | 0.404     | 0.574  | 0.673  | 0.681  | 0.695  | 0.643  | 0.549  | 0.497  | 0.396  | 0.380  | 0.439  | 0.444  | 0.282  | 0.328  | 0.277  | 0.430  |        |        |        |        |        |                                 |  |
| Mn           | <0.02     | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  |                                 |  |
| Hg           | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Mo           | <0.1      | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   |                                 |  |
| Ni           | <0.1      | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   |                                 |  |
| P            | 3         | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     | <2     |                                 |  |
| K            | <0.05     | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  | <0.05  |                                 |  |
| Se           | 0.46      | 0.18   | 0.12   | 0.28   | 0.09   | 0.22   | 0.12   | 0.11   | 0.10   | 0.11   | 0.29   | 0.22   | 0.17   | 0.20   | 0.25   | 0.213  |        |        |        |        |        |                                 |  |
| Si           | <0.02     | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  | <0.02  |                                 |  |
| Ag           | 6         | 1.5    | 1.0    | 1.0    | 1.0    | 0.9    | 1.0    | 0.7    | 0.9    | 1.4    | 0.6    | <0.2   | 1.2    | 0.4    | 0.6    | 1.522  |        |        |        |        |        |                                 |  |
| Na           | 0.221     | 0.162  | 0.127  | 0.112  | 0.105  | 0.101  | 0.094  | 0.088  | 0.079  | 0.073  | 0.081  | 0.081  | 0.046  | 0.073  | 0.067  | 0.107  |        |        |        |        |        |                                 |  |
| Sr           | <0.2      | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   | <0.2   |                                 |  |
| Tl           | <0.1      | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   |                                 |  |
| Sn           | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Ti           | <0.1      | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   | <0.1   |                                 |  |
| W            | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| V            | <0.01     | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  | <0.01  |                                 |  |
| Zn           | 0.084     | 0.100  | 0.103  | 0.107  | 0.097  | 0.114  | 0.067  | 0.063  | 0.057  | 0.075  | 0.064  | 0.057  | 0.065  | 0.053  | 0.022  | 0.394  |        |        |        |        |        |                                 |  |
| pH           | 7.4       | 7.3    | 6.9    | 6.9    | 7.0    | 7.0    | 6.9    | 6.6    | 6.9    | 6.5    | 6.6    | 6.4    | 6.7    | 6.7    | 6.4    | 6.71   |        |        |        |        |        |                                 |  |
| Conductivity | 263       | 160    | 124    | 111    | 97     | 100    | 93     | 88     | 81     | 69     | 69     | 69     | 53     | 66     | 59     | 136    |        |        |        |        |        |                                 |  |
| Sulphate     | 95        | 66     | 49     | 45     | 34     | 30     | 33     | 30     | 29     | 29     | 31     | 30     | 22     | 26     | 28     | 57.11  |        |        |        |        |        |                                 |  |

N.D. - not detected

Note: all concentrations in mg/L

\* if 50% or greater of analyses did not detect a measurable concentration, non-detects are assumed to have a concentration equivalent to 1/2 of detection limit in calculation of the average.

\* if greater than 50% of analyses showed measurable concentrations, non-detects are assumed to have a concentration equivalent to the detection limit in calculation of the average



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**Table 4 - Water quality in the receiving environment after release of waste rock seepage**

|                   |          | Jan   | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
|-------------------|----------|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| W16 (L/s)         |          | 32.82   | 26.35    | 26.70    | 33.90    | 217.75   | 472.35   | 242.67   | 130.80   | 134.96   | 88.82    | 51.18    | 39.03    |
| WR Seepage (L/s)  |          | 0.023   | 0.017    | 0.017    | 0.021    | 0.136    | 0.265    | 0.168    | 0.092    | 0.079    | 0.069    | 0.039    | 0.028    |
| Dilution Ratio    |          | 1458  | 1508     | 1545     | 1640     | 1600     | 1781     | 1446     | 1425     | 1715     | 1284     | 1315     | 1378     |
|                   |          | Resulting concentration in receiving environment (mg/L) |          |          |          |          |          |          |          |          |          |          |          |
| Background(mg/L)* |          | CCME Guideline** (mg/L)                                 |          |          |          |          |          |          |          |          |          |          |          |
| Aluminum T-Al     | 0.017    | 0.017   | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    | 0.017    |
| Arsenic T-As      | 0.00201  | 0.00201   | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  | 0.00201  |
| Cadmium T-Cd      | 0.000025 | 0.000029  | 0.000029 | 0.000029 | 0.000029 | 0.000029 | 0.000029 | 0.000029 | 0.000029 | 0.000029 | 0.000029 | 0.000030 | 0.000029 |
| Copper T-Cu       | 0.001    | 0.001   | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    | 0.001    |
| Lead T-Pb         | 0.0001   | 0.0002  | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   | 0.0002   |
| Mercury T-Hg      | 0.00001  | 0.00002   | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  | 0.00002  |
| Nickel T-Ni       | 0.0043   | 0.0044  | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   | 0.0044   |
| Selenium T-Se     | 0.0005   | 0.0005  | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   | 0.0005   |
| Silver T-Ag       | 0.00002  | 0.00003   | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  | 0.00003  |
| Thallium T-Tl     | 0.0005   | 0.0006  | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   | 0.0006   |
| Zinc T-Zn         | 0.004    | 0.004   | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    | 0.004    |

\* where a particular element has never been detected, the background concentration is assumed to be 1/2 of the most frequently reported detection limit.

\*\* where appropriate CCME guidelines have been calculated based on the average hardness (CaCO<sub>3</sub> equiv.) of the receiving environment (63.5 mg/L).

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**Table 5 - Maximum discharge to protect receiving environment**

|   | Jan   | Feb   | Mar   | Apr   | May    | Jun    | Jul    | Aug    | Sep    | Oct   | Nov   | Dec   |      |
|---|---|-------|-------|-------|--------|--------|--------|--------|--------|-------|-------|-------|------|
| W16 (L/s)                               | 32.82   | 26.35 | 26.70 | 33.90 | 217.75 | 472.35 | 242.67 | 130.80 | 134.96 | 88.82 | 51.18 | 39.03 |      |
| Maximum Discharge (m <sup>3</sup> /day) | <b>Discharge Required to Elevate Receiving Environment Concentrations to CCME Guidelines for the Protection of Aquatic Life</b> |       |       |       |        |        |        |        |        |       |       |       |      |
|   | Copper  | 3088  | 2482  | 2516  | 3199   | 44658  | 22829  | 12300  | 12750  | 8327  | 4802  | 3667  |      |
|   | Lead  | 1302  | 1045  | 1059  | 1346   | 8642   | 18763  | 9623   | 5186   | 5360  | 3518  | 2028  | 1547 |
|   | Selenium  | 499   | 401   | 407   | 517    | 3320   | 7229   | 3686   | 1985   | 2063  | 1342  | 774   | 592  |
|   | Zinc  | 719   | 578   | 585   | 744    | 4776   | 10370  | 5317   | 2865   | 2962  | 1943  | 1120  | 855  |
| Cadmium***                              | 44  | 35    | 35    | 45    | 289    | 628    | 323    | 174    | 179    | 118   | 66    | 52    |      |

\*based on detection limit, has not been detected in these waters

\*\* based on one sample, all other samples showed no detectable concentrations of lead in these waters

\*\*\* model for maximum discharge for cadmium based on 65:1 dilution of discharged waters, assumes no measurable concentration in the receiving environment

|  |     | Potential effects to stream flow |     |     |     |     |     |     |     |     |     |     |  |
|--|-----|----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Monthly average streamflow (L/s)                     | 33  | 26                               | 27  | 34  | 218 | 472 | 243 | 131 | 135 | 89  | 51  | 39  |  |
| Streamflow during discharge, selenium limiting (L/s) | 39  | 31                               | 31  | 40  | 256 | 556 | 285 | 154 | 159 | 104 | 60  | 46  |  |
| % increase   | 18% | 18%                              | 15% | 18% | 18% | 18% | 18% | 18% | 18% | 17% | 18% | 18% |  |
| Streamflow during discharge, cadmium limiting (L/s)  | 33  | 27                               | 27  | 34  | 221 | 480 | 246 | 133 | 137 | 90  | 52  | 40  |  |
| % increase   | 2%  | 2%                               | 2%  | 2%  | 2%  | 2%  | 2%  | 2%  | 2%  | 2%  | 2%  | 2%  |  |

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**Table 6 - Estimated nitrogen loading to receiving environment from blasting residues.**

|   | Explosive consumption (kg) | % Nitrogen | % Loss | Total nitrogen losses (kg) |
|---|----------------------------|------------|--------|----------------------------|
| ANFO  | 73718                      | 34.6       | 0.94   | 240                        |
| Emulsion  | 18778                      | 21.7       | 5.1    | 208                        |
| Total (kg)=   |                            |            |        | 448                        |
| Period of active mining (days)  |                            |            |        | 147                        |
| Loss N per day (kg)=  |                            |            |        | 3.0                        |
| Daily cumulative flow (litres) in Go Creek (W16) during low flows (February @ 26 L/s)=      |                            |            |        |                            |
| Estimated increase in nitrogen species concentrations (mg/L)=                               |                            |            |        | 2246400                    |
| Estimated increase in nitrogen species concentrations (mg/L)=                               |                            |            |        | 0.136                      |
| Cumulative average concentrations of nitrogen species in the receiving environment (mg/L) = |                            |            |        |                            |
| Cumulative nitrogen loading (mg/L) =  |                            |            |        | 0.078                      |
| Cumulative nitrogen loading (mg/L) =  |                            |            |        | 0.214                      |

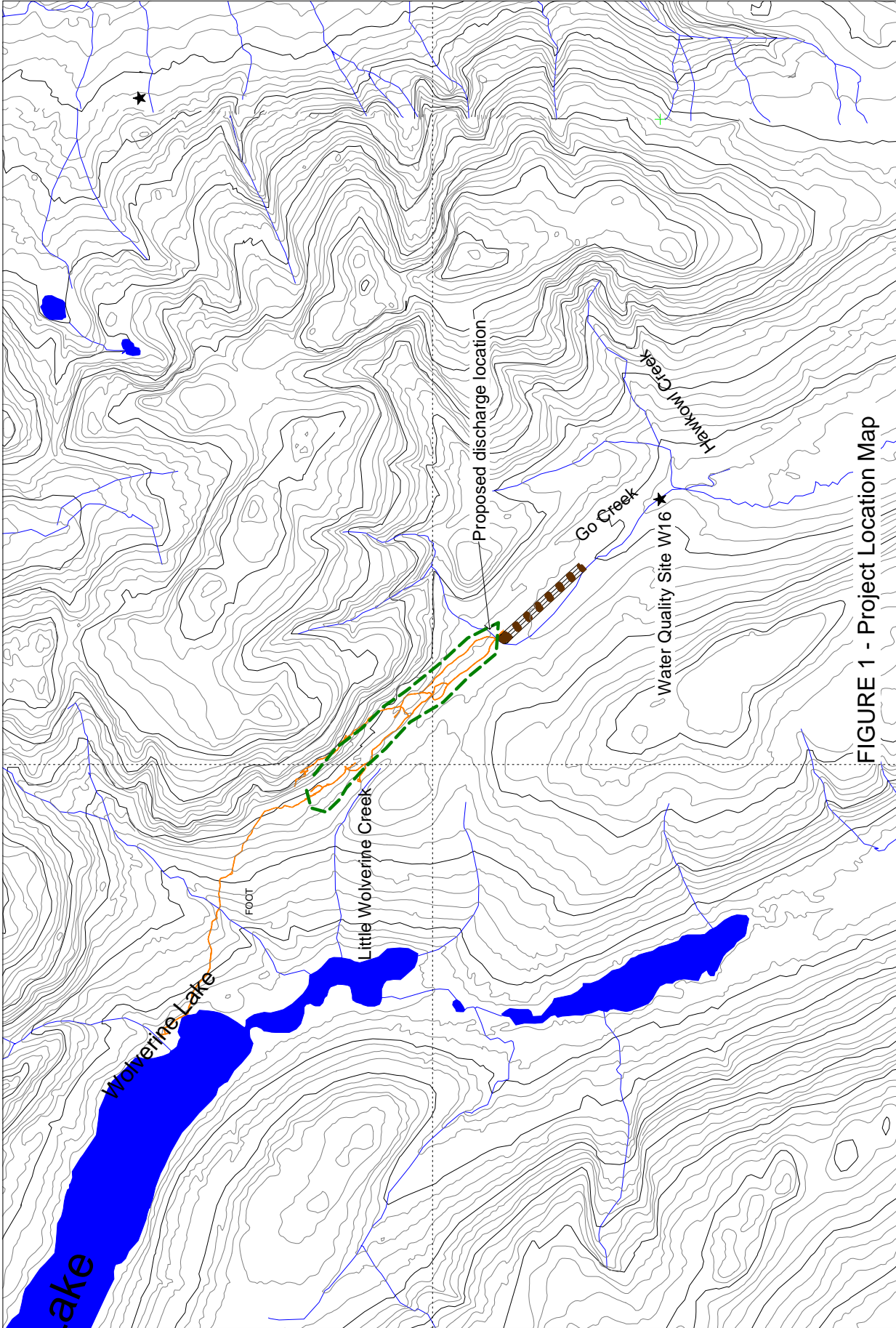
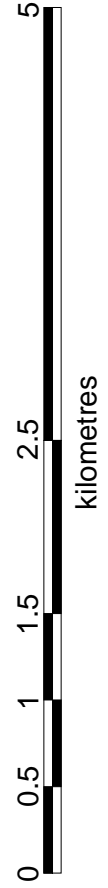
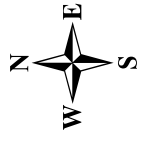


FIGURE 1 - Project Location Map

Scale: 1:50,000



- - - Project Area
- Exploration Roads
- Wolverine Airstrip



Contour Interval: 20m



Photograph 1 – Channel proposed for groundwater discharge during test-mining dewatering operations

**APPENDIX B  
SPILL CONTINGENCY AND  
EMERGENCY RESPONSE PLAN**

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**EXPATRIATE RESOURCES LTD.**

**SPILL CONTINGENCY PLAN**

**October, 2004**

**EXPATRIATE RESOURCES LTD.**

**SPILL CONTINGENCY PLAN**

**WOLVERINE PROJECT**

Approved by: \_\_\_\_\_

Jason Dunning, VP Exploration  
Expatriate Resources Ltd.

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Reviewed and approved by:

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Project Manager (TBA)

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# 1 INTRODUCTION

Part II of the Yukon Environmental Protection Act requires spills to be reported and cleaned up promptly. Part II places far-reaching obligations on Expatriate Resources Ltd. and individuals to report and clean up spills. It is Expatriate's responsibility to show reasonable care by ensuring that records of inspection and maintenance of equipment are kept, employees receive adequate spill training and equipment and procedures are available to respond to spills.

Section 133 of Part II requires that a person having control of the pollutant, or every person who spills or causes a spill, which is likely to cause an adverse effect should immediately notify:

- a) The Environmental Protection Officer through calling the Yukon Oil Spill Hot Line: 867-667-7244.
- b) Any member of the public who may be adversely affected by the spill.
- c) The "owner" of the spilled substance.
- d) The person who has control of the spilled substance.

In addition, employees of public authority who know of a spill are also required to notify the Environmental Protection Officer through the Yukon Oil Spill Hot Line: 867-667-7244.

Section 133 defines a spill as a release of a substance into the natural environment, from or out of a structure, vehicle or other container that is abnormal in quantity in light of all circumstances of the discharge.

In addition to the Yukon Environmental Protection Act notification requirement, the Fisheries Act, Transportation of Dangerous Goods Act and the Canadian Environmental Protection Act all require that a person having control of the pollutant, or every person who causes a spill, which is likely to cause an adverse effect should immediately report the event to the respective authorities and other various government agencies.

All emergencies will require immediate action as necessary, with priorities of:

- 1. protecting lives and preventing injury;
- 2. protecting the environment;
- 3. protecting the property; and
- 4. minimizing disruption or interference with Expatriate's business activities.

This manual is intended to provide a guide in the event of a chemical spill. The areas of responsibility of the various personnel who will be directly involved are outlined to prevent doubt as to what each person should be doing at the time of an emergency.

This procedure should be reviewed twice per year by the Project Manager in consultation with the President. The review date should be recorded and kept on file.

### **1.1 The CANUTEC Guide to Initial Emergency Response**

This guide was developed in 1986 to provide information and advice to persons responding to emergency situations involving hazardous materials. It was developed through the Transportation of Dangerous Goods Act primarily for first responder, i.e., fire departments and police. The guide should only be used by those familiar with it and there is also a 24-hour hot line at which more information can be made available at 613-966-6666. The guide has many hazardous materials listed in alphabetical order (orange section) and by ON number (green section). Once you have selected the product of concern, there is a corresponding guide number. This guide number can be found in the yellow section. The guide has grouped all hazardous materials under 38 classes in which potential hazards and emergency action is easily found.

### **1.2 Reporting of Spills**

Workers are to report all minor spills to their supervisor who will, in turn, report to the Project Geologist. Minor spills are those that can be easily and safely handled by those people in the area, and generally by the person(s) initiating the spill. These spills are generally within confined areas, are small in nature, have minimal health and safety risks, and, if outside, have no chance of migrating into the environment.

The reason for this type of reporting schedule is to document spills with the intent of incident reduction through proper follow-up and remedial measures.

### **1.3 Small Quantity Exemptions**

The Yukon Territory does not yet have a small quantity exemption specifically related to the spill regulation. The Saskatchewan and British Columbia governments have also developed lists of small quantity exemptions which can also be used for reported decision making (see Appendix J).

### **1.4 Major Spills**

These would be spills of greater potential than minor spills, which exceed any small quantity exemption, have potential health and safety risks and/or are questionable. When in doubt, treat the spill as major. The number to call is 1-867-667-7244 (the Yukon Oil Spill Hot Line). The minimum information that must be made available during this call is as follows:

- (a) Your name.
- (b) Company particulars.
- (c) Name of the spilled material.
- (d) Cause of spill.

- (d) Location of spilled material.
- (e) Quantity of spilled material.
- (f) Time of spill.
- (g) Spill impact.
- (h) Details of any action taken at the site of the spill.

To assist in ensuring that all the appropriate information is collected prior to the reporting of a spill, an Emergency Action Reporting Procedures (Appendix B) is to be followed by the Project Manager or his/her designate. This procedure, together with information derived from Appendix D, will be initiated during the physical inspection of the spill site and completed through the control group discussions. This can also be used as a guide for the detailed spill report that will be written by the Project Manager.

### **1.5 Documentation of Spills**

All spills will be documented in a spill log book located at the Camp. The Project Manager or his/her designates has the responsibility of preparing a detailed report of all major spills. These reports will include all details of the spill, all contact with government officials and all remedial action taken. These reports will be circulated within the Company and filed in the Corporate Environmental Department's Central filing system.

### **1.6 Investigation Response**

DIAND is the regulatory body of the government that would investigate a hazardous material spill site. The Environmental Protection Officer requesting permission to investigate a spill will follow the established procedure for initial contact at the Camp's Main Office. Once the Project Geologist has been informed that there are environmental official(s) requesting permission to enter the property, he/she will contact the Project Manager or his/her designate who will meet them. Here, the objective of the inspection will be heard.

If they are here to investigate a spill then the appropriate individuals will be contacted. The Project Manager will accompany the official(s) throughout the investigation and keep notes of all details.

## **2 SPILL CONTINGENCY PLAN**

### **2.1 Guidelines for Spill Containment and Clean up**

This section is designed to give the reader a quick review of the methods of handling spills. Please refer to specific sections for further details.

In order to promote prompt and proper clean up of spills, some general guidelines on containment and clean up of spills are reviewed. It is important from both a safety and an environmental perspective that prompt and proper clean up of the spill is undertaken.

Spill identification may be determined by review of many sources including the following:

- a) Chemical packaging labels.
- b) Chemical form (solid, liquid, powder, etc.).
- c) Chemical container method (drum, etc.).
- d) Material Safety Data Sheets (MSDS).

Proper handling of the spilled material is important for your own protection. Once you have identified the spilled product it is necessary to review the appropriate chemical handling procedure. Please refer to the individual chemical Material Safety Data Sheets (MSDS). MSDS binders are available at the Camp.

The response plan must take into consideration the types of materials being handled, their physical and chemical properties, and also the correct methods of neutralization, handling and/or containment.

A list of products that exist on the Wolverine Project site is shown in Appendix I.

## **3 CHEMICAL HANDLING**

### **3.1 *Handling of Acids and Alkalies***

#### **3.1.1 Acid Spills**

Spills of acid will be contained using sandbags and neutralization can be accomplished using either soda ash or lime. Both the sandbags and lime are stored at the Camp. Following neutralization, the area may be carefully flushed with water.

**Note:** Prior to using water in any clean up, consult the guidelines for the specific neutralizing agent being proposed for the chemical as inappropriate use of water may be severely hazardous.

Any water used for flushing a spill area should be contained, recovered and disposed of in an approved manner. It cannot be discharged to a sewer or ditch unless compliance is maintained with regulations. Any contaminated soil must be removed and disposed of in an approved manner.

### **3.2 Alkali Spills**

Detoxification of strong alkali spills such as sodium hydroxide can be accomplished using acetic acid. These spills can be contained using sandbags and pumped into auxiliary containers. In the case of dry spills, removal and subsequent approved disposal of contaminated soil may be more desirable than the use of acid for neutralization depending on the nature and extent of the spill.

## **4 TYPE OF MATERIAL AND LOCATION OF SPILL**

Response types based on material type and spill location are detailed below:

### **4.1 Solid Material Spill in the Dry Area**

- a) Clean up and recover material with protective gear.
- b) Detoxify the area.
- c) Store/transport recovered material and review the mode of disposal.

### **4.2 Liquid Material Spill in the Dry Area**

- a) Contain spill using earthen berms.
- b) Clean up and recover material with protective gear. Material recovery may utilize pumps or sorbets as appropriate for type of spill.
- c) Detoxify area.
- d) Store/transport recovered material and review the mode of disposal.

### **4.3 Solid Material Spill**

- (a) Cover material with plastic.
- (b) Isolate any drainage from the spill area, if possible, using earthen berms.
- (c) Notify downstream users if appropriate.
- (d) Clean up and recover material using protective gear.
- (e) Detoxify area.
- (f) Store/transport recovered material and review the mode of disposal.

### **4.4 Liquid Material Spill in an Area Wet from Rain**

- (a) Contain the spill using earthen berms.

- (b) Isolate drainage, if possible, using earthen berms.
- (c) Notify downstream water users if appropriate.
- (d) Clean up and recover material using protective gear. Material recovery may utilize pumps or sorbets as appropriate for type of spill.
- (e) Detoxify the area.
- (f) Store/transport recovered material and review the mode of disposal.

#### **4.5 Solid or Liquid Spill in a Drainage Ditch**

- (a) Contain the spill by placing an earthen berm across the ditch far downstream of the spill.
- (b) Isolate drainage, if possible, using earthen berms.
- (c) Detoxify area.
- (d) Store/transport recovered material and review the mode of disposal.

#### **4.6 Solid or Liquid Spill into Wolverine Lake or Stream**

- (a) Isolate drainage and contain the spill using earthen berms, if possible.
- (b) Recover the material, if possible, using protective gear.
- (c) Notify downstream water users.
- (d) Implement environmental monitoring of downstream waters as soon as possible after arriving at the scene.

## **5 MAJOR DUTIES AND RESPONSIBILITIES**

The following outlines the responsibilities and procedural sequences of events following the discovery of an emergency situation. An emergency situation may be defined as an incident that may cause personnel injury, uncontrolled damage and/or disruption of business. Examples of such cases would be a fire, a chemical spill and/or chemical discharge. It is important that each individual knows his/her capabilities in order to prevent undue harm to personnel and/or equipment.

## 5.1 Action Reporting Procedure for a Major Spill

- (a) Any employee discovering an emergency situation shall immediately make an initial determination as to whether he/she can remedy or alleviate the situation prior to seeking additional help or notify his/her supervisor.

**NOTE:** Life threatening situations must be dealt with immediately.

- (b) The emergency situation shall be brought to the attention of a supervisor as soon as practicable after discovery.
- (c) The supervisor shall immediately investigate the emergency situation and obtain all of the relevant information necessary (e.g., MSDS's), take initial action to remedy or alleviate the situation and notify the Project Manager as soon as practical with all pertinent information.

The minimum relevant information shall include the following:

- Description of the emergency event.
  - Time the emergency event was discovered.
  - Where the emergency event occurred.
  - Number and status of persons involved.
  - Remedial action implemented to alleviate the situation.
- (d) The Project Manager shall immediately notify the President or his/her designate and inform him/her of the nature of the emergency and actions taken.
- (e) The Project Manager, in consultation with management and the Corporate office, or his/her designate will make a decision to **declare an emergency**.
- (f) Once an emergency situation has been declared, all key personnel shall congregate at the designated command centre.
- (g) The Project Manager or his/her designate shall at his/her discretion, designate an Emergency Response Co-ordinator to develop an Emergency Action Plan and to co-ordinate all the work activities surrounding the emergency to rectify the situation (the selection to be based on the location and type of emergency).
- (h) The Project Manager or his/her designate shall notify the President, who shall be updated on the status of the emergency.
- (i) The Project Manager or his/her designate will authorize whatever corrective action is necessary (leasing special equipment, etc.) and the Emergency Response Coordinator shall initiate such action.
- (j) The Project Manager or his/her designate shall contact the appropriate provincial and federal agencies (**list of phone numbers is attached**) and provide the necessary information as approved by the President. The Project Manager or his/her designate, in consultation with the President, shall co-ordinate corrective actions with the appropriate provincial and federal agencies.
- (k) The Project Manager shall keep all the records and prepare chronological logs of all pertinent information for use in reporting to the President and to facilitate a post-response assessment. The Project Manager will be responsible for all reports to the provincial and federal agencies.

## **6 EMERGENCY RESPONSE**

The emergency response will vary with the nature and circumstances of the emergency. Some emergencies will require the service of a response team.

### **6.1 *Logistics Support***

Logistic support from outside services will be available through the Emergency Telephone Listing, as attached. These services include emergency equipment. Heavy equipment, pumps, emergency lighting, protective clothing, neutralization chemicals, etc., are available at the mine site.

### **6.2 *Training***

Expatriate employees will receive training to include instruction in spill recognition and assessment, spill hazards, spill reporting, communications, clean up procedures and general emergency response.

## **7 PLAN REVIEW**

The Emergency Response Plan will be reviewed once per year by the Project Manager and site management.

## 8 CORPORATE CALL OUT PROCEDURES FOR EMERGENCY

When a situation exists that may warrant the declaration of an emergency, the Project Manager must be notified. It is his/her responsibility to notify the appropriate persons and agencies thereafter.

The Corporate Office must be notified as soon as possible of the declaration of any emergency in accordance with the list of priorities set out in Section 11.0.

| <b>Name</b>   | <b>Position</b> | <b>Office No.</b>        | <b>Off Site No.</b>                |
|---------------|-----------------|--------------------------|------------------------------------|
| Jason Dunning | VP Exploration  | 604-682-5474<br>ext. 225 | 604-476-1755<br>cell: 604-831-6111 |
| Harlan Meade  | President & CEO | 604-682-5474             | 604-274-1443<br>cell: 604-657-2957 |

## 9 EMERGENCY TELEPHONE NUMBERS

|                           | Telephone Number |
|---------------------------|------------------|
| <b>Hospital</b>           |                  |
| Watson Lake               | 867-536-4444     |
| Health Unit               | 867-536-7843     |
| <b>Ambulance</b>          |                  |
| Watson Lake               | 867-536-4444     |
|                           |                  |
| <b>RCMP - Watson Lake</b> | 867-536-5555     |
| <b>Laboratories</b>       |                  |
| ASL                       | 604-984-0221     |
| ASL - Whitehorse          | 1-800-665-0243   |
|                           |                  |

## 10 TELEPHONE LISTS OF GOVERNMENT AGENCIES FOR REPORTING SPILLS

|  | Telephone No.                | Fax No.      |
|--|------------------------------|--------------|
| <b>Provincial Emergency Program</b>  |                              |              |
| Environmental Spill Reporting (24 hours)   | 867-667-7244                 |              |
| <b>Ministry of the Environment</b>   |                              |              |
| Department of Indian and Northern Development<br>Watson Lake, District Conservation Officer<br>Whitehorse, District Conservation Officer | 867-536-7363<br>867-667-5221 |              |
| Department of Fisheries and Oceans   | 867-667-5110                 |              |
| Mine Rescue Station  | 867-667-5450                 |              |
| <b>Environment Canada, Environmental Protection Branch</b>   |                              |              |
| Emergency Response Oil or Chemical 24-Hour Service<br>For chemical information call CANUTEC<br>24-hour basis<br>General                  | 613-996-6666<br>613-992-4624 | 613-954-5401 |

## 11 DETAILED DESCRIPTION OF DUTIES

### 11.1 VP Exploration

|                                |   |
|--------------------------------|---|
| <b>Reporting to:</b>           | President & CEP.  |
| <b>Duty Station:</b>           | Wolverine Project Camp office (Command Centre).   |
| <b>General Responsibility:</b> | Manages all aspects of emergency response in consultation with the President & CEO.   |
| <b>Specific Duties:</b>        | Declaration of Emergency in consultation with the Corporate Office.<br>Request the summoning of supervisors to the Command Centre.<br>Designates an Emergency Response Co-ordinator.<br>Notifies the Corporate Office.<br><br>Control access on and off the property. |

### 11.2 Emergency Response Co-ordinator (TBA)

The Project Geologist will act as the Emergency Response Co-ordinator. If not, the Project Manager will assume these duties and responsibilities.

|                                |  |
|--------------------------------|--|
| <b>Reporting to:</b>           | Project Manager.   |
| <b>Duty Station:</b>           | Command Centre.  |
| <b>General Responsibility:</b> | Implement actions necessary to effect the response.  |
| <b>Specific Duties:</b>        | Develops an Action Plan.<br>Designates an On-Scene Co-ordinator.<br>Notifies and dispatches response team individual. Logs individuals assigned to the scene.<br>Dispatches Equipment.<br>Coordinates implementation of action plan from Command Centre.<br>Receives information from on-scene Co-ordinator and relays to the Project Manager. |

### **11.3 On-Scene Co-ordinator (TBA)**

|                                |   |
|--------------------------------|---|
| <b>Reporting to:</b>           | Emergency Response Centre.  |
| <b>Duty Station:</b>           | At the scene.   |
| <b>General Responsibility:</b> | Effect Action Plan at the scene.  |
| <b>Specific Duties:</b>        | Co-ordinates activities of the Emergency Response Team.<br>Designates a lead person delegates duties as necessary. Acts as spokesperson for on-scene inquiries.<br><br>Relays information to Emergency Response Co-ordinator. |

### **11.4 Emergency Response Team (TBA)**

|                                |                             |
|--------------------------------|-----------------------------|
| <b>Reporting to:</b>           | On-Scene Co-ordinator.      |
| <b>Duty Station:</b>           | At the Scene (as assigned). |
| <b>General Responsibility:</b> | Implements Action Plan.     |
| <b>Specific Duties:</b>        | As assigned.                |

### **11.5 Final Report and Spill Assessment**

Following the spill assessment, a final report will be generated by the Project Manager.

## **12 Final Report and Response Assessment**

### **12.1 Chronological Report**

The Project Manager shall prepare a detailed chronological report of all circumstances surrounding the emergency.

### **12.2 Final Report**

Distribution of the final report (or portions thereof) to regulatory agencies may be required depending upon the nature of the emergency.

### **12.3 Post-Response Assessment**

A post-response assessment will be held with the Emergency Response Team to evaluate the response, identify areas of improvement and to make procedural changes as necessary.

**APPENDIX A  
ACTION STEPS**

## APPENDIX A ACTION STEPS

1. Report spill.
2. Stop source, if possible.
3. Contain spill materials.
4. Protect area.
5. Remove material.
6. Reclaim area.
7. Spill report.

**APPENDIX B**  
**EMERGENCY ACTION REPORTING PROCEDURE**

Available in hardcopy only

**APPENDIX C**  
**INFORMATION FLOW FOR RECOVERY OPERATIONS**

Available in hardcopy only

**APPENDIX D**

**INFORMATION FLOW FOR RESPONSE TO SIGNIFICANT INCREASE  
IN ENVIRONMENTAL MONITORING DATA**

Available in hardcopy only

**APPENDIX E**  
**EMERGENCY RESPONSE TELEPHONE LOG**



**APPENDIX F**  
**FIELD SPILL RESPONSE EVENT LOG**



**APPENDIX G**  
**SPILL RESPONSE ENVIRONMENTAL FIELD LOG**



**APPENDIX H**

**EQUIPMENT CHECKLIST IN SPILL RESPONSE STORAGE FACILITY**

| <b>APPENDIX H</b>   |                                   |           |
|---|-----------------------------------|-----------|
| <b>EQUIPMENT CHECKLIST IN SPILL RESPONSE STORAGE FACILITY</b> |                                   |           |
| <b>Location:</b> <u>    Wolverine Camp    </u>                |                                   |           |
| Item No.  | Description                       | Check ( ) |
| 1   | (1) 30-gallon garbage can         |           |
| 2   | (2) 2-gallon plastic buckets      |           |
| 3   | (1) first aid kit                 |           |
| 4   | (2) sets of rubber gear           |           |
| 5   | (2) pairs of pull-on rubber boots |           |
| 6   | (2) pairs of disposable coveralls |           |
| 7   | (2) pairs of rubber gloves        |           |
| 8   | (2) open-head drums               |           |
| 9   | (5) gallons of washdown water     |           |
| 10  | (2) dozen plastic sample bags     |           |
| 11  | (50) large plastic bags           |           |
| 12  | (2) square shovels                |           |
| 13  | (1) round shovel                  |           |
| 14  | mist mass                         |           |
| 15  | (2) pairs of chemical goggles     |           |
| 16  | (1) fire extinguisher             |           |
| 20  | (2) pairs of leather gloves       |           |
| 21  | (8) water sample bottles          |           |
| 22  | (2) rolls of duct tape            |           |
| 23  | (1) toolbox                       |           |
| 24  | (1) flashlight                    |           |
| 25  | (1) set of banding cutters        |           |
| 26  | (1) camera                        |           |
| 27  | cables and slings                 |           |
| 28  | roll oil sorbent mat              |           |
| 29  | soda lime                         |           |

**APPENDIX I**  
**LIST OF PRODUCTS AT**  
**THE WOLVERINE PROJECT SITE**

**List of Products at the Wolverine Project Site**

| <b>Product Name</b>           | <b>Product Use</b> | <b>Manufacturer / Supplier</b> | <b>WHMIS Classification</b> |
|-------------------------------|--------------------|--------------------------------|-----------------------------|
| Diesel engine coolant         | coolant            |                                |                             |
| Diesel engine lubricating oil | lubricant          |                                |                             |
| Diesel fuel conditioner       | fuel conditioner   |                                |                             |
| Snowmobile oil                | oil                |                                |                             |
| Kerosene                      | oil                |                                |                             |
| Regular gasoline              | fuel               |                                |                             |
| Grease                        | grease             |                                |                             |
| Propane                       | fuel               |                                |                             |
| Anti-freeze                   | anti-freeze        |                                |                             |
| Hydraulic oil                 | oil                |                                |                             |
| Diesel                        | fuel               |                                |                             |
|                               |                    |                                |                             |
|                               |                    |                                |                             |

**APPENDIX J**

**THE SASKATCHEWAN GOVERNMENT  
SMALL QUANTITY EXEMPTIONS**

APPENDIX J

THE SASKATCHEWAN GOVERNMENT  
SMALL QUANTITY EXEMPTIONS

| Item No.   | Pollutant  | Form Character or Concentration    | Spills to be Reported If Amounts Equal or Exceed |          | Time Period |
|--|--|------------------------------------|--|----------|-------------|
|  |  |                                    | On Site  | Off Site |             |
| <b>Substances Listed Under the Environmental Contaminants Act (Canada)</b> |  |                                    |  |          |             |
| 1  | Polychlorinated biphenyl (also known as PCB)   | Any substance containing PCB       | 1 kg   | 50 g     | 24 hours    |
| 2  | Polychlorinated terphenyls (also known as PCT)   | Any substance containing PCT       | 1 kg   | 50 g     | 24 hours    |
| 3  | Polybrominated biphenyl (also known as PBB)  | Any substance containing PBB       | 1 kg   | 50 g     | 24 hours    |
| 4  | Mirex (also known as dechloranel)  | Any substance containing mirex     | 1 kg   | 50 g     | 24 hours    |
| 5  | Other substances listed in regulations under the Environmental Contaminants Act (Canada) |                                    |  |          |             |
| <b>Petroleum and Petroleum Products</b>                                    |  |                                    |  |          |             |
| 6  | Gasoline   | Liquid                             | 200 L  | 100 L    | 24 hours    |
|  |  | Liquid from above ground container | 500 L  |          | Any period  |
|  |  | Liquid from below ground container | Any subsurface loss                              |          | Any period  |
| 7  | Diesel fuel  | Liquid                             | 200 L  | 100 L    | 24 hours    |
|  |  | Liquid from above ground container | 500 L  |          | Any period  |

APPENDIX J

THE SASKATCHEWAN GOVERNMENT  
SMALL QUANTITY EXEMPTIONS

| Item No. | Pollutant                | Form Character or Concentration    | Spills to be Reported If Amounts Equal or Exceed |          | Time Period |
|----------|--------------------------|------------------------------------|--|----------|-------------|
|          |                          |                                    | On Site  | Off Site |             |
|          |                          | Liquid from below ground container | Any subsurface loss                              |          | Any period  |
| 8        | Bunker oils              | Liquid                             | 200 L  | 100 L    | 24 hours    |
|          | Aviation fuel, jet oil   | Liquid from above ground container | 500 L  |          | Any period  |
|          | Kerosene, stove oil      | Liquid from below ground container | Any subsurface loss                              |          | Any period  |
| 9        | Lubricating oils         | Liquid                             | 100 L  | 50 L     | 24 hours    |
| 10       | Asphalt                  | Liquid                             | 500 L  | 100 L    | 24 hours    |
| 11       | Other petroleum products | Liquid                             | 100 L  | 50 L     | 24 hours    |

| APPENDIX J (Continued)                                   |  |                                 |   |          |             |
|--|--|---------------------------------|---|----------|-------------|
| THE SASKATCHEWAN GOVERNMENT<br>SMALL QUANTITY EXEMPTIONS |  |                                 |   |          |             |
| Item No.   | Pollutant  | Form Character or Concentration | Spills to be Reported<br>If Amounts Equal or Exceed |          | Time Period |
|  |  |                                 | On Site   | Off Site |             |
| <b>Acids and Bases</b>                                   |  |                                 |   |          |             |
| 69   | Acetic acid  |                                 | 100 kg  | 20 kg    | 24 hours    |
| 70   | Hydrochloric acid (also known as muriatic acid)                  |                                 | 50 kg   | 10 kg    | 24 hours    |
| 71   | Hydrofluoric acid  |                                 | 5 kg  | 1 kg     | 24 hours    |
| 72   | Nitric acid  |                                 | 50 kg   | 10 kg    | 24 hours    |
| 73   | Oleum (also known as overstrength sulphuric acid)                |                                 | 50 kg   | 10 kg    | 24 hours    |
| 74   | Phosphoric acid  |                                 | 50 kg   | 10 kg    | 24 hours    |
| 75   | Sulphuric acid   |                                 | 50 kg   | 10 kg    | 24 hours    |
| 76   | Sodium hydroxide (also known as caustic soda)                    |                                 | 100 kg  | 20 kg    | 24 hours    |
| 77   | Potassium hydroxide (also known as caustic potash)               |                                 | 100 kg  | 20 kg    | 24 hours    |
| 78   | Calcium hydroxide, calcium oxide (also known as lime, quicklime) |                                 | 500 kg  | 100 kg   | 24 hours    |
| 79   | Other acids and bases  |                                 | 50 kg   | 10 kg    | 24 hours    |

| APPENDIX J (Continued)           |   |                                 |   |              |             |
|----------------------------------|---|---------------------------------|---|--------------|-------------|
| THE SASKATCHEWAN GOVERNMENT      |   |                                 |   |              |             |
| SMALL QUANTITY EXEMPTIONS        |   |                                 |   |              |             |
| Item No.                         | Pollutant   | Form Character or Concentration | Spills to be Reported<br>If Amounts Equal or Exceed |              | Time Period |
|                                  |   |                                 | On Site   | Off Site     |             |
| Miscellaneous Organic Substances |   |                                 |   |              |             |
| 80                               | Halogenated solvents (carbon tetrachloride, chloroform, methylene chloride, etc.) | Liquid                          | 25 L  | 5 L          | 24 hours    |
| 81                               | Non-halogenated solvents (benzene, hexane, etc.)                                  | Liquid                          | 25 L  | 5 L          | 24 hours    |
| 82                               | Acrylonitrile (also known as vinyl cyanide)                                       | Liquid                          | 25 L  | 5 L          | 24 hours    |
| 83                               | Vinyl chloride  | Liquid                          | 10 L  | 2 L          | 24 hours    |
| 84                               | Chlorobenzenes gas  |                                 | Any quantity  | Any quantity | Any period  |
| 85                               | Chlorophenols   | Liquid                          | 10 L  | 2 L          | 24 hours    |
| 86                               | Methanol  | Liquid                          | 500 L   | 100 L        | 24 hours    |
| 87                               | Edible oils (rapeseed, coconut, palm)   | Liquid                          | 500 kg  | 250 kg       | 24 hours    |
| 88                               | Urea  |                                 | 500 kg  | 100 kg       | 24 hours    |
| 89                               | Other organic substances  |                                 | 25 kg   | 5 kg         | 24 hours    |

| APPENDIX J (Continued)                                   |  |   |   |                               |             |
|--|--|---|---|-------------------------------|-------------|
| THE SASKATCHEWAN GOVERNMENT<br>SMALL QUANTITY EXEMPTIONS |  |   |   |                               |             |
| Item No.   | Pollutant  | Form Character or Concentration                 | Spills to be Reported<br>If Amounts Equal or Exceed |                               | Time Period |
|  |  |   | On Site   | Off Site                      |             |
| Miscellaneous Inorganic Substances                       |  |   |   |                               |             |
| 90   | Ammonia  | Anhydrous when released by<br>container failure | Any quantity  | Any quantity                  | Any period  |
| 91   | Calcium  |   | 100 kg  | 50 kg                         | 24 hours    |
| 92   | Calcium chloride   |   | 1,000 kg  | 500 kg                        | 24 hours    |
| 93   | Chlorine (also known as liquid<br>chlorine, calcium hypochlorite,<br>sodium hypochlorite, chloride of<br>lime) | Liquid or solid                                 | Equip to 100kg of<br>chlorine                       | Equal to 20 kg of<br>chlorine | 24 hours    |
| 94   | Chlorine   | Gas when released by a container<br>failure     | Any quantity  | Any quantity                  | Any period  |
| 95   | Cyanide compounds  |   | Equal to 5kg of<br>cyanide                          | Equal to 1kg of<br>cyanide    | 24 hours    |

| APPENDIX J (Continued)                                   |   |  |   |                           |             |
|--|---|--|---|---------------------------|-------------|
| THE SASKATCHEWAN GOVERNMENT<br>SMALL QUANTITY EXEMPTIONS |   |  |   |                           |             |
| Item No.   | Pollutant                                   | Form Character or Concentration        | Spills to be Reported<br>If Amounts Equal or Exceed |                           | Time Period |
|  |   |  | On Site   | Off Site                  |             |
| 96   | Fertilizers (primarily nitrogen)            |  | Equal to 100kg of nitrogen                          | Equal to 50kg of nitrogen | 24 hours    |
|  | Fertilizers (primarily phosphate)           |  | Equal to 50kg of phosphorus                         | 10kg of phosphorus        | 24 hours    |
| 97   | Hydrogen fluoride                           | Gas when released by container failure | Any quantity  | Any quantity              | Any period  |
| 98   | Potassium chloride (also known as potash)   |  | 1,000 kg  | 500 kg                    | 24 hours    |
| 99   | Potassium permanganate                      |  | 100 kg  | 20 kg                     | 24 hours    |
| 100  | Sodium chloride (also known as common salt) |  | 1,000 kg  | 500 kg                    | 24 hours    |
| 101  | Sodium sulphate                             |  | 1,000 kg  | 500 kg                    | 24 hours    |
| 102  | Sulphur                                     |  | 500 kg  | 250 kg                    | 24 hours    |
| 103  | Other inorganic substances                  |  | 100 kg  | 20 kg                     | 24 hours    |
| <b>Metals</b>  |   |  |   |                           |             |
| 104  | Lead  | In solution                            | 10 kg   | 2 kg                      | 24 hours    |
| 105  | Nickel                                      | In solution                            | 25 kg   | 5 kg                      | 24 hours    |
| 106  | Zinc  | In solution                            | 25 kg   | 5 kg                      | 24 hours    |

| APPENDIX J (Continued)                                   |  |                                     |   |            |             |
|--|--|-------------------------------------|---|------------|-------------|
| THE SASKATCHEWAN GOVERNMENT<br>SMALL QUANTITY EXEMPTIONS |  |                                     |   |            |             |
| Item No.   | Pollutant                                    | Form Character or Concentration     | Spills to be Reported<br>If Amounts Equal or Exceed |            | Time Period |
|  |  |                                     | On Site   | Off Site   |             |
| 107  | Copper (also known as bluestone)             | In solution or a sulphate compound  | Equal to 254kg of copper                            | 5 kg       | 24 hours    |
| 108  | Arsenic                                      | In liquid or solid form             | 10 kg   | 2 kg       | 24 hours    |
| 109  | Cadmium                                      | In solution or powder form          | 10 kg   | 2 kg       | 24 hours    |
| 110  | Chromium                                     | In solution or powder form          | 10 kg   | 2 kg       | 24 hours    |
| 111  | Selenium                                     | In solution or powder form          | 10 kg   | 2 kg       | 24 hours    |
| 112  | Mercury                                      | All forms including organic mercury | 1 kg  | 100 g      | 24 hours    |
| 113  | Other metals                                 | In solution or powder form          | 10 kg   | 2 kg       | 24 hours    |
| <b>Radioactive Materials</b>                             |  |                                     |   |            |             |
| 114  | Uranium diruanate (also known as yellowcake) |                                     | Not applicable                                      | Any amount | Any period  |
| 115  | Radioactive isotopes                         |                                     | Not applicable                                      | Any amount | Any period  |
| <b>Waste Products</b>                                    |  |                                     |   |            |             |
| 116  | Domestic liquid waste                        |                                     | Not applicable                                      | 300 L      | 24 hours    |
| 117  | Industrial liquid waste waters               |                                     | 1,000 L   | 100 L      | 24 hours    |
| 118  | Agricultural liquid waste (liquid manure)    |                                     | Not applicable                                      | 200 L      | 24 hours    |
| =  | =  | grams                               |   |            |             |
| kg   | =  | kilograms                           |   |            |             |
| L  | =  | litres                              |   |            |             |

**APPENDIX K**  
**MATERIAL SAFETY DATA SHEETS**

**APPENDIX L**  
**REPORTABLE LEVELS FOR CERTAIN SUBSTANCES**

## APPENDIX K

### REPORTABLE LEVELS FOR CERTAIN SUBSTANCES

Federal regulations made under the Transportation of Dangerous Goods Act (Canada) and B.C. Special Waste Regulation 63/88.

| Item | Column 1<br>Substance Spilled  | Column 2<br>Specified Amount   |
|------|--|--|
| 1    | Explosives of Class 1 as defined in Section 3.9 of the federal regulations   | Any  |
| 2    | Flammable gases of Division 1 of Class 2 as defined in Section 3.11(a) of the federal regulations  | 10 kilograms, where spill results from equipment failure, error or deliberate action or inaction |
| 3    | Non-flammable gases of Division 2 of Class 2 as defined in Section 3.11(d) of the federal regulations  | 10 kilograms, where spill results from equipment failure, error or deliberate action or inaction |
| 4    | Poisonous gases of Division 3 of Class 2 as defined in Section 3.11(b) of the federal regulations  | 5 kilograms, where spill results from equipment failure, error or deliberate action or inaction  |
| 5    | Corrosive gases of Division 4 of Class 2 as defined in Section 3.11(c) of the federal regulations  | 5 kilograms, where spill results from equipment failure, error or deliberate action or inaction  |
| 6    | Flammable liquids of Class 3 as defined in Section 3.12 of the federal regulations   | 100 litres   |
| 7    | Flammable solids of Class 4 as defined in Section 3.15 of the federal regulations  | 25 kilograms   |
| 8    | Products or substances that are oxidizing substances of Division 1 of Class 5 as defined in Sections 3.17(a) and 3.18(a) of the federal regulations  | 50 kilograms   |
| 9    | Products or substances that are organic compounds that contain the bivalent "0-0" structure of Division 2 of Class 5 as defined in Sections 2.17(b) and 3.18(b) of the federal regulations | 1 kilogram   |
| 10   | Products or substances that are poisons of Division 1 of Class 6 as defined in Sections 3.19(a) to (e) and 3.20(a) of the federal regulations  | 5 kilograms  |
| 11   | Organisms that are infectious or that are reasonable believed to be infectious and the toxins of these organisms as defined  | Any  |

| Item | Column 1<br>Substance Spilled  | Column 2<br>Specified Amount  |
|------|--|---|
|      | in Sections 3.19(f) and 3.20(b) of the federal regulations   |   |
| 12   | Radioactive materials of Class 7 as defined by Section 3.24 of the federal regulations   | All discharges or a radioactive level exceeding 10 mSv/h at the package surface and 200 µSv/h at one metre from the package surface |
| 13   | Products or substances of Class 8 as defined by Section 3.25 of the federal regulations  | 5 kilograms   |
| 14   | Miscellaneous products or substances of Division 1 of Class 9 as defined by Sections 3.27(1) and (2)(a) of the federal regulations | 50 kilograms  |
| 15   | Miscellaneous products or substances of Division 2 of Class 9 as defined in Sections 3.27(1) and 2(b) of the federal regulations   | 1 kilogram  |

**NOTE:** Federal Regulations = Transportation of Dangerous Goods Regulations made under The Transportation of Dangerous Goods Act (Canada).

Special Waste Regulation = B.C. Regulation 63/88.

**APPENDIX M**  
**SPILLS ACTION PLAN PROCEDURE**

|  |                                     |                |                 |
|--|-------------------------------------|----------------|-----------------|
| <b>Expatriate Resources Ltd.<br/>ORGANIZATIONAL MANUAL</b> | <b>Site:</b> Wolverine Project      |                |                 |
|  | <b>Page(s):</b> 1 of 7              |                |                 |
|  | <b>Date:</b> July, 2004             |                |                 |
|  | <b>Replaces:</b> New                |                |                 |
| <b>Subject: Spills Action Plan</b>                         | <b>Compiled By:</b> Project Manager |                |                 |
|  | <b>Approved By:</b>                 |                |                 |
|  | Project Manager                     | VP Exploration | President & CEO |

**INTRODUCTION**

Part II of the Yukon Environmental Protection Act requires spills to be reported and cleaned up properly.

All spills will require immediate action as necessary, with priorities of:

1. protecting lives and preventing injury;
2. protecting the environment;
3. protecting the property; and
4. minimizing disruption of interference with Expatriate Resources Limited's business activities.

This procedure is intended to provide a guide in the event of a chemical spill. All spills must be reported to the Project Manager. The Project Manager will screen all information associated with the reported incident and make a follow-up. Depending on the magnitude of the incident, the Project Manager or his/her designate will be notified immediately. Note that minor types of spills can be handled readily by staff and resources already in place at the site of the incident, and may not require the involvement of senior management or specialized emergency response teams. Other types of emergencies beyond the capability of those at the scene are likely to be considered major and require additional resources, expertise and formal management.

|   |                                     |                       |                            |
|---|-------------------------------------|-----------------------|----------------------------|
| <b>Expatriate Resources Ltd.<br/>ORGANIZATIONAL MANUAL</b>  | <b>Site:</b> Wolverine Project      |                       |                            |
|   | <b>Page(s):</b> 2 of 7              |                       |                            |
|   | <b>Date:</b> July, 2004             |                       |                            |
|   | <b>Replaces:</b> New                |                       |                            |
| <b>Subject: Spills Action Plan</b>  | <b>Compiled By:</b> Project Manager |                       |                            |
|   | <b>Approved By:</b>                 |                       |                            |
|   | <b>Project Manager</b>              | <b>VP Exploration</b> | <b>President &amp; CEO</b> |
| <b>ACTION REPORTING PROCEDURE</b>   |                                     |                       |                            |
| <p>1. Any employee discovering an emergency situation shall immediately make an initial determination as to whether he/she can remedy or alleviate the situation prior to seeking additional help or notify the Project Manager.</p> <p><b>Note:</b> Life threatening situations must be dealt with immediately.</p>  |                                     |                       |                            |
| <p>2. The emergency situation shall be brought to the attention of the Site Manager and the Project Manager as soon as practicable after discovery.</p>   |                                     |                       |                            |
| <p>3. The Project Manager shall immediately investigate the emergency situation and obtain all of the relevant information necessary (such as MSDS's), take initial action to remedy or alleviate the situation and notify the Project Manager or his/her designate as practicable with all pertinent information.</p> <p>The minimum relevant information shall include:</p> <ul style="list-style-type: none"> <li>(a) a description of the emergency event;</li> <li>(b) time the emergency event was discovered;</li> <li>(c) where the emergency event occurred;</li> <li>(d) number and status of persons involved; and</li> <li>(e) remedial action implemented to alleviate the situation.</li> </ul> |                                     |                       |                            |
| <p>4. The facility Project Manager shall immediately notify the President (604-682-5474) his/her alternate and inform them of the nature of the emergency and actions taken.</p>  |                                     |                       |                            |
| <p>5. The Project Manager or his/her designate in consultation with the President will make a decision to DECLARE AN EMERGENCY.</p>   |                                     |                       |                            |
| <p>6. Once an emergency situation has been declared, all key personnel shall congregate at the designated command centre (Mine Camp).</p>   |                                     |                       |                            |

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| <b>Expatriate Resources Ltd.<br/>ORGANIZATIONAL MANUAL</b>   | <b>Site:</b> Wolverine Project      |                       |                            |
|  | <b>Page(s):</b> 3 of 7              |                       |                            |
|  | <b>Date:</b> July, 2004             |                       |                            |
|  | <b>Replaces:</b> New                |                       |                            |
| <b>Subject: Spills Action Plan</b>   | <b>Compiled By:</b> Project Manager |                       |                            |
|  | <b>Approved By:</b>                 |                       |                            |
|  | Project Manager                     | <b>VP Exploration</b> | <b>President &amp; CEO</b> |
| <p>7. All fuel spills must be immediately reported to an inspector or to the Environment Canada Spill Line (867-667-7244), contained and cleaned up upon discovery.</p> <p>8. For major spills, all reports will only be submitted by the Project Manager in consultation with the President.</p> <p>9. All requests for information should be directed to the Project Manager or the President</p> <p>10. For all major spills, a procedure entitled "Spill Contingency Plan" should be used in place of this procedure. The Spill Contingency Plan outlines the responsibilities and procedural sequences of the events following the discovery of an emergency situation (in progress – TBA).</p> <p>11. For reporting purposes, use the attached form entitled "Spill Report."</p> |                                     |                       |                            |

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| <b>Expatriate Resources Ltd.<br/>ORGANIZATIONAL MANUAL</b>  | <b>Site:</b> Wolverine Project      |                |                 |
|   | <b>Page(s):</b> 4 / 5 of 7          |                |                 |
|   | <b>Date:</b> July, 2004             |                |                 |
|   | <b>Replaces:</b> New                |                |                 |
| <b>Subject: Spills Action Plan</b>  | <b>Compiled By:</b> Project Manager |                |                 |
|   | <b>Approved By:</b>                 |                |                 |
|   | Project<br>Manager                  | VP Exploration | President & CEO |
| <b>SPILL REPORT</b>   |                                     |                |                 |
| <b>Report date:</b>   |                                     |                |                 |
| <b>Date and time of spill (if known):</b>   |                                     |                |                 |
| <b>Date and time reported to management:</b>  |                                     |                |                 |
| <b>Date and time reported to government:</b>  |                                     |                |                 |
| <b>Location and map co-ordinates (if known) and direction if moving:</b>                              |                                     |                |                 |
| <b>Party responsible:</b>   |                                     |                |                 |
| <b>Product spilled and estimated quantities (provide metric volumes/weights if possible):</b>         |                                     |                |                 |
| <b>Cause and effect of spill:</b>   |                                     |                |                 |
| <b>Is spill terminated or continuing?</b>   |                                     |                |                 |
| <b>Extent of contamination:</b>   |                                     |                |                 |
| <b>Factors affecting spill or recovery (temperatures, wind, snow, ice, terrain, buildings, etc.):</b> |                                     |                |                 |
| <b>Containment (naturally, booms, dykes or other)/no containment:</b>                                 |                                     |                |                 |
| <b>Action (if any) taken or proposed to control, recover, clean up or dispose of spill:</b>           |                                     |                |                 |
| <b>Do you require assistance? If so, in what form?</b>  |                                     |                |                 |
| <b>Hazard to persons, property or environment (fire, drinking water, threat to fish or</b>            |                                     |                |                 |

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| <b>Expatriate Resources Ltd.<br/>ORGANIZATIONAL MANUAL</b>      | <b>Site:</b> Wolverine Project      |                              |                 |
|   | <b>Page(s):</b> 4 / 5 of 7          |                              |                 |
|   | <b>Date:</b> July, 2004             |                              |                 |
|   | <b>Replaces:</b> New                |                              |                 |
| <b>Subject: Spills Action Plan</b>                              | <b>Compiled By:</b> Project Manager |                              |                 |
|   | <b>Approved By:</b>                 |                              |                 |
|   | Project<br>Manager                  | VP Exploration               | President & CEO |
| <b>wildlife):</b>   |                                     |                              |                 |
| <b>SPILL REPORT (Continued)</b>                                 |                                     |                              |                 |
| <b>Agencies on site:</b>  |                                     |                              |                 |
| <b>Others notified of spill:</b>                                |                                     |                              |                 |
| <b>Comments and/or recommendations/further action required:</b> |                                     |                              |                 |
| <b>Reported by:</b>   |                                     | <b>Position of Employee:</b> |                 |
| <b>Location:</b>  |                                     | <b>Telephone No.:</b>        |                 |
| <b>Reported to:</b>   |                                     | <b>Position of Employee:</b> |                 |
| <b>Location:</b>  |                                     | <b>Telephone No.:</b>        |                 |
| <b>Report by:</b> Project Manager                               |                                     |                              |                 |
| c.c. President, VP Exploration                                  |                                     |                              |                 |

## **APPENDIX C CONSULTATION**

## **Wolverine Advanced Exploration Program Public Consultation**

Expatriate Resources Ltd., operator of the Wolverine Joint Venture Property, is proposing and advanced exploration for the property. This program will include underground test mining to assess geotechnical conditions of the Wolverine deposit and to collect a bulk sample for metallurgical testwork. This program is required to assess the suitability of the Wolverine deposit for underground mining. Ground access to the Wolverine Property is necessary to support this test mining program. Several alternatives for this access have been assessed and consultation with First Nations and other stakeholders regarding the proposed advanced exploration program has been completed. Concerns and issues were considered by the company during development of the advanced exploration plan. Responses to these concerns are provided.

Jan 12, 2001

Meeting with YTG Renewable Resources at the Gartner Lee offices in Whitehorse

In attendance: Jon Bowen – YTG

Chuck Hubert – YTG

Rick Farnell – YTG

Byron Nutton - DFO

Forest Pearson – Gartner Lee

Paul Sparling – White Mountain Consulting

Justin Himmelright – Expatriate Resources

Mr. Himmelright provided a brief overview of the purpose of the meeting, the consultation anticipated, and the components of the program. The underground development, potential waste rock disposal alternatives, access alternatives, and potential wildlife mitigation measures were presented.

A map of the access alternatives and various habitat and cultural resources of the region was provided for review and comment. Mr. Himmelright gave a slide show of photos taken from the air, covering the extent of the proposed access alternatives.

| <b>Issue</b>   | <b>Response</b>  |
|--|--|
| Separation of Finlayson Project<br>Assessment and advanced exploration<br>proposal | Separate scope of work, decisions<br>regarding the Finlayson Project<br>permitting will be based on the<br>exploration work. |

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| <p>Underground storage of waste rock in advanced exploration closure plan</p>  | <p>Waste characterization testwork on materials as they are removed from the underground. Temporary storage concept that allows selective removal of potentially acid generating materials. Longterm management will be dependent on decisions related to development of the Finlayson Project. If the project is developed, potentially acid generating materials will be moved to storage facilities at Kudz Ze Kayah. If the project is not developed and permanent closure of the Wolverine site is required, permanent storage of the acid generating waste rock will be required. At this time the company will investigate the potential for permanent land disposal in a lined facility and/or returning waste rock to the flooded area underground for sub aqueous disposal .</p> |
| <p>Expatriate assumption of Cominco's Socioeconomic Agreement (SEA) for Kudz Ze Kayah.</p>   | <p>Expatriate is assuming the Kudz Ze Kayah SEA. Negotiations of SEA for the Wolverine and other exploration activities on Expatriate lands is underway. Exploration work on previous Cominco lands covered by Cominco SEA and the SEA currently being negotiated will cover work on Expatriate and Wolverine Joint Venture lands.</p>   |
| <p>KZK Wildlife monitoring agreement works well, a continuence or extension of that agreement to cover new activities would be supported</p> | <p>Wildlife monitoring agreement provides principles and support for regional monitoring activity; not spatially constrained. Expatriate will work within the spirit of that agreement for the advanced exploration program at Wolverine and other parts of the Finlayson Project development. Assessment of exploration road alternatives heavily weighted by these considerations. For this reason, the company did not assess in detail a direct road connection to the Robert Campbell Highway from the Wolverine Property.</p>  |

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| <p>Winter road – obviously not a haul road and would make clearer separation of Finlayson project and advanced exploration program. Definitely reduces the potential for environmental effects.</p>   | <p>The use of a winter road exclusively would provide significant benefit to the company in terms of reclamation and environmental liability. As such, the Company considered this option. It was concluded that the limitations of a winter road could present a risk to the successful implementation of the advanced exploration program. Issues identified by the company include seasonal limitation of program initiation, logistical issues with stockpiling of materials, and lack of ground access support during the underground development, captive equipment and lack of flexibility in addressing potential closure and long term management options at the site. The company has addressed these concerns by revising the originally proposed routes to include a barge/ice road across Wolverine Lake. This concept could not be used as the ore haul corridor required by the Finlayson Project and reduces the total road construction required for the advanced exploration program, therefore reducing the potential for environmental effects.</p> |
| <p>Southern route will bisect caribou habitat. It will pass through largely open ground and will be very visible. Caribou will be able to see the road from a long distance and do not habituate well to persistent traffic. Caribou are present in this area throughout the year, little opportunity for seasonal management methods for mitigation.</p> | <p>Traffic along the proposed road will not be persistent. The majority of road traffic will occur in two periods; mobilization and demobilization from the Wolverine site. The road is not intended for long term use (limited to two years by Land Use Permit under the <i>Territorial Land Use Regulations</i>). A review of the herd database provided by Renewable Resources indicates that caribou are present in the area primarily in the early fall (rut season), indicating that seasonal management and avoidance methods could be applied as a mitigation to potential effects on caribou.</p>  |

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| Road construction in a more treed area (Northern Route) would be more hidden and maintain “wilderness area” attributes.                           | Completion of the northern route would require major bridge crossing of Nougha Creek and road construction in this area and around Wind Lake would pass through permafrost and bog areas; very difficult road building with potential for noticeable initial effects to terrain.  |
| Winter road along the Northern Route would avoid permafrost problems.   | Winter road along the northern route would require tree clearing since this is a forested area. Winter road along the southern route would not require tree clearing. As previously mentioned, the exclusive use of a winter road presents logistical and program flexibility risks which would effect the successful implementation of the advanced exploration program. |
| Rick Lakes area widely used for recreational purposes by guide-outfitters and traditional use by Ross River. An access road may disrupt that use. | Expatriate is currently negotiating agreements with the Kaska which will cover compensation for disruption of traditional use. Guide outfitters are present in the area during the hunting season. Road traffic can be managed to limit potential effects to their activities.  |
| Northern route option: extend the road past Wind Lake going north down the east creek Valley to the KZK tote road                                 | The East Creek area is very wet and would be a difficult build. East Creek in this area is considered to be an important habitat component for the Finlayson Creek fish population. This route would be unnecessarily long and not preferred.   |
| Southern route as a winter road?  | Some moose in the area during early November but otherwise few wildlife concerns.   |
| Environmental management procedures – i.e. no fishing or hunting policy for workers.  | Has been established.   |
| Caribou fence in Muskrat House valley?  | Some mention in archaeological reports, not found or identified. Heritage studies will be carried out for the proposed access route before it is constructed.   |
| Swans nesting in Muskrat House Valley ?   | None observed in this area.   |
| Southern route would take longer time to return to wilderness setting due to open terrain.  | The company has proposed reclamation measures that are intended to expedite the return of the road to a natural appearance.   |

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| <p>More assessment of winter road option should be included in the road application.</p> | <p>The company undertook a detailed assessment of the equipment, materials and activities required to implement the proposed advanced exploration program (BGC, 2001). Based on this assessment, the company concluded that limited, seasonal access would present a risk to the successful implementation of the program.</p> |
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Jan. 16, 2001

Meeting with Environment Canada and DIAND Water Resources at the Environment Canada boardroom in Whitehorse.

In attendance: Benoit Godin – Environment Canada  
 Bill Slater – DIAND Water Resources  
 Doug Davidge – Environment Canada  
 Justin Himmelright – Expatriate Resources

Mr. Himmelright presented a brief overview including the purpose of the meeting, the anticipated consultation and permitting schedule, and the general concepts for operations and closure and environmental mitigations anticipated for the test mining area. A map of the test mining area was tabled for review including the proposed adit location, existing roads and airstrip, topography and ground cover conditions (trees and swamps).

| <b>Issue</b>  | <b>Response</b>   |
|---|---|
| <p>Is the Company prepared to commit to one road for all activities including advanced exploration and ore haul activities?</p> | <p>One road would be preferable but may not be achievable. The relative magnitude of the Finlayson Project provides access options that cannot be considered by the exploration activities. An example of this is the crossing of Nougha Creek proposed in the Northern Route. A crossing of this magnitude would be very difficult to achieve as part of an advanced exploration program. As part of a larger project, it becomes a more reasonable alternative to consider. The issue of using existing temporary roads for upgrade to ore haul will be considered in Finlayson Project EA.</p> |

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| <p>Blasting residues, ammonia a potential water quality issue from the underground.</p>                            | <p>It is proposed to use gel type explosives will be used as necessary to minimize losses to the environment. Dewatering and discharge from the underground development during exploration will be carried out under controlled conditions. Water quality will be monitored and treated if required. If ammonia and nitrogen species are an issue, a bioreactor plant will be brought on line to treat the discharge. A similar type of plant exists at Homestake's Nickel Plate Mine.</p> |
| <p>Potential issues with longterm drainage from adit</p>   | <p>Adit developed as a decline. Surface conditions and drill information indicate that it is relatively deep to groundwater and the adit is not likely passively drain. If necessary, long term closure of the adit and underground working will include measures to limit adit drainage. These measures can be developed at a later date when the conditions and long term fate of the underground workings are more clear.</p>   |
| <p>Will the mining contractor be required to exercise environmental controls ?</p>                                 | <p>Yes, this is a requirement of EXR' s environmental policy.</p>  |
| <p>B Licence is only for advanced exploration program?</p>   | <p>Yes.</p>  |
| <p>Groundwater baseline data available ?</p>   | <p>Only anecdotal information available from exploration drilling. Surface conditions indicate that groundwater is not near surface in the area proposed for the portal.</p>   |
| <p>Moving materials back underground for closure may result in "humidity cell" effect in underground workings.</p> | <p>Materials will be characterized and stockpiled to allow selective removal from the stockpile if necessary. If the long term closure plan is to include moving potentially acid generating materials back underground, these materials will be placed only in areas that are permanently flooded under natural conditions (i.e. no wetting and drying cycles and no humidity cell effect).</p>   |

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|---|--|
| Will the temporary dump be lined to reduce seepage to groundwater ? | The location selected is reported to provide dry conditions with little or no potential for groundwater infiltration to the stockpile or seepage to the surrounding aquifer. The sloped cap and seepage collection which are incorporated in the design of the stockpile will limit and control potential seepage. Geotechnical investigations this summer will confirm the foundation conditions at the base of the proposed stockpile. If necessary, a liner will be used in the stockpile design to limit effects on groundwater. |
| Is there any water quality data for the proposed road crossings ?   | There is water quality for most streams in the area. The proposed access road does not cross any significant drainages. Stream crossings will be ground truthed and water samples taken before construction.   |

Jan 17, 2001

Meeting with Ross River First Nation and community members, Land Claims office in Ross River.

In Attendance: Norman Sterriah – Chief, Ross River Dena Council  
Cliff McLeod – Councillor, Ross River Dena Council  
Jenny Ceasar – Councillor, Ross River Dena Council  
Ted Charlie – Councillor, Ross River Dena Council  
Johnny Ledue – First Nation Member, Land Claims  
Dorothy Dick – First Nation Member, Community Liaison Manger for Expatriate Resources and Cominco Ltd.  
Robertson Dick – First Nation Member  
Kathlene Suza – First Nation Member, Land Claims Communications Coordinator  
Annie Ledue – First Nation Member – Elder  
George Smith – First Nation Member – translator  
Grady Sterriah – First Nation Member – Elder  
Robert Etzel – First Nation Member – Elder  
Dennis Shorty – First Nation Member  
Eileen Johnny – First Nation Member – Elder  
George Johnny – First Nation Member – Elder  
Jack Pauls – community member  
Don Taylor – community member

Mr. Himmelright provided an introduction of himself and the company and a brief history of its operations in the area. He discussed the purpose of the meeting and provided an overview of the advanced exploration program. A map showing the various access

alternatives was provided for review. Mr. Himmelright gave a slide show of photographs taken from the air that covered the potential access routes.

Questions were posed and answered throughout the presentation and afterwards. The meeting was generally informal with many side discussions being carried out amongst people in the room throughout the meeting. In total, the meeting lasted about 4 hours. Many issues were discussed which were outside the topic of the proposed advanced exploration program. The following is a summary of the issues raised which were specific to the advanced exploration program.

| <b>Issue</b>  | <b>Response</b>   |
|---|---|
| What is the schedule?   | Road construction and underground work to be carried out as soon as financing can be arranged. Seasonal condition will play a significant role in the program schedule. Access is limited during lake freeze up and break up.   |
| What is selenium?   | Selenium is a metal associated with the ore deposit. It is a metal of environmental concern   |
| Will any chemicals be used?   | There will be no chemicals used to process ores during the advanced exploration program. Blasting agents, fuel and lubricants, and cement will be basically the only chemical materials used at the mine.   |
| Where will the adit be located?   | Location indicated on the map   |
| Have you located the caribou fence?   | Information on the location of the caribou fence is confusing. Some information indicates that it is in the Muskrat House creek drainage area and other information indicates that is in the Rick Lakes Valley. Robertson Dick identified a land feature on one of the photographs of the Rick Lakes area was supposedly constructed by hand as a caribou fence many years ago. |
| Will the company block access of First Nations to the area?                                   | The area will continue to be open to First Nations use as it has in the past. There must be some consideration for safety zones around work areas.  |
| How will you ensure the area is reclaimed?  | We expect that there will be a requirement for a reclamation bond from the federal government in order to carry out the advanced exploration program. It is the policy of the company to reclaim disturbed areas in a timely and site-specific manner.  |
| Proposed southern route crosses R-Block. No on is allowed on these areas, even First Nations. | DIAND Lands has indicated that it is possible to grant land use permits to cross the R-Blocks. The establishment more long-term permits such as surface lease or Licence to Operate (as would be required   |

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|---|--|
|   | for an ore haul route) would require a change in the status of land tenure. Consultation with First Nations is a key aspect of acquiring a Land Use Permit to cross R-Blocks.  |
| What about the socio-economic agreement?  | We are working on a socio-economic agreement and hope to have an agreement soon. A negotiating team, designated by the Kaska Nation, has been our primary point of contact.  |
| First Nations will not support development of roads within their territory until a socio-economic agreement (SEA) is reached. | The company and the Kasak can continue to work on the SEA during the environmental review and approval process for the advanced exploration program. It is expected that the SEA under negotiation can be completed prior to any road construction.. |

Participants at the meeting suggested some alternative variations on the proposed access routes presented. These variations were carried through to other meetings for further consideration.

An invitation was extended to the company to continue consultation and expedite the SEA process through 3 day consultation and negotiation session. The end of February was selected as the preferred time for this meeting. Meeting attendants were reminded of the upcoming SEA negotiation session, scheduled for Jan 22 in Vancouver.

Jan 18, 2001

Meeting in Whitehorse with DIAND representatives to report on the progress of the consultation.

In Attendance: Kevin McDonnell – DIAND Environment  
Derek Fraser – DIAND Environment  
John Huff – DIAND Lands  
Marj White – DIAND Lands  
Hugh Copeland – DIAND Minerals  
Karen Peltier – DIAND Minerals  
Scott Herron – DIAND Environment  
Colin Parkinson – Coast Guard (on speaker phone)  
Byron Nutton - DFO  
Justin Himmelright – Expatriate Resources

Mr. Himmelright presented a brief summary of the results of the consultations and presented some of the issues raised during the weeks meetings.

Jan 22, 2001

Meeting Expatriate boardroom in Vancouver.

In Attendance: Rod Snow – Davis and Company, representing the Kaska Nation  
Vic Mitandir – designated negotiator on behalf of the Kaska Nation  
Stanley Nole – Executive Director, Ross River Dena Council

Clifford George – Councillor, Ross River Dena Council  
Kathleen Souza – First Nation member, Land Claims Communications  
coordinator for the Kaska Nation  
Dorothy Dick – First Nation member, Community Liaison Manager for  
Expatriate Resources and Cominco Ltd.  
Harlan Meade - President and CEO, Expatriate Resources  
Justin Himmelright - Manager of Environment, Expatriate Resources

The original purpose of the meeting was to continue negotiation of the SEA. Discussions in this meeting centered around an explanation of the timing constraints of the permitting process and how it affects the company's schedule for ongoing work in the Finlayson area.

Various individuals commented on the previous weeks meeting. In general the community was pleased with the outcome and the spirit of co-operation demonstrated by the company. At this stage the community is in support of an expedited SEA process and filing of applications for the advanced exploration program. Further technical review on behalf of the community will be required in advance of filing the applications to provide a determination of the preferred access route.

Dates were established to carry out the extended consultation and negotiation process. It was agreed that a final meeting involving Ross River, Expatriate Resources, and YTG Renewable Resources would be conducted to discuss access route issues in advance of filing of applications for advanced exploration.

Feb 8, 2001

Community meeting in Ross River to present the advanced exploration access route alternatives and receive community comments.

In Attendance: Harlan Meade – Expatriate Resources  
Justin Himmelright – Expatriate Resources  
Dorothy Dick – Ross River  
Millie Pauls – Ross River  
Josephine Acklack – Ross River (elder)  
George Johnny – Ross River (elder)  
Eileen Johnny – Ross River (elder)  
Mary J. Dick – Ross River (elder)  
Arthur John – Ross River (elder)  
Jenny Caesar – Ross River  
Kathleen Souza – Ross River  
Grady Sterriah – Ross River  
Ian Shorty – Ross River  
Frank Johnny – Ross River  
Cynthia Dick – Ross River  
Lorraine Sterriah – Ross River  
Joe Sheridan – Yukon College  
Jack Caesar – Ross River  
Jessie Peter – Ross River  
John Acklack – Ross River  
Robertson Dick – Ross River  
Cliff McLeod – Ross River

Vera Sterriah – Ross River

| <b>Issue</b>  | <b>Response</b>   |
|---|---|
| What are you going to do about damage to traditional areas, recreation, water, and wildlife ? | Minimize effects to wildlife through careful management. No hunting or fishing for mine employees. Socioeconomic agreement includes provision for compensation for loss of land use during mine operations. Effects on water will be controlled with water treatment. Older mines have problems with water quality but new ideas on mine management and current laws ensure that downstream water quality will be good. |
| How wide will the road be ?   | During exploration, the access road will be about 4 to 5 m wide, same as the Kudz Ze Kayah Road. If it becomes a haul road, it will be about twice as wide (8 to 10 m).   |
| What about local contracting and employment opportunities ?                                   | Ross River has a distinct advantage in providing services and employees because it is so close to the mine site. In addition, the socio-economic agreements which we will have will give the community a distinct advantage.  |
| What types of stuff would you haul on the access road ?                                       | Groceries and camp supplies, heavy equipment, steel, concrete and explosives for underground work, and fuel.  |
| What about during sensitive times of the year like calving or rut ?                           | We would have a management plan for the road. This plan would call for reduced road activity during these times.  |
| What is the expected schedule for road construction ?   | We would like to be building the road this summer but it is dependent on financing. We may end up doing it in the fall or going in on a winter road in the winter. Also, we have a number of permits we have to get before we can start construction.   |
| Are you going to build another airstrip ?   | Not for the exploration. There will be another airstrip, on the Robert Campbell Highway near the Kudz Ze Kayah Road during mine production to fly in workers, supplies etc.   |

Following a lunch break, the group reconvened. A Resource Advisory Committee (RAC) was formed from members in attendance at the meeting. Expatriate presented the committee with the maps of various access alternatives under consideration and photographs of the area to use as resources in their deliberations. The RAC members then caucused in private to discuss the access options.

Meetings were held on February 9<sup>th</sup>, related mainly to SEA negotiations. At these meetings the Kaska representatives advised Expatriate that the southern hybrid option

was the preferred option of the community, subject to management considerations and a detailed assessment.

Feb 20, 2001

Meeting in Whitehorse to discuss the preferences of the First Nations regarding the access routes with YTG Renewable Resources

In attendance: Jon Bowen – YTG

Chuck Hubert – YTG

Rick Farnell – YTG

Vic Mitandir – Kaska representative.

Justin Himmelright – Expatriate Resources

Rick Farnell started the meeting with an introduction to the types of work and research that have been done on the Finlayson Caribou herd over the past years. The Ross River Dena have been consulted and have participated in much of this work. Some of the things that have been done in the past include a wolf control program, controlled hunts for condition assessment, aerial surveys, and tagging programs. Rick presented a number of slides outlining the effects of the wolf control program on the Finlayson caribou herd. Weather conditions and hunting also play a role in health of the herd. Bear predation is not a significant issue for the herd. A continued, moderate wolf control program would work to increase the sustainable hunting yield from the herd.

Victor Mitandir introduced himself as the representative of the Kaska on mining issues. He is at the meeting as an observer and to provide information back to Kaska on the meeting. Victor would like to get copies of the caribou data and would like the YTG people to come to Ross River and discuss the road and caribou issues.

Justin Himmelright provided a brief summary of the consultation and work that has been completed to date. He reviewed the two road options that had initially been considered and the issues associated with each one. Mr. Himmelright stated that a principle consideration in the initial selections was the crossing of R-Block lands; which had been avoided to the extent possible. Following consultation with the Kaska, it was determined that crossing R-Blocks may not be an issue, provided it was the best route to go on. Through this consultation a third route option was identified; one which travelled almost due east from Kudz Ze Kayah to Wolverine Lake and crossed R-Blocks 15 and 16. This route has been put forward by the Kaska as their preferred option, subject to a detailed ground assessment and finalization of the exact route.

Justin discussed further the options of air support or winter roads that had been put forward by YTG as their preferred method of access for the advanced exploration program. These options had been discussed amongst the management team of the company and it was determined that at some stage of the exploration program, an all season access road was going to be required. Winter access and air support could not reasonably be used to support the program from economic or logistic perspectives. From the company's perspective, winter road access has many advantages in terms of reduced environmental disturbance and liability but cannot feasibly support the program due to the logistical considerations of stockpiling and the transportation constraints it would place on the program.

| <b>Issue</b>  | <b>Response</b>   |
|---|---|
| <p>Has the company considered an access option following the previous winter road out to the Robert Campbell Highway ?</p>  | <p>The option to connect to Robert Campbell Highway was considered in initial screenings but was eliminated early based on previously stated wishes of the Kaska and YTG Renewable Resources to limit access corridors to the region. The previous winter road was used to mobilize two cats to the Wolverine site in 1996. This is a considerably different magnitude of mobilization than the 1000+ tonnes of equipment and materials that are needed for the advanced exploration program. The route used by the cats in 1996 could not be followed exactly; some areas traveled by the cats could not be accessed by cat trains pulling heavy loads. New road would need to be built to move around these areas. The existing winter road crosses Nougha (Wolverine) Creek which, for reasons stated in previous meetings, cannot be done for this program. This means that even for a winter road, new road would need to be slashed out of the forested area on the east side of the creek. The area on this side of the creek near the Robert Campbell Highway is also on R-Block and the particular area hosts a number of archaeological sites, including cabins and graves. The length of new road would be several kilometres since the original winter road crossing was fairly far up the creek.</p> |
| <p>The access provisions that are applied to the Kudz Ze Kayah road could be applied to the Robert Campbell Highway access option. This option presents less of an intrusion into the caribou habitat south of the project area and limits access to those areas.</p> | <p>The terrain south of the project area (caribou habitat) is easily accessible once you have reached the general vicinity of the project. The terrain is open and passable by snow machine and four track vehicles for much of the area. For this reason, the proposed southern route does not constitute a dramatic increase in the accessibility of the area. The forested area between the Robert Campbell Highway and the highlands to the south of the project area acts as a barrier and buffer to potential human intrusion. Additional access corridors linking the Robert Campbell Highway to these southern areas present a higher potential for human intrusion to the area than the proposed southern route.</p>   |

|  |  |
|--|--|
|  | <p>The controlled access provisions applied to the Kudz Ze Kayah Road are expensive. Unnecessarily doubling that expense by having to maintain two controlled accesses is not the preference of the company. To the knowledge of the company, the Kaska (Ross River) are opposed to any additional access routes to the area.</p>  |
| <p>The proposed southern route has the potential to alienate calving and rutting areas.</p>  | <p>The company undertook a more detailed assessment of potential wildlife effects of the proposed advanced exploration project, including the access road (appended report). The conclusion of the report is that significant adverse effects to local wildlife (including caribou) are not likely to result from this program.</p>  |
| <p>The access road has the potential to alienate these back country areas, particularly Rick Lakes, as wilderness destinations.</p>  | <p>It is possible that these areas will be less appealing to wilderness enthusiasts and hunters with the presence of the road. It should be noted that the company is considering this to be a temporary road. Long term road access to the Wolverine area for the Finlayson Project will be considered as part of the environmental assessment of that project.</p> <p>There are other stakeholders (mining companies, First Nations) with an interest in these lands. The possibility that occasional visitors will find the area less appealing due to the activities of other interests in the area should be weighed against the potential benefits of mineral exploration activity and mining in the area.</p> |
| <p>The Kaska would like to see maps of the area which show the caribou data provided by Renewable Resources and the various themes presented on the Expatriate maps (heritage sites, wildlife habitat features, land tenure boundaries, proposed access options etc.). This would aid in their internal discussions regarding access routes.</p> | <p>Expatriate undertook to develop and provide their maps to the Kaska (see letter below) for this purpose.</p>  |
| <p>A heritage survey of the area should be done.</p>   | <p>Expatriate proposes to undertake a detailed ground truthing of the selected route before construction. This will include a heritage assessment, terrain hazards assessment, fisheries and aquatic resources at stream crossings etc. The specific location of the route will be finalized to avoid sensitive areas, based on</p>  |

It was suggested that Expatriate reconsider the option of additional access to the Robert Campbell Highway in more detail, including at least partial use of the existing winter access route. Expatriate responded that the Robert Campbell Highway access option was not presented to the community in Ross River for serious consideration and additional consultation would be required. Expatriate suggested that representatives of Renewable Resources and Expatriate go to the community and discuss this option.

Due to problems in scheduling a meeting to review the northern route alternative, it was not done. Expatriate has forwarded maps and airphotos of this possible route (maps requested by the Kaska representative, see above) and the proposed southern route to the Ross River Resource Advisory committee. Copies of the minutes from this meeting were also sent to the committee (see letter below). No formal response has been received as yet.

### ***Wolverine 2004***

The following negotiation and consultation activities have been carried out in 2004:

- |                    |  |
|--------------------|--|
| March 31, 2004     | Negotiation session on the Wolverine Project Socio-economic Agreement held in Ross River.  |
| April 22, 2004     | Project overview document entitled "Opportunity for Yukon Silver-Zinc Project Development, Kaska First Nation Traditional Territory, Yukon" prepared for Kaska and the Yukon Government. |
| July 15, 2004      | Negotiation session on the Wolverine Project Socio-economic Agreement held in Ross River.  |
| July 16, 2004      | Ross River Chief and Council and Yukon Government representatives tour Wolverine Project area and meet Expatriate Board of Directors.  |
| September 14, 2004 | Teleconference negotiation session on the Wolverine Project Socio-economic Agreement   |
| October 14, 2004   | Negotiation session on the Wolverine Project Socio-economic Agreement held in Ross River.  |

### ***Future Consultation (2004 and moving forward)***

Expatriate intends to carry out a thorough consultation program throughout the regulatory and review process. The Company will hold open houses in Whitehorse, Ross River and Watson Lake at regular intervals as the project develops. Other potentially affected communities may be identified as the assessment process proceeds and will be included in open house circuit. The open houses will be well publicized and open to all members of the public.

Each open house will present, in a clear and understandable format, up-to-date information on the project and the review process. Expatriate officials and their consultants will be available to answer questions during these open houses. Questionnaires will be distributed to attendees for voluntary completion and return to the Company.

Expatriate Resources will endeavour to identify potentially effected groups and address concerns raised by the public and reviewers. Working groups may be developed, including stakeholders and reviewers, to address specific technical and regulatory issues associated with the project.

The specific details of future consultation plans for the Wolverine Project will be developed in association with stakeholders.

## **APPENDIX D WILDLIFE CONSIDERATIONS**

# **Appendix**

**(to be included as part of the Wolverine  
Advanced Exploration Program Level III MLU  
Upgrade Application)**

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**Expatriate Resources Ltd.**

**WOLVERINE ADVANCED EXPLORATION PROGRAM**

**WILDLIFE CONSIDERATIONS**

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**November 2004**

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## **SUMMARY**

Expatriate Resources Ltd. is currently planning mining operations within the Finlayson District west of the Robert Campbell Highway. This area is located midway between Ross River and Watson Lake in southeastern Yukon. To complete feasibility studies for the proposed Yukon Silver-Zinc Project, Expatriate needs to conduct an advanced exploration program at their Wolverine property. This advanced exploration program requires the development of an underground test mine.

The Finlayson region has high wildlife value due to its geographic location and its variety of ecosystems and habitats contained therein. The local populations of woodland caribou and moose are particularly important for the local First Nations. This report describes general ecology of these and other wildlife resources in the region and summarizes existing information from previous studies on these wildlife resources. Using this information, the effects of the proposed advanced exploration program on wildlife are assessed and potential mitigative measures are suggested to reduce such effects.

## **1.0 INTRODUCTION**

Expatriate Resources Ltd. (Expatriate) is currently planning mining operations within the Finlayson District of Southeast Yukon (Expatriate Resources Ltd. 2004). The project area is roughly midway between the communities of Ross River and Watson Lake, immediately west of the Robert Campbell Highway.

A component of the Yukon Zinc-Silver Project, Applied Ecosystem Management Ltd (“AEM”) carried out a study of the wildlife for the proposed underground Wolverine mine area. It has been recognized there is a diverse wildlife in the Wolverine deposit area; which has led to this review. In AEM’s Wolverine Advanced Exploration Program Wildlife Considerations Report, Anderson et al. (2001) concluded that in isolation, the proposed Yukon Zinc-Silver Project (formerly referred to as the Finlayson Project), does not appear to cause adverse effects on the local wildlife populations; however, that all care must be undertaken to ensure development and mining activities do not introduce a measurable negative influence on the local environment. Recommendations to mitigate impact on the local environment and wildlife was summarized and can be found presented in Table 1.

In order to complete feasibility studies for the proposed Yukon Silver-Zinc Project, Expatriate needs to conduct an advanced exploration program at their Wolverine property. This advanced exploration program requires the development of an underground test mine for the purpose of assessing ground conditions and underground mining costs. Facilities necessary for test mining at the Wolverine site consist primarily of underground development, laydown areas for equipment and materials, a waste rock stockpile, a borrow area for aggregate, and settling ponds for runoff and water management. An existing airstrip will be utilized for air traffic. Multi-season ground access is not required at this time to support the advanced exploration work. A temporary winter access route will be rehabilitated off of the Robert Campbell Highway, which leads to the Yukon Silver-Zinc Project (Figure 1). The rehabilitated temporary winter access is approximately 32 km long. The advanced exploration program, including test mining, is expected to last approximately 6 to 8 months with additional follow up activities based on the results of the exploration program. Expatriate had contracted Applied Ecosystem Management Ltd. (AEM) in 2001 to assess the potential effects of the proposed Wolverine Advanced Exploration Program on wildlife and to suggest mitigative measures to reduce such effects.

## **2.0 WILDLIFE RESOURCES AND PREVIOUS WILDLIFE STUDIES WITHIN PROJECT AREA**

The Yukon Silver-Zinc Project area occurs at the southern extent of the Tintina Trench at the intersection of three ecoregions, the Pelly Mountains, Liard Basin, and Yukon Plateau North ecoregions (ESWG 1995), and includes boreal, subalpine, and alpine environments. Within a single Yukon ecoregion, environmental gradients created by elevation perhaps exert the strongest control over the distribution of vegetation communities. In the Yukon Silver-Zinc Project area the definition of boreal zone refers to the forested, low elevation valley bottoms and low-lying terrain surrounding Finlayson and Wolverine Lakes. Most waterbodies and wetlands are associated with this zone. Subalpine zone refers to the zone between the relatively closed-canopy forests in the boreal zone and the dwarf shrub, herb, and non-vegetated rock areas in the

alpine zone. It should be recognized that the subalpine zone represents a btrial gradient between these low and high elevation conditions; the subalpine environment is dominated by tall shrub vegetation with scattered spruce and fir forests at its lower limits, grading into lower stature shrub and herb communities at upper elevations. The alpine zone is defined by treeless conditions with rock, low shrub, and herb communities being characteristic features. Similar to most areas of Yukon, wildfire exerts an important control over the distribution and seral stage of vegetation communities in the area.

General physiographic conditions within the project area range from the low lying, rolling topography near Finlayson Lake to the high elevation, rugged terrain of the Pelly Ranges. Elevation ranges between approximately 1000 – 2000 m above sea level within the general project vicinity, with treeline occurring between 1300 – 1500 m. Discontinuous permafrost underlies much of the area.

The Finlayson region contains high wildlife values, likely owing to its location with respect to the intersection of the three ecoregions, the range of topographical features on the landscape, and the juxtaposition of various habitats. Although a comprehensive species inventory and local ecosystem mapping have not been completed for the project area, considerable information on wildlife resources and habitat values has been gathered. Primary information sources include studies on caribou, wolf, and moose population dynamics conducted over the past 20 years by YTG Renewable Resources (e.g. Farnell & McDonald 1988; Jingfors 1988; Larsen & Ward 1995; Hayes et al. 2000; Hayes & Harestad 2000). Information available from these studies includes published and unpublished reports, caribou survey data and population distribution, and radio-tracking results. General information on wildlife in the Finlayson region and specifically the Kudz Ze Kayah and Yukon Silver-Zinc Project areas was also gained through discussions between Expatriate representatives and the Department of Renewable Resources, Fish and Wildlife Branch. Baseline wildlife survey programs have also been implemented by Expatriate and its predecessors to identify critical species and their habitats and to provide or supplement existing information sources (e.g. Cominco 1996). Other potential sources of data that exist but have not been explored fully include local First Nations trapline returns and licensed hunt databases.

The following sections will synthesize any previously collected information on various wildlife species or species groups. Due to the quantity of information and value to local First Nations groups, resident sport hunters, and the Yukon guiding industry, emphasis will be placed on caribou, moose, wolves, and bears. For these species, general habitat requirements and usage patterns will also be outlined.

## **2.1 Woodland Caribou**

### **2.1.1 Ecotypes**

Several subspecies of caribou exist within Canada. Barrenground caribou (e.g. Porcupine and Bathurst caribou herds) include three subspecies: Arctic Island caribou (*Rangifer tarandus pearyi*), continental tundra caribou (*Rangifer tarandus granti*), and Canadian barrenground caribou (*Rangifer tarandus groenlandicus*) (Mallory & Hills 1998). These caribou are gregarious, forming herds sometimes numbering in excess of 10,000 animals, and typically exhibit long-distance migrations between open coniferous habitats during the winter and tundra calving grounds in the

summer. Although they may forage on herbs, mosses, willows, and grasses, terrestrial reindeer lichens are the preferred food source, particularly on winter ranges.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recognizes three ecotypes of the woodland caribou subspecies (*Rangifer tarandus caribou*) (COSEWIC 2000), which have characteristic adaptations and tremendous variation in behaviour, habitat use patterns, and morphology (Dzus 2000). The *boreal ecotype* includes non-migratory animals found in coniferous forests and muskeg throughout parts of Yukon, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, and Newfoundland. In contrast to barrenground caribou, the boreal ecotype woodland caribou typically occur in small herds of 3 to 5 animals, occasionally numbering up to 20 or more. The primary winter forage of this ecotype is terrestrial lichens. The *northern mountain ecotype* includes those animals found in more mountainous terrain of northern British Columbia, Yukon, and Northwest Territories. Northern mountain caribou are moderately gregarious and undertake short-distance migrations from alpine and subalpine calving and summer ranges to winter ranges in low elevation lodgepole pine/black spruce forests. Within these winter ranges, the caribou forage on terrestrial lichens. The *southern mountain ecotype* inhabits mountainous terrain in southeastern British Columbia and west central Alberta. Similar to the northern mountain ecotype, these animals undergo short migrations between summer and winter ranges. However, the southern mountain ecotype forages primarily upon arboreal lichens during winter and may return to higher elevations to do so as the snowpack deepens. Although the latest COSEWIC classification identifies west-central Alberta populations as the southern mountain ecotype, they are more similar to the northern mountain ecotype in their migratory and food habits as well as habitat utilization patterns (Edmonds & Bloomfield 1984; Brown & Hobson 1998).

#### 2.1.2 General Habitat Requirements and Usage Patterns

The Finlayson Caribou Herd belongs to the northern mountain ecotype of the woodland caribou. Caribou give birth to a single calf (rarely twins) on ridges and upper slopes of subalpine basins in late May. Small aggregations form by mid-June in the uplands and upper forests where the caribou remain throughout the summer. From late spring through the summer, caribou utilize many of shrub and herb vegetation types as well as open-canopy subalpine fir forests on valley slopes.

Rutting aggregations form in early October and occupy the uplands (ridges and plateaus), including the upper elevations of the project area. At this time, caribou may utilize any of the alpine shrub and herb vegetation types. After the rut, caribou disperse throughout the area and occupy the alpine, subalpine, and upper forests until late fall (mid-November), utilizing a wide range of vegetation types. By mid-November, caribou start to move down into the boreal forest, including open-canopy black spruce forest vegetation.

By December-January, caribou have moved down to their traditional winter range in the Pelly River lowlands. This winter range includes the boreal forest along the Robert Campbell Highway north of the project area. In early to mid-May, caribou once again move to higher elevations, following the receding snow to their upland calving areas.

#### 2.1.3 Previous Studies

The Finlayson Caribou Herd is highly valued as a subsistence base for the Ross River Dena, by resident sport hunters, by the Yukon guiding industry, and for their own intrinsic value.

Accordingly, this woodland caribou herd has been the subject of a significant management effort by the YTG Renewable Resources department since the early 1980s when caribou population numbers were declining. Although wolves prey primarily upon moose in the study area (Hayes et al. 2000), wolf predation is also an important factor in caribou calf survival. Data from 1982 to 1997 show a significant negative correlation between wolf numbers and calf survival. A wolf control program was implemented between 1983 and 1989 out of concern for the declining caribou population. In conjunction with wolf control, sport hunting was limited to bull caribou and First Nations hunters were encouraged to select male over female caribou. Annual monitoring of the caribou herd (population surveys, rut surveys, radio-collaring) by YTG is ongoing.

During wolf control, the wolf population was substantially reduced in the area occupied by the Finlayson Caribou Herd, allowing the herd population numbers to increase. The Finlayson herd rebounded from a low of approximately 1,800 adults in the early 1980s to an estimated 4,500 by 1990 and stabilized at approximately 4,000 adults by the mid 1990s (Farnell et al. 1998). Approximately 1,000 to 2,000 caribou inhabit the general region around the project area. Woodland caribou use of the Kudz Ze Kayah and Wolverine Lake areas shows high variability as between 66 and 552 caribou were counted in the general project areas during annual rut surveys throughout the 1990s.

In co-operation with YTG Renewable Resources, both the Kudz Ze Kayah and Yukon Silver-Zinc Projects conducted baseline ungulate surveys in the immediate project area. Aerial surveys were flown in 1995 and 1996 to document caribou distribution and numbers at key periods of the year, corresponding to late winter, calving, post-calving aggregation, and rutting activity. Additional information on caribou was also obtained during a 1995 moose survey. The survey data provided key population characteristics (such as peak calving date, post-calving calf:cow ratio, and numbers on rutting range). Most upper subalpine and alpine areas surrounding Wolverine Lake and the Kudz Ze Kayah mine site are considered Key Habitats by YTG Renewable Resources for the Finlayson Caribou Herd during the fall rut; however, survey data indicates that limited calving and post-calving aggregation activity occurs in or immediately adjacent to the Yukon Silver-Zinc Project area.

## **2.2 Moose**

### **2.2.1 General Habitat Requirements and Usage Patterns**

Moose (*Alces alces*) utilize forested vegetation types during much of the year, particularly in the winter when they inhabit the lowlands along Finlayson Creek down to the Robert Campbell Highway. Riparian forests and closed conifer stands provide important browse and thermal cover during this time. Tall shrub vegetation types are also utilized into the winter period. During spring to fall, moose are widely distributed throughout the area and can occur in any of the vegetation types. Alpine areas are infrequently utilized due to their poor cover and food availability. During the rut and post-rut, moose occupy upper subalpine basins and utilize the tall shrub vegetation types and the open-canopy subalpine fir forests. One or occasionally two calves are born during late spring each year.

### **2.2.2 Previous Studies**

Finlayson region moose are also an important resource for the user groups identified above, including the Ross River Dena, as YTG surveys in 1992 showed densities in the Frances Lake area

to be among the highest (381 moose/1000 km<sup>2</sup>) recorded in Yukon (Larsen and Ward 1995). During wolf control, the regional moose population increased from 3,000 to 10,000 animals (Farnell et al. 1998). Data on moose distribution and numbers were also obtained through baseline aerial surveys flown in March and November 1995 to document late-winter and post-rut distribution. Additional data on moose were obtained during the course of caribou surveys. Moose may occur on the Kudz Ze Kayah and Wolverine properties throughout the year. Moose are well dispersed in the project area during summer and early fall but tend to congregate in post-rut groups in the upper elevations around the project area. The information indicates that moose spend early winter in the project area and may remain into late winter during some years.

Moose represent 94% of the biomass killed by wolves in the Finlayson area (Hayes et al. 2000) and the population dynamics of these two species have been examined intensively as a result of the wolf control program implemented during the 1980s. As moose calves are preyed upon most frequently by wolves, it is not surprising that calf recruitment into the breeding population decreases as wolf densities increase (Hayes et al. 2000).

## **2.3 Wolves**

### **2.3.1 General Habitat Requirements and Usage Patterns**

Wolves (*Canis lupus*) are found in most forested and tundra habitats. Pack sizes in east-central Yukon range from 2 to 20, with a mean of about 6.5 (Hayes et al. 2000). Large ungulates dominate their prey base, though they forage occasionally on smaller mammals such as beaver, snowshoe hare, and ground squirrel. An average of 6 pups (Hayes & Harestad 2000) are born in late April/early May in den sites excavated into ridges, in old beaver lodges, in shallow rock caves, or in hollow trees.

### **2.3.2 Previous Studies**

Similar to most areas of Yukon, wolves play an important role in the Finlayson region. They are considered to be the primary predator of caribou and moose and thus have been studied intensively by YTG Renewable Resources. The wolf control program between 1983 and 1989 was successful in reducing the wolf population by approximately 85% (Farnell and Hayes 1992). During the control program, the caribou calf to cow ratio increased as did calf survival and total population size. Following the control program, the wolf population was monitored to examine recovery rates and within six years wolf numbers recovered to pre-control levels (Hayes & Harestad 2000). This quick rebound was attributed to increased pup survival and decreased dispersal during the early years of population recovery. These studies also revealed that kill rates of wolves on moose are best modeled by the number of packs and pack sizes and are unrelated to prey density or snow depth (Hayes et al. 2000).

During previous wildlife studies, wolves or their sign were observed infrequently around the Kudz Ze Kayah and Wolverine properties. Any wolf sightings were scattered throughout the uplands of the area. It was acknowledged, however, that mineral exploration activities concurrent with the 1995 baseline fieldwork programs may have discouraged wolves from fully utilizing some portions of the Yukon Silver-Zinc Project area.

## **2.4 Bears**

### **2.4.1 General Habitat Requirements and Usage Patterns**

Grizzly bears (*Ursus arctos*) are found in mountainous and tundra terrains in northern and western Canada. They emerge from hibernation in March and utilize lower elevation forests, meadows, and wetlands in the spring where they forage on early green-up vegetation. As the snowpack recedes, they move to higher elevations where they forage above the treeline for much of the summer. Subalpine and alpine habitats are particularly important during late summer and fall for the variety of berries that can be found throughout these environments. Grizzlies enter dens, often excavated into alpine slopes, in late fall where they remain until the following spring. Sows breed every two or three years and give birth to one or two young in their dens in January.

Black bears (*Ursus americanus*) are most common in forested habitats below treeline. Sows breed every two years and typically produce two or three young in January or February. They emerge from hibernation in late winter/early spring and spend the summer foraging on vegetation, berries, insects, and carrion. Dens are excavated under tree roots, in banks, or in hollow logs and hibernation usually begins in late October. Black bears are typically more tolerant of human development than are grizzly bears.

#### 2.4.2 Previous Studies

Both grizzly and black bears can be found throughout the entire Finlayson area and were occasionally observed near the Kudz Ze Kayah and Wolverine properties during baseline wildlife data collection programs. In north Yukon, grizzly bear home ranges are generally very large and it is likely that one or two grizzlies include the project area as part of their home ranges. No bear den sites were observed during previous wildlife surveys. Grizzlies range throughout the open valleys, subalpine, and alpine environments of the region, and may occur in any portion of the project area. Black bears are more abundant in the lower forests toward Finlayson Lake and the Robert Campbell Highway. Black bears are not expected to be common in the project area because of the predominance of high elevation subalpine and alpine habitats.

### 2.5 Thinhorn Sheep

Key habitats for thinhorn sheep (*Ovis dalli*) include winter ranges, lambing areas, rutting grounds, mineral licks, and migration corridors. These habitats are critical because they are limited in extent and are used repeatedly by the sheep. Thinhorn sheep inventories were not carried out in either the Kudz Ze Kayah or Wolverine Lake baseline programs, but incidental sightings were recorded. YTG sheep surveys flown in 1986, 1988, and 1995 suggest that sheep utilize portions of the Campbell Range to the east of Wolverine Lake as late winter range and lambing areas. Between 41 and 72 individual sheep were surveyed during these flights but all occurred outside of the Yukon Silver-Zinc Project area. The mountains southwest of Wolverine Lake and north of Money Creek are also believed to be used by sheep as a lambing area and a summer range for nursery bands. A small portion of the mountain range has been designated as a Key Habitat for sheep; however, baseline vegetation mapping for the Yukon Silver-Zinc Project does not indicate that this area contains high sheep values.

### 2.6 Furbearers and Small Carnivores

Beavers (*Castor canadensis*) are moderately abundant in small lakes and ponds of the project area and can be expected throughout the lower and mid-elevation streams and ponds. Other furbearers and small carnivores that were not recorded during previous wildlife programs but which

are known to occur in the region and expected to occur in parts of the project area include coyote (*Canis latrans*), lynx (*Lynx canadensis*), red fox (*Vulpes vulpes*), wolverine (*Gulo gulo*), marten (*Martes americana*), short-tailed weasel (*Mustela erminea*), least weasel (*Mustela nivalis*), mink (*Mustela vison*), and river otter (*Lutra canadensis*).

## 2.7 Small Mammals

No direct information was collected for small mammals in the project area. Similar to most areas of Yukon, snowshoe hares (*Lepus americanus*) occur throughout the region and inhabit most forested and shrub habitats throughout the boreal and subalpine zones of the project area. Ground squirrels (*Spermophilus parryii*) occur on subalpine slopes in the area. One observation of a grizzly bear foraging for ground squirrels was recorded in the Kudz Ze Kayah project area. Both snowshoe hares and ground squirrels represent an important prey base for numerous avian and mammalian predators. No information is available on mice and voles.

## 2.8 Birds

### 2.8.1 Waterfowl/Waterbirds

Waterfowl use of the immediate project area is limited to the few scattered ponds and larger waterbodies and suitable wetlands are restricted to the small lakes and ponds at the top end of Geona Creek and South Creek. However, the Finlayson Lake/River area and the east slope of the Pelly Mountains form part of the important Tintina Trench migration corridor, used extensively by waterfowl and other waterbirds on their north-south migrations. For example, trumpeter swans (*Cygnus buccinator*) are known to migrate through the Finlayson River valley and breed in the lakes and potholes throughout the Pelly lowlands. Greater white-fronted geese (*Anser albifrons*) also migrate through the Pelly River and Finlayson River valleys in significant numbers from late August until mid-September. Migrating northern phalaropes (*Phalaropus lobatus*) were observed in small numbers on ponds near Wolverine Lake. Approximately 200,000 Alaskan and Siberian breeding sandhill cranes (*Grus canadensis*) migrate northward through the study area in May and June and return southward between late August and late September. Common loons (*Gavia immer*) are also known to occur on Wolverine Lake.

### 2.8.2 Raptors

Golden eagles (*Aquila chrysaetos*) were observed on numerous occasions during the baseline wildlife programs. Bald eagles (*Haliaeetus leucocephalus*) and gyrfalcons (*Falco rusticolus*) have also been observed in the Kudz Ze Kayah – Wolverine Lake area. No raptor nest sites or family groups were observed in the immediate project footprints during previous studies.

### 2.8.3 Ptarmigan

Ptarmigan (*Lagopus spp.*) are common in the project area and all three species of ptarmigan (willow, rock, and white-tailed) may occur within the region. The various willow, willow/birch, and subalpine fir/shrub habitats provide abundant cover and food for willow ptarmigan during the breeding season and into the fall. Shrub communities are utilized in the winter for food and cover by all three species.

## 2.9 Critical/Sensitive Habitats

With the current limited extent of vegetation mapping and the lack of a regional framework in which to evaluate the project, it is very difficult to assess habitat rarity and sensitivity. Within the immediate project area, the most sensitive and potentially important habitats for a range of species include wetlands, open waterbodies, and riparian shrub and forest communities. These habitat types are also of limited spatial extent in the Finlayson area; however, it is not currently possible to quantify their regional distribution. Most upland forest, shrub, and alpine habitat types that occur within the immediate project area are expected to be common throughout the region.

### **3.0 POTENTIAL EFFECTS OF THE ADVANCED EXPLORATION PROGRAM ON WILDLIFE**

The Wolverine and Kudz Ze Kayah wildlife programs were developed to: provide necessary information to assess wildlife resources and habitat values in the study area; provide the basis for an assessment of the potential effects of mine development, operation, and decommissioning; and provide a baseline for future monitoring activities. The intent of the programs was not to provide a complete inventory of all wildlife in the project area, but rather to identify important species and their habitats and to supplement existing information sources collected by government agencies. The amount of baseline wildlife information collected for the Kudz Ze Kayah and Wolverine (Yukon Silver-Zinc) Projects, in addition to YTG Department of Renewable Resources information, represents some of the most extensive ungulate baseline data collection performed in Yukon. Both types of wildlife programs were focused on species of regional concern, woodland caribou and moose. These data sources, as summarized in the previous sections, will form the basis for an assessment of the potential effects of the Wolverine Advanced Exploration Program.

General habitat requirements that should be considered in such an assessment include forage availability, cover, travel corridors, territory size and boundaries, etc. in addition to the critical components (rutting and calving grounds, nesting sites, etc.) that were evaluated in previous studies. An understanding of the regional availability of these general habitat requirements is necessary to most accurately assess potential effects to wildlife resulting from the Wolverine Program. It should be noted, however, that information for the project area is lacking with respect to regional ecosystem information. Ecosystem mapping for the region may allow direct and potential project effects to be quantified. The following assessment makes use of existing information to identify potential program effects and is qualitative in nature only.

#### **3.1 Potential Effects of Proposed Program and Corresponding Mitigation Measures**

The primary wildlife concerns associated with increased resource development related to the Wolverine Advance Exploration Program are:

- Increased hunting and predation pressure facilitated by new access trails (access effects);
- Alteration or loss of habitats such as winter ranges and nesting areas (habitat effects);
- Disruption or displacement of critical wildlife functions such as breeding and migration (disturbance effects);
- Increased animal-vehicle collisions (trail traffic effects).

The following sections deal with the potential effects of the program on wildlife (see Table 1 for a summary). Mitigation and management measures proposed in this report have been drawn largely from previous work done for the Kudz Ze Kayah Project. These strategies were developed by Cominco Ltd. through extensive consultation Renewable Resources biologists and Ross River Dena Council.

### 3.1.1 Caribou

#### 3.1.1.1 *Access Effects*

Although increased access to caribou range may be somewhat beneficial for First Nations sustenance hunters, the potential for unsustainable harvest (legal or illegal) and uncontrolled recreational activity over the duration of the trail life (potentially < 2 yrs solely in winter months) may be detrimental to the Finlayson Caribou Herd. Accordingly, YTG Renewable Resources and the Ross River Dena have identified increased access to the traditional range of the herd, especially along their migration route to winter range, and the potential for increased harvest as the primary concern of resource development in the Finlayson area.

As the access trail would be rehabilitated from the Robert Campbell Highway to the existing exploration trails on the Wolverine property, it will be afforded the same protection measures to restrict access during the winter months of operation. A security station post with 24-hour guard will be maintained near the junction with the Robert Campbell Highway. Only authorized vehicles are allowed on the trail and there is a 'No Hunting' or 'Fishing' policy for company employees. This arrangement will be in place when the access trail is first used in January 2005 and should be very effective at mitigating the potential effects of increased hunting and recreational activity on local wildlife populations. The importance of maintaining a manned station cannot be under-stressed as gates alone are not necessarily an effective access prevention method (R. Anderson, pers. obs.).

Research on interactions between wolves and boreal woodland caribou has revealed that linear corridors may act to increase wolf hunting efficiency (James 1999). However, as the proposed trail avoids traveling directly through key caribou habitat, noticeable increased predator efficiency from the trail is not expected.

#### 3.1.1.2 *Habitat Effects*

No rare habitat types were identified during the Wolverine (Yukon Silver-Zinc) Project vegetation survey and all habitat types encountered appear to be typical of the region. The proposed program will, nonetheless, result in short-term and long-term direct habitat loss for caribou in the Finlayson region. Caribou depend on subalpine basins and ridges for calving and on high ridges and plateaus for rutting. Most calving activity occurs outside of the project area and habitat on rutting ranges adjacent to the development area will not be directly affected by the project. The proposed access trail from Robert Campbell Highway to the Wolverine site is expected to directly impact less than 12.0 hectares of boreal and subalpine habitat because of the existing footprint. Since the habitat that will be effected by the program is common and widely distributed in the region, and the program area is not designated as Key Habitat for caribou, the direct loss of a small amount of habitat should not be detrimental to caribou populations.

A larger effect may arise, however, from a functional loss of habitat. Studies have shown short-term changes in the movement and distribution of woodland caribou in response to

hydroelectric development (Northcott 1985), timber harvesting (Chubbs et al. 1993), simulated oil and gas exploration (Bradshaw et al. 1997), and haul-trail activity (Cumming & Hyer 1998). Long-term avoidance of landscape features resulting from resource development activities (e.g. seismic lines, trails, harvested or otherwise fragmented habitats) have also been noted for woodland caribou in northeastern (Dyer 1999; James and Stuart-Smith 2000) and west-central Alberta (Smith 2000; Oberg 2001). The distance to which these disturbances will have been avoided ranges from a few hundred metres to several kilometres, depending on the magnitude of the disturbance. Dyer (1999) found reduced use of habitat near trails for boreal caribou in northern Alberta. This avoidance affect varied by habitat type and season. In open habitat, caribou used areas within 500 m of a trail less than expected throughout the year. In closed habitat, avoidance ranged from 250 m in the winter (high trail activity) to 100 m in the summer (low trail activity). Oberg (2000) found similar trail avoidance with mountain ecotype caribou in west-central Alberta, where caribou showed less than expected use within 100 m of inactive trails. Avoidance of active trails was not tested. Based on a conservative estimated avoidance area of 500 m on either side of the access trail, 1800 ha may receive less use than expected by chance. This does not, however, mean that this 1800 ha will receive no use by caribou.

Recent work by Oberg (2000) revealed that mountain caribou avoided streams by up to 250 m. The observation database provided by Renewable Resources indicates very few caribou sightings in the vicinity of the proposed access trail corridor. As much of this corridor parallels streams from the Robert Campbell Highway to Wolverine Lake, it may be that the lack of sightings in the area is related to Oberg's findings. If caribou naturally avoid this area, functional habitat loss from the proposed trail, which parallels streams for much of its length, may be limited.

Since the area of direct habitat loss within the proposed exploration mine site is expected to be small (less than 1 ha), short-term mitigation of habitat effects for the mine site will focus on minimizing the disturbance of caribou and potential functional habitat loss. Such mitigation measures are described in detail below (Section 3.1.1.3 Disturbance Effects).

Over the long term, direct habitat loss will be mitigated through closure and reclamation procedures. Access trails and staging areas used for this program will be closed according to standard operation practice in Yukon. Surfaces will be scarified if required and all ice bridges removed. Stockpiled organic materials such as brush and trees will be placed on the scarified surface in a random manner to create an uneven surface. Large boulders will be moved onto the surface when available. Stream crossing areas will be crossed in such a way to minimize streambank erosion and potential sedimentation of streams. However, scarified surfaces will only be seeded in areas where ground stability or potential stream sedimentation is a concern. Most portions of the trail will be allowed to revegetate naturally from trailside seed sources, thereby returning the area to a more natural state. Because a portion of the access trail that forms part of the proposed access route is swamp to bog, upon completion of the project no permanent access to the Wolverine site will remain.

As terrestrial lichen is notoriously slow to regenerate and woodland caribou prefer old-growth forested stands with relatively high lichen abundance, caribou use of reclaimed mine and trail areas may be limited by forage availability for several decades. However, as the total area

of disturbance is relatively small and the area is not located within the main wintering area, the loss will not likely have a noticeable effect on winter forage availability for the herd.

Deactivation of the trail will limit access to the area and will limit passage through the program area with motorized vehicles. Reclamation procedures should assist in initiating the natural regeneration process. As the footprint of the proposed project is relatively small in size, it will directly disturb only a small percentage of caribou habitat in the Finlayson area and will likely have little direct effect on habitats that are critical to caribou reproductive activities. The functional habitat loss is considerably harder to quantify and is expected to affect a larger area.

### 3.1.1.3 *Disturbance Effects on Energetics and Movements*

In addition to disturbance-related habitat effects, access construction and exploration activities may affect caribou through increased energetic requirements (due to increased movement rates, decreased feeding, etc.) or through barrier effects to movement.

Several studies have addressed the energetic effects of disturbance on caribou (see Dyer 1999 for a review). Disturbance from human activity related to trails, oil wells, and aircraft have been found to influence caribou behaviour, which in turn has the potential to increase energetic demands. Information from 1995 surveys and from previous YTG radio-collar location surveys indicates that the main calving and post-calving aggregation areas are to the south of the project area (Figure 2). Likewise, key rutting areas are several kilometres west of the test mine site. Given the distance between the mine site and the upland calving, post-calving, and rutting areas, the majority of development and mining-related activity (truck traffic, machinery, heavy equipment operation, and camp/office operation) should not interfere with caribou calving or rutting activity. Winter has been suggested as the period in which caribou are most susceptible to increases in energetic cost (Bradshaw et al. 1997). As the winter range of the Finlayson herd lies to the northwest of the project area, disturbance effects are not expected to be large during this critical time.

Effects on movement may be important during other sensitive periods such as calving, post-calving, and during the rut. Dyer (1999) found that trails may act as semi-permeable barriers to movement within homeranges for boreal woodland caribou. Based on simulated random movement within an animal's homerange, Dyer found that caribou crossed trails less than 40% of expected. Unfortunately there is no similar study of the barrier affects of trails on mountain-ecotype caribou. However, low traffic volume on the access trail, combined with an access corridor that does not appear to bisect core areas of a particular seasonal range, should mean that barrier effects of the trail will be limited. Caribou in the Finlayson area are known to disperse after the rut and inhabit the uplands and lower slopes into mid-November. During this time, caribou occur in varying numbers in the general project area. The project is not expected to interfere with movements of caribou between their upland calving, summer, and rutting ranges and winter range in the Pelly River lowlands as movement to the winter range should be in a north-westerly direction, away from the proposed mine site. Additionally, movements towards the winter range will likely correspond with freeze-up on Wolverine Lake. Traffic on the access trail during this time will be very light as the lake will be unusable for barge traffic or ice trail development. However, the access trail will be monitored during mid-November to early-January and April to May to provide site-specific data for managing this potential effect.

To prevent the disturbance of caribou outside the mine site or trail, employees will not be allowed to construct any unnecessary trails or operate motorized recreational vehicles. Occasional aircraft traffic to the Wolverine airstrip would not be close to the caribou calving areas; nonetheless, limited aerial activity periods will be enforced during caribou calving (May to early June) and rutting (October) seasons.

#### 3.1.1.4 *Trail Traffic Effects on Mortality*

Vehicle and truck traffic along the access trail have the potential to increase caribou mortality through collisions. Measures to reduce the potential for collisions will include:

- driver education,
- setting and enforcing speed restrictions during the migration periods,
- posting warning signs at locations with the greatest potential for animal collisions;
- reporting animal locations by radio to the security gate and other drivers, and
- adjusting speed and frequency of traffic during particularly high risk periods.
- “right of way” and “minimum distance” provisions for caribou crossing the access trail.

No vehicular animal mortalities have been reported for the Kudz Ze Kayah Trail since its construction.

### 3.1.2 Moose

#### 3.1.2.1 *Access Effects*

Increased access has been identified by YTG as a concern for local and regional moose populations. This potential effect can be managed by controlling access, as outlined above for caribou. Use of the trail as a travel corridor by wolves may impact predation rates in the local area; however, regional effects are expected to be small.

#### 3.1.2.2 *Habitat Effects*

Direct habitat loss is expected to have a minimal effect on moose. The area comprising the mine site provides spring, summer, and fall habitat for moose. As with caribou habitat, the removal of this small amount of moose range in the mine area is not expected to be substantial. Moose are generally more tolerant of human activity than caribou and often use disturbed sites as they begin to regenerate. Hence, the area representing functional habitat loss is not expected to be significantly larger than the area of direct habitat loss.

The effect of habitat removal for the trail and test mine site is expected to represent only a relatively short-term habitat loss extending until shortly after decommissioning. Natural regeneration is expected to return these disturbed sites to productive moose habitat within 10 years after decommissioning. Reclamation activities, including re-grading and seeding/planting, will help decrease this short-term effect. In instances where the initial habitat was mature forests, the younger successional stages occurring after mine closure may actually benefit moose.

#### 3.1.2.3 *Disturbance Effects on Energetics and Movements*

A potential exists for displacement of moose from habitat as a result of construction and mining activities as moose may react by staying out of the mine site and immediately adjacent

area. The mine site, however, is not expected to create a complete barrier to moose movement either during or after mining. The mine site is relatively small and compact and large mammals will be readily able to move around the mine site features. It has been shown that some large mammals adapt very quickly to the presence of industrial activity and readily move through and around a mine site (e.g. Echo Bay's Lupin Mine, Cominco's Red Dog Mine). Animals will still be able to travel through the adjacent areas to access the upper subalpine basins, which are used during the rut and post-rut. The lower portions of these subalpine basins and the lower valley slopes are used by moose for calving and will also still be accessible. Limited aerial activity periods will also benefit moose in the project area.

#### 3.1.2.4 *Trail Traffic Effects*

Mortality from collisions with vehicles along the access trail has the potential to effect the local moose population. Measures to mitigate and manage this potential effect on moose are the same as those outlined above for caribou. Wildlife logs will be kept throughout the operating period and can be reviewed by YTG Renewable Resources as requested. Although this is not considered a scientific monitoring program, the results can be used to indicate presence at different times of the year.

#### 3.1.3 Wolves

Wolves are a significant component of the wildlife resources of the region. Habitat reduction during life of the project is likely not substantial for wolves, which travel large areas in pursuit of prey. Disturbance associated with the project is likely to deflect wolves away from the immediate mine area and result in a loss of hunting terrain during the life of the project. Mitigation for this short-term loss of habitat for wolves is not considered necessary. Reclamation and natural succession after decommissioning will return much of project related facilities to suitable hunting terrain for wolves. The long-term reduction of habitat at the mine site is not expected to have a substantial effect on the regional wolf population. Wolves should still be able to travel through the project area, between the boreal forest to the north and the uplands and valleys to the south. The presence of the access trail may have a minor positive energetic effect for wolves that take advantage of the trail for movement during low-use periods. Although fatalities from collisions with vehicles could result, speed restrictions should minimise this risk. Overall, substantial effects on the regional wolf population are not expected.

#### 3.1.4 Bears

Access control will minimize the potential for increased hunting pressure on both black bears and grizzly bears. The reduction of habitat at the mine site and access trail should not substantially affect the regional grizzly bear population. Based on home range size in other parts of the Yukon (26 km<sup>2</sup> in south-western Yukon, Pearson 1975), the actual amount of habitat directly-affected by the proposed trail and Wolverine Advance Exploration mine site should be less than 2% of the home range of one or possibly two grizzlies. Additionally, the habitat types affected by the project are common in the region. Since the habitat in the project area is not considered ideal for black bear, very few black bears are expected to inhabit the project area. Hence removal of habitat is not expected to have a noticeable effect on black bears. The

potential for direct mortality of bears through encounters with construction and mine site workers will be reduced through implementation of the following practices:

- recording of all bear sightings;
- warning signs posted and information circulated for workers in the event that bears are regularly observed near the camp and mine site; and
- containment of food wastes in suitable, bear proof containers, daily incineration of food wastes, and hauling of residue to a landfill.

Persistent bear problems will be reported to the local conservation officer who will deal with any bear control issues.

### 3.1.5 Furbearers and Small Carnivores

Effects to smaller carnivores and furbearers will be related to reduction in available habitat. The access trail will likely remove a small amount of boreal forest habitat that is used by upland furbearers (e.g., foxes, marten, weasel). The areas involved are expected to return to productive habitat once they are decommissioned and natural succession occurs.

### 3.1.6 Birds

The Tintina Trench is a major migration corridor of continental significance for very large numbers of migrating ducks, geese, swans, and sandhill cranes. Air traffic around the Wolverine airstrip will increase the risk of bird strikes. Bird strikes could have serious consequences for aircraft and occupants. This potential effect will be mitigated by restricting flights during periods of poor visibility and during migration periods. No bird strikes have been reported at the Wolverine airstrip since its construction.

Effects to raptors (mostly golden eagles and gyrfalcon) are not expected to be substantial. The short-term reduction of hunting terrain is not likely to effect local or regional populations of these two species. Breeding by either species has not been documented in the vicinity. No nest sites were observed during aerial surveys and no family groups were observed in the area during groundwork or overflights.

The most significant bird species that rely on the mine site area for habitat are ptarmigan species. In terms of direct habitat removal, the mine development will affect willow ptarmigan that breed in the willow, birch and mixed shrub units. Densities of breeding willow ptarmigan can vary widely, ranging from 4-5 pairs/km<sup>2</sup> in low years to 25-30 pairs/km<sup>2</sup> in high years. Although it is difficult to predict population-level effects without detailed habitat information, based on direct habitat loss of approximately 0.18 km<sup>2</sup>, decreases in population numbers should be minimal. It will, however, be important to ensure that the No Hunting rules for employees are enforced, as this likely poses the greatest threat of population-level effects from the project.

## 3.2 Potential Cumulative Effects on Caribou and Moose in the Program Area

A determination of the significance of cumulative effects on caribou and moose populations would require a quantitative analysis of previous and current project effects, including mapping and classifying the existing human footprint on the landscape (e.g. old trails, clearings, etc.).

Since such quantification is not currently possible, the following section discusses qualitatively the potential cumulative effects of the proposed project in conjunction with other existing or potential activities in the region.

### 3.2.1 Development and Mining Activities

Timber harvesting and oil and gas potential in the region is very low, with no current programs operating nor proposed; as a result, the potential for additive negative effects from these activities is considered to be very low. Similarly, the area has no agricultural capability and urban development will continue to be very limited. Expatriate Resources Ltd. currently holds the majority of mineral claims in the immediate region; it is therefore unlikely that further mine development will proceed from a separate company. No additional Expatriate mines (beyond the proposed Wolverine mine as part of the Yukon Silver-Zinc Project) are currently in the planning stages for the Finlayson area.

While the Wolverine Advanced Exploration Program and the Yukon Silver-Zinc Project (Wolverine) are essentially one project, therefore consideration should be given to the potential for negative cumulative effects associated with one project. When considering potential cumulative effects of the project, it is important to recognize that due to the nature of mineral exploration and development the Wolverine Advanced Exploration Program necessarily precedes the Yukon Silver-Zinc Project (end result). Also, much of the surface disturbance that will be created during the Wolverine Advanced Exploration Program will likely be incorporated into the Yukon Silver-Zinc Project. As such, these two separate activities are expected to have limited additive spatial effects. However, the Wolverine Advanced Exploration Program will add an additional component to existing human activity in the region in the years leading up to development of the Yukon Silver-Zinc Project.

The effects on wildlife from the Yukon Silver-Zinc Project cannot be determined at this time and, as such, it is difficult to predict the cumulative effects of the Wolverine Advanced Exploration Program and through extension, the Yukon Silver-Zinc Project. A short-term reproductive impact (decreased calf/female ratio) was observed in the southern portion of the Finlayson Herd's range during the "staking rush" that occurred in the Finlayson region between 1995 and 1996 (Farnell 2000). Once the intense helicopter-assisted staking activities ceased, calf/female ratios returned to pre-disturbance levels. However, the intensity and spatial extent of exploration activities that occurred during the 1995-1996 seasons are orders of magnitude beyond the levels that will be associated with either the Wolverine Advanced Exploration Program or Yukon Silver-Zinc Project. Based on this observation, it seems unlikely that the advanced exploration program will contribute substantially to the total cumulative effects of existing factors and future mine development.

### 3.2.2 Exploration Activities

Expatriate is the only company currently conducting mineral exploration activity in the Finlayson region. The company holds the majority of the mineral claims and has valid land use approvals and permits for exploration activity. Grassroots exploration, including prospecting and mapping, line cutting, geophysical surveys, trenching, and diamond drilling, will be conducted on an ongoing basis. The magnitude of the activity in any given season will be dependent on the results of previous exploration. A reasonable estimate would be 15 to 30

exploration staff working in the region between June and September each year. Workers would be housed at one of the main camps (Wolverine) and supported by helicopter to the various remote exploration targets. Since exploration workers will utilise planned infrastructure, the only impact on habitat will be habitat alteration from line cutting operations, drill pad clearing, etc. The most disruptive impact of exploration activities will be the use of helicopters to access remote areas. Human presence in work areas may result in short term habitat avoidance during the summer exploration season. As stated in Section 3.2.1, the intensity of the Wolverine Advanced Exploration Program is expected to be orders of magnitude less than that incurred during the 1995-1996 “staking rush”, when a short-term measurable reduction in the caribou cow/calf ratio was recorded.

### 3.2.3 Other Activities

Hunting and the direct/indirect effects of the Robert Campbell Highway are probably the largest sources of anthropogenic-caused wildlife mortalities in the area. The exact numbers of vehicle-wildlife collisions on the Highway are not currently known. The Finlayson region is part of the Teslin Outfitters guiding concession. Hunting activity (moose and caribou) occurs during the late fall. Data on estimated licensed harvest for the Finlayson Caribou Herd suggests that an average of 47 animals were taken per year during the seven years prior to the permit hunt. First Nations harvest is not included in these figures, however. The exact number of visitors and animals taken is not known. Direct caribou and moose mortalities resulting from development and mining activities, in particular vehicle-animal collisions, may be cumulative with legal harvest and highway mortalities. However, the likelihood of direct animal mortality occurring as a result of advanced exploration activity is very low. No known vehicle collisions or hunting deaths have occurred in the area as a result of exploration activities in the past. Given the mitigation and management measures proposed, this trend is expected to continue; therefore, cumulative, additional animal mortalities from the advanced exploration program are unlikely.

### 3.2.4 Total Cumulative Effects

Potential cumulative effects to caribou and moose in the region resulting from past and future activities include mortality from hunting and vehicle collisions, direct habitat loss through clearing, earthworks, and trail construction, and functional habitat loss through avoidance of active work areas (Table 2). The proposed advanced exploration program is not expected to provide a substantial addition to existing cumulative effects given the mitigation and management measures proposed herein. As no current threshold levels for total cumulative effects have been set, it is not possible to assess the current situation in relation to a total allowable cumulative impact from all influencing factors. YTG, DIAND and Ross River Dena will need to begin to address this issue if potential projects are to be assessed in this light.

## 4.0 CONCLUSION

The Finlayson area of Southeast Yukon is home to many wildlife species. Moose and caribou are of particular importance to several stakeholders including YTG Renewable Resources and the Ross River Dena. As a result, every effort must be extended to ensure

development activities do not result in measurable negative effects to local populations. To assess the feasibility of the Wolverine mine, the Wolverine Advanced Exploration Program has been proposed. The potential effect of this program on local wildlife and methods to mitigate these effects are summarised in Table 1.

In isolation, the proposed advanced exploration program is not anticipated to result in substantial adverse effects to local wildlife populations. The Wolverine Advanced Exploration Program is also not expected to contribute substantially to existing negative cumulative environmental effects for regional wildlife populations. However, it should be recognized that in the absence of regional ecosystem mapping, land use planning objectives, and allowable thresholds for cumulative effects, total cumulative adverse temporal and spatial effects are currently difficult to quantify and assess in terms of significance.

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## **6.0 APPENDIX: Figures and Tables**

Figure 1: Map of project area with existing and proposed access routes.

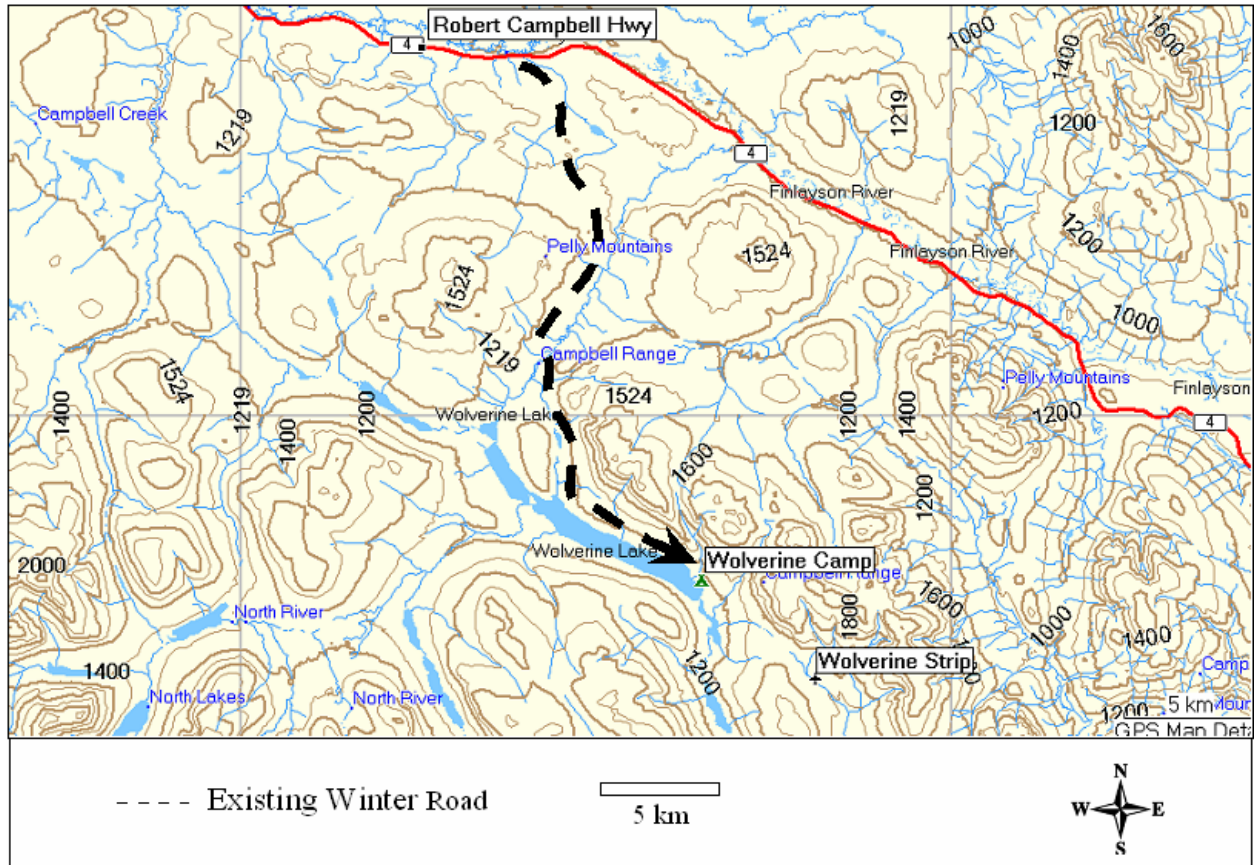


Figure 2: Map of greater project area with seasonal caribou distribution data.

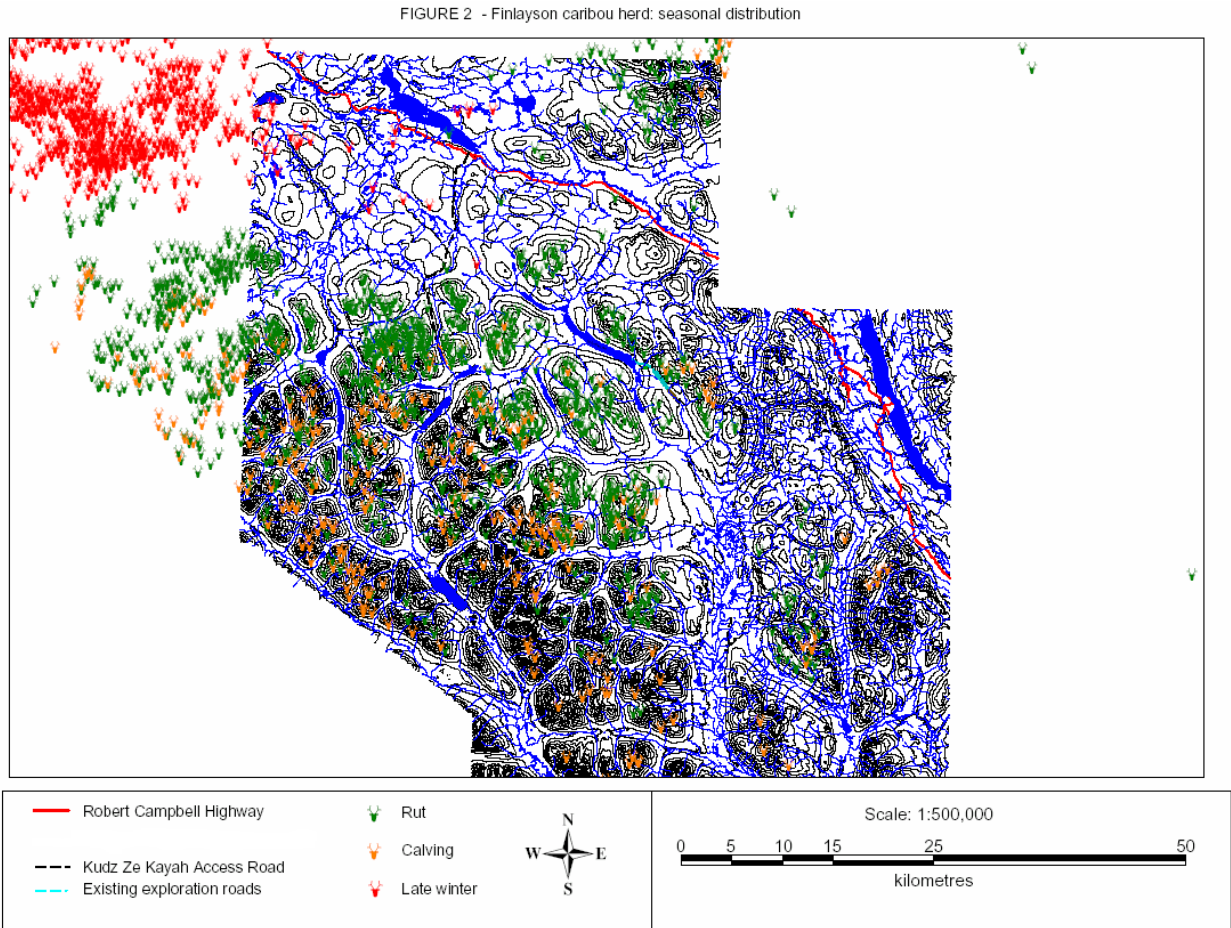


Table 1: Summary of potential effects of proposed Wolverine Advanced Exploration Program and mitigative measures.

| <b>Species</b> | <b>Predicted Effect</b>   | <b>Potential Mitigation</b>  |
|----------------|---|--|
| Caribou        | <ul style="list-style-type: none"> <li>- access effect</li> <br/> <li>- habitat effect</li> <br/> <li>- disturbance effect</li> <br/> <li>- trail traffic effect</li> </ul> | <ul style="list-style-type: none"> <li>- access control including                             <ul style="list-style-type: none"> <li>- gated, manned security station</li> <li>- no hunting policy for employees</li> <li>- closure of trail using reclamation procedures, ditching/berming, removal of stream crossings, replacement of organic mat, recontouring of trail surface</li> </ul> </li> <li>- reclamation of mine site and access trail using various scarification techniques and natural regeneration</li> <li>- mitigation of functional habitat loss through disturbance effect mitigation as described below</li> <li>- no construction of unnecessary trails</li> <li>- no operation of off-trail vehicles</li> <li>- limited aerial activity periods during calving and rutting</li> <li>- attempt to avoid caribou in Wolverine Lake</li> <li>- monitoring to assess disturbance</li> <li>- driver awareness/traffic control as follows                             <ul style="list-style-type: none"> <li>- driver education programs</li> <li>- setting and enforcing speed restrictions during migration periods</li> <li>- posting warning signs at locations with high potential for animal collisions</li> <li>- reporting animal locations by radio to security gate and other drivers</li> <li>- adjusting speed and frequency of traffic during particularly high risk periods</li> </ul> </li> <li>- right of way and minimum distance provisions for caribou crossing the trail</li> </ul> |

|                               |   |  |
|-------------------------------|---|--|
| Moose                         | <ul style="list-style-type: none"> <li>- access effect</li> <li>- habitat effect</li> <li>- disturbance effect</li> <li>- trail traffic effect</li> </ul>           | <ul style="list-style-type: none"> <li>- access control as per above</li> <li>- no mitigation planned though natural succession will occur after decommissioning</li> <li>- no mitigation planned though limited aerial activity periods will also benefit moose</li> <li>- driver awareness/traffic control as per above</li> <li>- avoidance of moose swimming in Wolverine Lake (barge traffic)</li> <li>- wildlife logs</li> </ul> |
| Wolves                        | <ul style="list-style-type: none"> <li>- habitat effect</li> </ul>  | <ul style="list-style-type: none"> <li>- no mitigation planned though natural succession will occur after decommissioning</li> </ul>   |
| Bears                         | <ul style="list-style-type: none"> <li>- access effect</li> <li>- habitat effect</li> <li>- trail traffic effect</li> <li>- direct conflict with workers</li> </ul> | <ul style="list-style-type: none"> <li>- access control as per above</li> <li>- no mitigation planned</li> <li>- driver awareness/traffic control as per above</li> <li>- record of all sightings</li> <li>- warning signs/information for mine workers when bear in area</li> <li>- containment of food wastes in bear proof containers, incineration of food wastes, haul residues to landfill</li> </ul>                            |
| Furbearers & Small Carnivores | <ul style="list-style-type: none"> <li>- habitat effect</li> </ul>  | <ul style="list-style-type: none"> <li>- no mitigation planned though natural succession will occur after decommissioning</li> </ul>   |
| Birds                         | <ul style="list-style-type: none"> <li>- air traffic effect</li> </ul>  | <ul style="list-style-type: none"> <li>- flight restrictions during conditions of poor visibility and during migration periods</li> </ul>  |

Table 2: Potential for substantial additions to cumulative effects for caribou and moose.

| Focus Species | Issue   | Potential for substantial addition associated with Wolverine Advanced Exploration Program  |
|---------------|---|--|
| Caribou       | Direct habitat loss (through alteration, development)   | Low. The direct footprint of the Advanced Exploration Program (drill pads, survey lines, test pit and waste rock storage) is estimated to be less than 40 ha over the duration of the project.   |
|               | Functional habitat loss and disruption (avoidance of active work areas and increased disturbance) | Low regional, with moderate potential for local impacts, but of limited duration and spatial extent. Most functional loss from trail, which may be in an area naturally avoided by caribou.  |
|               | Increased vehicle mortality (vehicle-animal collisions)   | Low. Low vehicle speeds and a minimal numbers of vehicles will be active in the area.  |
|               | Increased human hunting mortalities.  | Low. No new public access will be created directly from the Robert Campbell Highway. The original Kudz Ze Kayah access trail will remain gated and manned. The proposed barge/ice trail link across Wolverine Lake will avoid the creation of a permanent trail between the Kudz Ze Kayah and Wolverine deposit. |
| Moose         | Direct habitat loss (through alteration, development)   | Low regional, moderate local. The direct footprint of the Advanced Exploration Program (drill pads, survey lines, access trail, test pit and waste rock storage) is estimated to be less than 40 ha over the duration of the project.  |
|               | Functional habitat loss and disruption (avoidance of active work areas and increased disturbance) | Low regional and local.  |
|               | Increased vehicle mortality (vehicle-animal collisions)   | Low. Low vehicle speeds and a minimal numbers of vehicles will be active in the area.  |
|               | Increased human hunting mortalities.  | Low. No new public access will be created directly from the Robert Campbell Highway. The original Kudz Ze Kayah access trail will remain gated and manned. The proposed barge/ice trail link across Wolverine Lake will avoid the creation of a permanent trail between the Kudz Ze Kayah and Wolverine deposit. |