Wolverine Project

RECLAMATION AND CLOSURE PLAN

VERSION 2006-01

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1 Introduction

This report describes the activities pertaining to decommissioning and closure of the Wolverine Project mine operations. Wherever possible, concurrent reclamation of disturbed areas will occur throughout the operational phase of the mine. Most decommissioning and closure activities will however commence following cessation of underground mining and processing operations.

Provided below are initial plans for temporary closure, decommissioning and closure and reclamation for the Wolverine Project. These plans provide a basis for long-term planning and a vehicle for ensuring that closure considerations are factored into long-term mine planning and development at the site. However, the plans are largely conceptual at this stage and will evolve throughout operations following acquisition of additional site specific data relevant to closure planning.

Yukon Zinc Corporation (YZC) intends to implement an environmentally sound and technically feasible decommissioning and closure plan for the proposed Wolverine Project. Throughout the Pre-Feasibility and Feasibility evaluations of the Wolverine Project and the corresponding environmental assessment, an important objective was to fully consider all of the closure aspects of the project and to ensure that the operation be developed such that eventual passive closure was achievable. The following decommissioning and closure plans are a summation of that process and were guided by the following principles and objectives:

- Progressive reclamation measures will be implemented during mine operations
- Post-closure land use will be commensurate with surrounding areas
- Closure will include environmental protection measures that prevent adverse environmental impacts
- Closure of the operation will ensure the protection of public health and safety
- Closure planning will incorporate and commit to a comprehensive site monitoring program to assess effectiveness of closure measures for the long term

The development of closure activities and mitigation measures has involved an assessment of the critical components that could potentially place the public or the environment at risk. Site specific monitoring and contingency plans will continue to be developed as necessary. Where possible, performance based criteria will be integrated into the monitoring programs.

A mechanism will be established to ensure that communication between government agencies, communities of interest and YZC is clear and consistent, and all closure objectives are met.

It is important to note that the length of the closure period will depend upon whether decommissioning, closure and reclamation objectives are met. Once decommissioning, closure and reclamation activities meet the respective objectives, the site will be declared as permanently closed (post-closure).

The sections below document the requirements for a temporary closure period, and those for the decommissioning and closure phase.

2 Temporary Closure

2.1 Introduction

A temporary suspension of mining and processing activities could result when factors such as changing market conditions or mine related factors occur. A temporary state of inactivity could be either a defined or indefinite period of suspension. A state of inactivity may evolve into a state of permanent closure if prevailing conditions for the resumption of operations are not favourable.

YZC recognizes the legitimate concern that government and the public have with respect to a state of temporary closure. At the same time, it must be recognized that world commodity prices are difficult to predict, are cyclical, and are not under the control of YZC. Consequently, the company may not be able to state when operations are likely to resume once the project is temporarily closed.

During a temporary closure, YZC intends to be a responsible steward of the site and demonstrate its commitment to re-opening the site by:

- continuing to have the site under the care and maintenance of an on-site caretaker
- continuing to maintain the main access road in a manner that heavy equipment can be brought to the site on short notice to deal with an environmental emergency
- implementing a performance-based monitoring program for the duration of the closure period
- adequately monitoring and maintaining buildings and facilities such as tailings facility
- ensuring that fixed equipment and buildings remain essentially intact on site

The sections that follow describe the activities that would occur during a temporary closure, including access and security measures pertaining the mine openings, facilities and equipment, and waste and water management plans.

2.2 Access and Security

The site will be manned or inspected by representatives from YZC on a 24-hour basis. The main access roads will be kept open with restricted access and maintained.

Surface facilities will only be accessible to YZC personnel, or designated representatives. All surface mine facilities will be locked and trespassing signs posted. Other potential entry to the buildings, such as windows, will be secured.

2.3 Mine Openings

The 1345 and 1360 Portal entrances will be fenced or gated to restrict access to the mine. In addition, access points to these openings will be blocked using large boulders (boulder fencing). All other access points to the vertical openings such as the vent shafts will be secured.

2.4 Industrial Complex Facilities and Equipment

Fuel storage and reagent tanks will be regularly inspected for leakage to ensure they are operating according to the applicable regulations and licenses. If required, a fuel distribution agent or a waste management contractor will pump the contents of storage tanks. Tanks that will not be reused will be removed and offered for sale or scrap, following appropriate procedures and protocols.

Mining equipment will be left in no load condition. All equipment not required for site maintenance or operations during this period will be stored in locked buildings or in appropriate areas.

All wastes will be handled, stored, managed and disposed of in a proper manner as outlined in the *Solid Waste Management Plan* (YZC, 2006b). As there will be no tailings or waste rock generated during this phase, the main waste sources will include domestic waste and other minor waste streams.

Depending on the anticipated closure period, chemicals or reagents that are deemed to have short shelf life will be returned to suppliers/manufacturers, and those chemicals that cannot be returned will be disposed of in a proper manner as per manufacturer's requirements.

2.5 Tailings Facility

Under temporary closure, no active discharge of tailings slurry to the tailings impoundment would occur. However, precipitation, runoff and groundwater from the underground workings would report to the facility. These various water sources will continue to add volume to the facility and treatment of excess water would be necessary to maintain adequate freeboard in the impoundment. Accordingly, tailings pond water would be treated and discharged to Go Creek as per the operating condition (see Section 2.6).

Structurally, the tailings dam and seepage recovery facility will be maintained in a safe operating condition. Operating and inspection protocols outlined in the Tailings Facility Operating, Maintenance and Surveillance Program will be followed, as the tailings facility will remain operational. In general, activities will include regular visual inspections, plus routine geotechnical inspections and dam safety reviews by a geotechnical engineer.

The tailings impoundment spillway will be inspected a minimum of three times per year, with particular attention paid to inspection prior to the spring freshet to ensure that the channel is not blocked and that the channel erosion protection is intact. The performance of the spillway will be monitored during the high runoff periods while the mine is in operation such that potential future problems, if any, can be identified and remedied prior to temporary or permanent mine closure.

2.6 Water Management

During temporary closure, water levels in the underground would be managed and dewatering to the tailings facility would occur to prevent flooding of the underground workings and subsequent damage to underground electrical and communication systems. Dewatering rates are expected to be low and on the order of 1 to 2 L/s.

Water entering the tailings facility would be minimized by maintaining all diversion ditches; however the relatively small quantity of water from the underground dewatering would still be expected to create a positive water balance in the impoundment. As such, water treatment of excess water accumulating in the tailings facility would occur to maintain adequate freeboard in the impoundment. The water treatment plant would therefore remain completely operational during temporary closure.

Other water management features such as industrial complex diversion ditches and sedimentation ponds would also remain fully operational and water would be managed to ensure no uncontrolled discharges occur.

3 Decommissioning and Closure Phase Activities

3.1 Introduction

Site decommissioning activities are anticipated to commence during the final stages of operations in late 2018, and take approximately one year to complete. The closure phase is anticipated to range from 5-10 years, and the final term is dependent on achieving site-specific criteria designed to allow for eventual passive closure. This concept will be largely dependent upon demonstrating that water naturally discharging in the tailings pond spillway is of a quality equal to or better than the Type A Water Licence discharge limits and that no deleterious discharges occur to Wolverine Creek from groundwater.

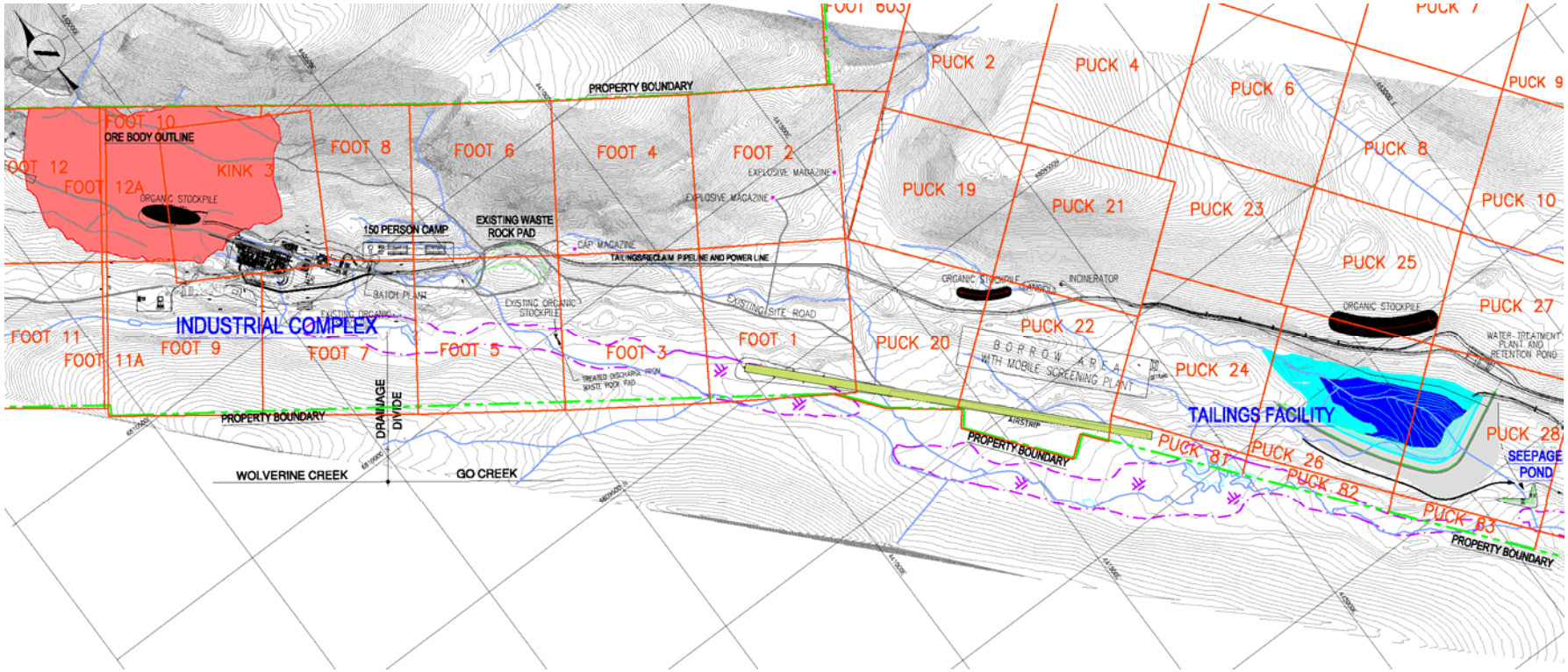
Figure 3-1 provides the general project layout at the end of operations. Following completion of the construction phase, an as-built layout will be completed and decommissioning and closure plans and disturbance footprint estimates will be revised. Closure planning is a continuous process and plans will be reviewed and revised during the operations phase to reflect onsite conditions.

3.2 General Closure Considerations

3.2.1 Decommissioning and Closure Workforce

A number of personnel will be required onsite to implement the various decommissioning, closure and reclamation tasks. The majority of these activities will be undertaken on a seasonal basis (May–October) and directed by an onsite manager. A caretaker will remain onsite following seasonal closure of the site.

The work force requirements for the decommissioning period and the early and late closure phases are provided in Table 3-1.



original drawing prepared by Yukon Zinc Corporation

Figure 3-1. Life of Mine Wolverine Project Site Layout

Table 3-1. Site Decommissioning, Closure and Reclamation Work Force Requirements

Personnel	Decommissioning Period 2018	Early Closure Period 2018-2022	Late Closure Period 2023-28
Project Manager	1	1	1
Mine Engineer	1	-	-
Environmental Coordinator/Kaska Monitor	2	2	2
Construction Supervisor	1	1	1
Equipment Operators	12	3	3
Facility Staff, Equipment Mechanics/Welders/Electricians	5	3	2
General Labourers	5	3	2
Camp Support Staff	9	6	3
Total Seasonal	**36**	**19**	**14**
Total Off-Season (Caretaker)	**1**	**1**	**1**

3.2.2 Activities and Timelines

The activities outlined below set out to address the long-term physical, chemical and biological requirements of the site through the decommissioning of infrastructure and the reclamation of surface disturbances. All decommissioning, closure and reclamation activities will be properly supervised and documented to ensure that works are constructed according to design plans and as per industry practice and legal requirements. Cost estimates for these activities are provided in Section 4.0.

The timing of facility closures is dependent on a number of factors including the purpose of the facility and its future use and environmental considerations. Table 3-2 provides a list of anticipated activities that will be required during the one year decommissioning period and the ten year closure period.

Prior to undertaking closure activities as part of a comprehensive environmental site assessment, areas of suspected oil, chemical, or other contaminant spills will be tested to confirm locations and quantities requiring clean-up.

Once tailings supernatant water quality is deemed suitable for discharge without treatment, the water treatment plant will be decommissioned. Upon completion of all activities proposed, a final site plan report will be prepared to document the facilities remaining on site. The plan will detail the locations of buried concrete foundations, as well as scrap and landfill disposal areas. It is anticipated that the final site plan will accompany the application for a *Certificate of Closure* under the Yukon Quartz Act.

Table 3-2. Activities Associated with the Decommissioning and Closure Phases

Component	Decommissioning Activities (2018-2019)	Closure Activities (2018-2028)
Mine workings	Seal all openings; install hydraulic plugs as main ramp is backfilled to limit outflow; mine will naturally flood	Monitoring of water quality as required; mine will continue to flood
Onsite roads	Reclaim unused roads	Performance monitoring of reclaimed areas
Industrial complex area	Remove mill and all process support infrastructure; Water treatment plant and infrastructure will remain operational; conduct remediation programs where necessary; reclaim disturbed areas	Performance monitoring of remediated and reclaimed areas; Water treatment plant will be removed at end of closure period
Mine access road	In use for removal of material and import of supplies; road access and traffic control maintained	Access and traffic controls in place until the end of the closure period; road route deactivated and reclaimed
Tailings facility	Will remain operational; regular inspections and monitoring, diversion ditches will be decommissioned	Permanent water holding structure to prevent acid rock drainage from mine wastes. Once the tailings pond water meets discharge criteria, the pipelines to the water treatment plant and the seepage dam will be decommissioned and removed.
Water treatment plant	In use for treatment of tailings effluent	Decommissioned only after tailings pond water meets discharge criteria
Biopass contingency treatment for Wolverine Creek	Depending upon hydrogeological data and underground chemistry data, biopass treatment channel construction proposed in Wolverine Creek	Monitor groundwater wells adjacent to creek and outflow from biopass system
Camp	Remove structures not required to support ongoing activities.	Remove all facilities at end of closure period
Airstrip	Will not be deactivated	Will not be deactivated
Power generation area	Assess future power requirements; deactivate most gensets and leave adequate capacity for the operation of the camp, and water treatment facility and pipeline pumps.	Remove remaining gensets once all activities are complete
Equipment	Market all mining and mill equipment. Assess equipment needs for closure period.	Market and dispose of all assets once support for water treatment and reclamation activities are no longer needed
Water supply systems	To be decommissioned once not required	To be decommissioned once not required
Landfill, land farm and incinerator	In use	To be decommissioned once not required

3.3 Closure Components

The following sections describe the closure strategies for each primary project component.

3.3.1 Mine Openings and Workings

Two closure considerations apply to the mine openings and workings at the Wolverine Project:

- ensure public safety and protection of wildlife
- prevent portal discharge of groundwater

To ensure public safety, all openings exposed to the surface will be capped or blocked. The 1360 and 1345 Portals will be sealed off by a barrier constructed of tires and course riprap to prevent access by the public and wildlife. It is proposed to construct the barriers of used heavy machinery tires, a technique used in Alberta and British Columbia. The tires would be compressed by an excavator equipped with a thumb attachment and wedged into the opening. Figure 3-2 illustrates the barrier proposed.

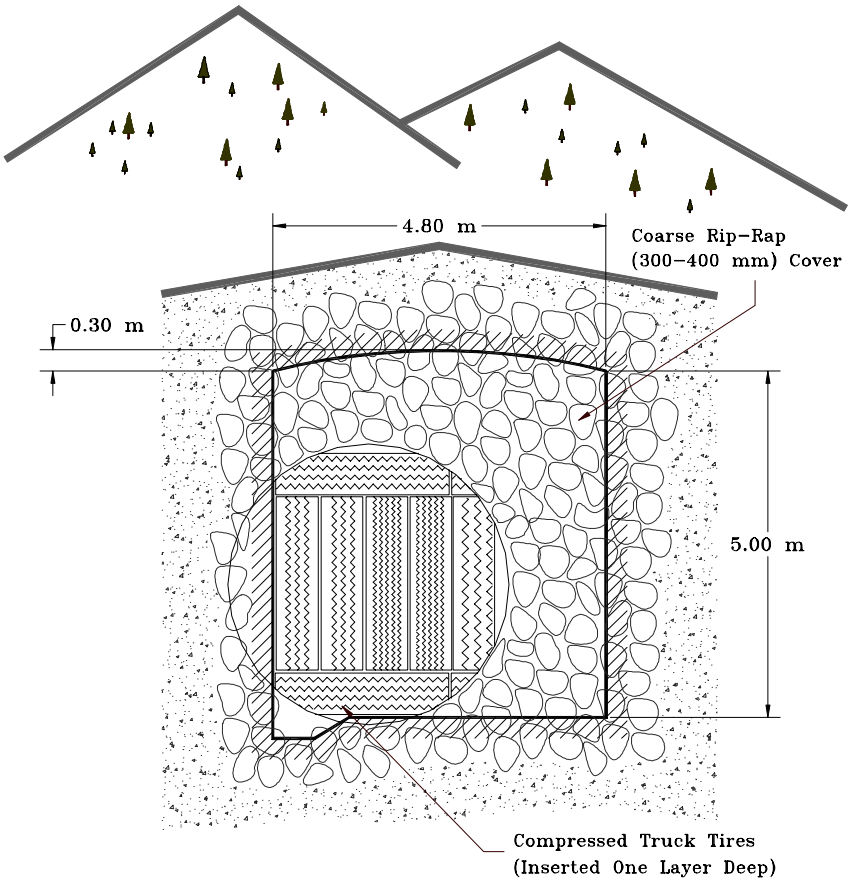


Figure 3-2. Tire and Rock Composite Portal Barrier

This type of portal barrier has several advantages:

- in the absence of sunlight, the rubber will degrade very slowly

- the compression of the tires ensures the tires are locked tight against the rock wall of the portal. If, over time these rock wall surfaces loosen, the tires will have some expansion to maintain the tight fit
- the configuration of tires (placed on edge) has enough gaps to ensure that it is permeable without permitting access by people or wildlife

The ventilation raises will pose safety hazards public and wildlife if left unattended at closure. The ventilation raises will be sealed with reinforced concrete plugs in accordance with the mine safety regulations.

Preventing the potential for discharge of groundwater from the mine workings is an important focus of the Wolverine Project closure plan. While most of the underground mine workings will contain paste backfill, it will be necessary to install hydraulic plugs at a couple of locations within the main access ramp, as well as the ventilation raises to minimize the potential for groundwater discharge. Detailed engineering of these plugs has not occurred to date as final designs will depend largely upon rock conditions at the targeted locations. Initial concepts include the use of engineered concrete/paste plugs, buttressed by a rebar net, which has been drilled and sealed into mine walls.

3.3.2 Tailings Facility

The tailings impoundment stores mill tailings, DMS float tails and waste rock. Specific details pertaining to facility layout, construction, and operation are provided in the *Tailings and Infrastructure Design and Construction Report (*YZC, 2006c).

The mill tailings and waste rock have high sulphide contents and if exposed for extended periods to atmospheric conditions will oxidize and result in acid rock drainage and higher metal concentrations. Accordingly, the operational and closure management plan is to store all of the materials below water to prevent sulphide oxidation. The tailings facility will be closed as a saturated deposit with minimum water cover of 0.5 m (Figure 3-3). The main closure works address the issues of long-term surface water quality and dam safety and are discussed in the following sections.

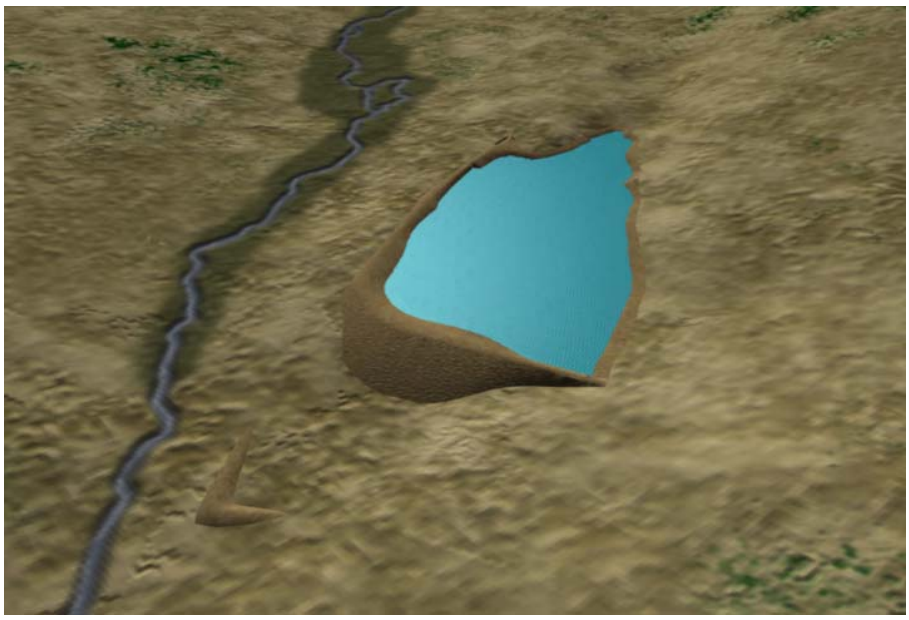


Figure 3-3. 3-Dimensional Rendering of Post-Closure Tailings Facility

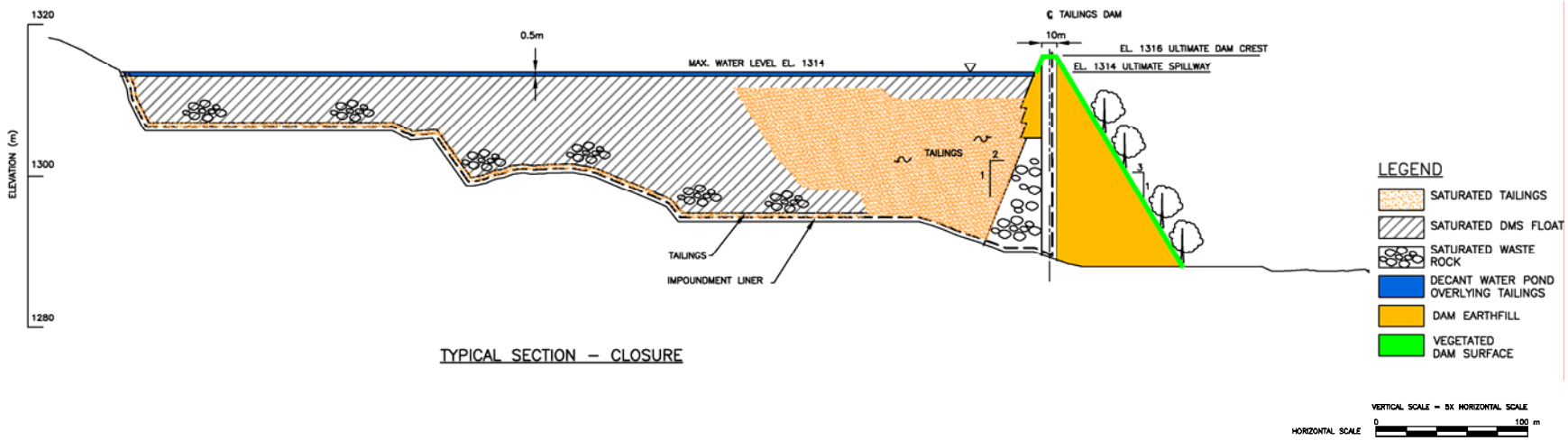
3.3.2.1 Water Quality at Closure

On closure, a 0.3 to 0.5 m thick layer of DMS material will be laid over the ice within the tailings area in winter. When the ice melts, it will provide a stable cover for the tailings and reduce the potential for remobilization and resuspension of tailings solids through wave action. A typical section through the impoundment on closure is shown in Figure 3-4.

During post-closure, the dominant inflow to the tailings impoundment water balance is runoff originating from the tailings area. Precipitation and evaporation rates also increase owing to the larger surface area of the impoundment pond. During the initial 3 years following closure, excess tailings water will be treated through the water treatment plant and water levels in the impoundment will be maintained below the spillway elevation of 1313.7 m.

At cessation of operations, approximately 80,000 m^3 of tailings water will be held in the impoundment. Upon removal of the diversion ditches, annual inflows of runoff and precipitation to the facility are expected to be on the order of 158,000 m^3. As such, roughly two tailings water volume replacements are expected to occur for each year. Because the tailings are to be covered with approximately 1 m of coarse DMS float, diffusion of tailings porewater to the overlying water column will be greatly attenuated. By the end of year-3 post-closure, approximately 5 to 6 complete volume replacements would have occurred with clean runoff water. After these flushings, impoundment water quality is expected to be of sufficient quality to allow passive discharge through the tailings spillway. As such, the 3-year post-closure treatment phase is dictated by the time required to flush tailings influenced water from the impoundment and water quality of the overflow being below discharge limits. Following the cessation of water treatment, the three pipelines, seepage recovery dam, and pumping facilities will be removed and disposed of in a proper manner. The tailings impoundment will be closed as a ‘wet” facility with a water cover over the tailings/waste rock and a permanent spillway to manage flood flows.

Long-term groundwater quality beneath the tailings impoundment following closure is expected to remain at baseline conditions owing to the installation of the Enviroliner on the base of the impoundment during construction.



original drawing prepared by Klohn Crippen Berger

Figure 3-4. Typical Section through Tailings Impoundment at Closure

3.3.2.2 Dam Safety

The dam is designed with a minimum factor of safety of 1.1 for the Maximum Credible Earthquake. Consequently, the main concerns with dam safety on closure are associated with erosion of the dam or blockage of the spillway. Accordingly, a long term care and maintenance plan will be prepared to confirm that erosion is not occurring and that the spillway is clear. Measures to mitigate these potential concerns include the following:

- Placement of a 25 m wide neutral rockfill, adjacent to the upstream crest of the dam. The rockfill will maintain the "freewater" away from the dam crest, further reducing the potential for water release even with a significant erosion event.
- The downstream slope of the dam will be revegetated to minimize erosion.
- The spillway will be located in an excavated channel lined with large riprap and will have a design capacity for the peak flow from the 10,000-year rainfall plus snowmelt event.

3.3.3 Water Management and Treatment

3.3.3.1 Tailings Area

As previously discussed, the water treatment plant will remain in operation to treat the tailings facility overflow water during the early phases of closure. The following infrastructure and equipment will remain operational or onsite to support water treatment plant operations:

- onsite roads to the camp, tailings facility and water treatment plant
- main access road
- light duty vehicles
- discharge pipelines and pumps
- fuel storage facility
- power generating facility with adequate capacity to power the water treatment plant, pumping systems, and camp
- small maintenance workshop
- laboratory and reagent storage facility
- communication system

The water treatment plant and the tailings facility diversion ditches and seepage dam will be decommissioned when the effluent quality from tailings facility is in compliance with Type A Water Licence requirements and suitable for passive discharge to the receiving environment.

Once water quality in the impoundment has consistently met discharge criteria, the following work will commence for decommissioning of the water management structures associated with the tailings impoundment:

- Removal of the Go Creek Diversion Structure and backfilling of Ditch B.

- Removal of the Ditch A Diversion Structure, and backfilling of at least 50 m of Ditch A downstream of the structure.
- Grass seeding and planting in all areas disturbed during the implementation of the above works.

3.3.3.2 Wolverine Creek Basin

The Wolverine Project reclamation and closure plan has included a contingency plan for mitigating the potential effects of poor quality groundwater, originating in the underground workings, and discharging into Wolverine Creek. It has been recognized that part of the groundwater that contributes to the flow in Wolverine Creek may be high in selenium and other metal concentrations. For the treatment of metals and selenium in groundwater that contributes to Wolverine Creek, a passive biological treatment system (termed biopass) is proposed. The biopass system represents passive biological treatment where dissolved selenium (selenate, selenite) is reduced to solid phase elemental selenium in a microbial process similar to that used in a bioreactor (active biological treatment) and metals are precipitated as metal sulphides.

The biopass system will be constructed in the Wolverine Creek channel along the stretch of the creek (e.g. 400 m long) that could potentially receive groundwater with high selenium and other metal concentrations derived from mine water (Figure 3-5). Clean water in Wolverine Creek, upstream of the biopass channel, will be diverted along the western margin of Wolverine Creek in a lined channel and re-introduced into Wolverine Creek in the lower reach that is not adversely affected by poor quality groundwater.

The biopass system will be approximately 2.5 m deep and 3 m wide and will collect groundwater that naturally discharges to Wolverine Creek. Deep groundwater that does not enter into Wolverine Creek will flow towards Little Wolverine Lake where no impacts to water quality are predicted to occur. The excavated channel that intercepts groundwater will be filled with an organic substrate to support the microrganisms that reduce dissolved selenium to solid phase elemental selenium as well as sulphate reducing bacteria. Organic materials that can be used as substrate include mixtures of mushroom compost, manure, alfalfa, sawdust or straw, along with natural peats in the area. On top of the organic substrate there is a gravel layer (0.15 m) that facilitates (lateral) drainage of the upward flowing treated effluent. The drainage layer overlying the organic substrate is sealed at the top by an impermeable geomembrane liner that limits exchange of water and gas with the overlying cover (0.25 m) of topsoil to protect the liner. Rainfall and surface runoff that infiltrates into the cover layer is collected in lateral sand drains and removed to prevent water saturation of the topsoil cover.

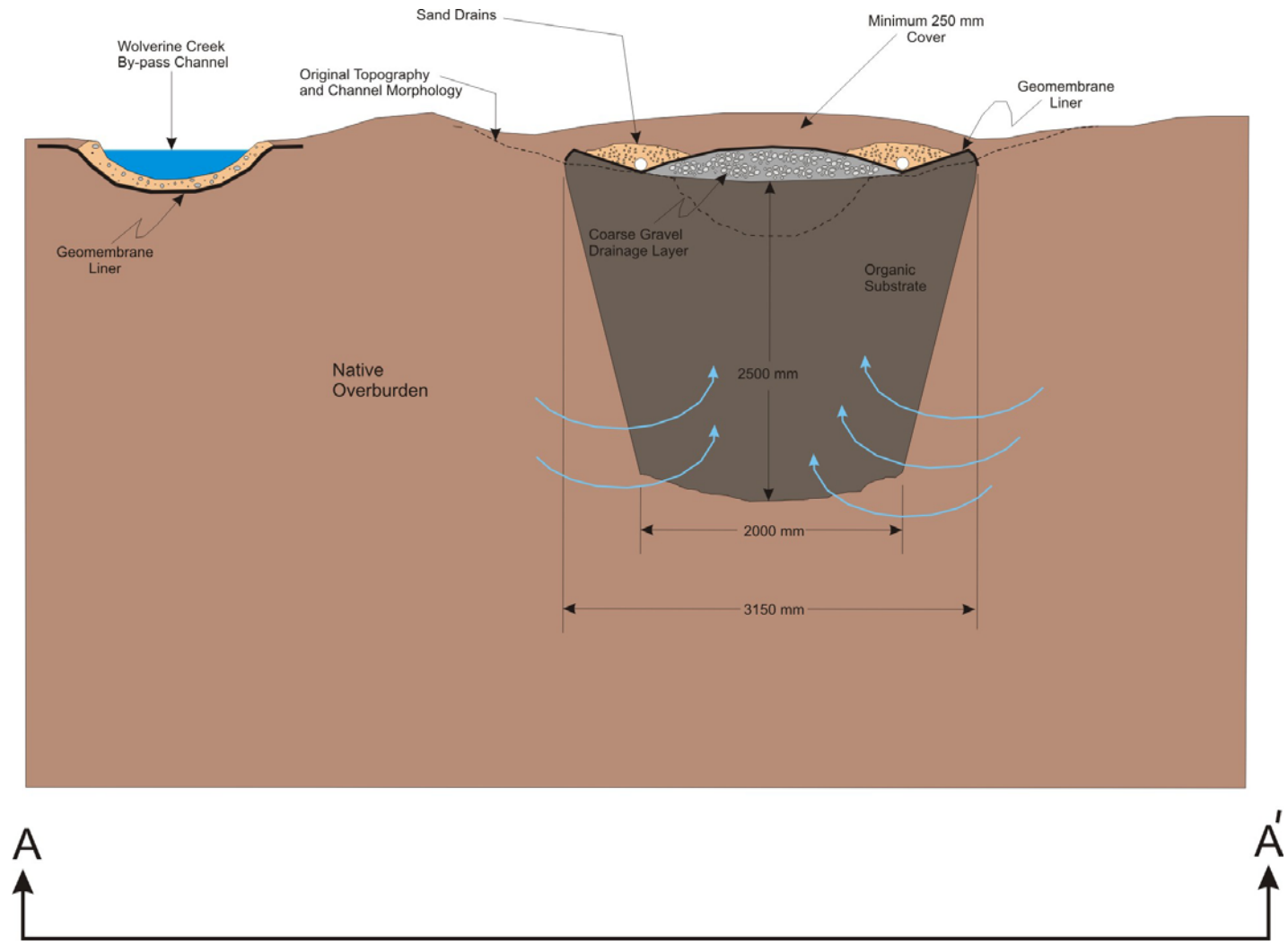


Figure 3-5. Cross Section along Wolverine Creek Illustrating Biopass Design and Diversion Channel

The groundwater that discharges into the more permeable organic substrate is treated while moving in a down-slope direction. Collected groundwater will flow upwards and through the organic substrate where treatment will occur. Before joining the non-diverted section of Wolverine Creek, the biopass system will merge into a french drain that discharges into Wolverine Creek. While the water exiting from the biopass system is expected to be depleted of oxygen, this water will be combined with the diverted well-oxygenated water from upper Wolverine Creek. Moreover, this combined flow will then traverse steep terrain for approximately a kilometer before reaching the mouth of Wolverine Creek and is expected to be fully oxygenated in this fish-bearing reach.

The groundwater discharge rates that can be treated will depend on the porosity of the organic substrate layer and the total length of the biopass system used. For example, by using a biopass system with a total length of 400 m, it will be possible to treat groundwater at discharge rates of approximately 2 L/s; groundwater discharge rates in the treatment area are expected to be less than 0.5 L/s.

3.3.4 Industrial Complex Infrastructure

Closure issues related to infrastructure include public health and safety, site stabilization, aesthetics, and restoration of disturbed lands. By the end of the closure period (post water treatment) all materials from industrial complex buildings will be completely removed with the exception of concrete foundations, which will be demolished and buried in situ.

The industrial complex buildings and facilities will be decommissioned in stages, with the water treatment plant supporting infrastructure (listed above) removed last.

Equipment with marketable value will be sold, and the remaining assets will be disposed of through demolition and salvage contracts. In the event that it is uneconomical to remove non-hazardous materials from the site, such material will be buried in the landfill.

3.3.4.1 Power Generation Infrastructure

During the initial closure stage, power requirements will be reduced and only those generators required for ongoing activities will remain operational to support the water treatment plant, pipeline pumps and auxiliary facilities. The excess gensets will be deactivated and removed from the site. Power poles and distribution lines to facilities no longer in use (such as the explosives storage area) will be salvaged or buried in the landfill.

At the end of the closure phase when water treatment is no longer required, the remaining gensets will be removed from the site, and the distribution lines will be re-spooled for salvage or buried in the refuse landfill if in poor condition. Poles will be removed and if the poles are treated with a preservative such as creosote, the contaminated portion of the poles will be disposed of in accordance with the Yukon Special Waste Regulations.

3.3.4.2 Explosives and Magazines

Unused explosives and detonation devices will be checked for condition and either returned to the supplier for credit, shipped to another third party user, or destroyed through appropriate procedures. In all cases the explosives will be handled, transported and disposed of in compliance with the Explosive Act. The explosives magazines will be returned to the supplier or to a third party.

3.3.4.3 Fuel Storage Tanks

Propane tanks used for the storage of propane for underground heating will be removed by a qualified contractor once underground operations cease. Associated fuel delivery lines will be removed and disposed of in an appropriate manner.

Excess fuel storage tanks will be hauled away for salvage. Containment liners will be removed and the berms will be recontoured. Diesel fuel will be required until all site operations cease. All tanks will be emptied of their contents in accordance with the Yukon Environment Act.

3.3.5 Borrow Areas

During construction, aggregate material will be required for the construction of the tailings dams and facility foundations. Runoff from the borrow areas will be controlled with ditches, sediment fences and settling ponds during operations. Progressive reclamation is anticipated for these areas following decommissioning. The slopes surrounding the borrow areas will be sloped for stability and re-vegetated using a custom seed mixture. The seed mixture will be developed during the operational phase as part of a revegetation research program.

3.3.6 Water Wells

The water supply wells for the camp will be decommissioned once water treatment and camp facilities are no longer required. The pump houses and the buried distribution system will be removed for salvage and or if deemed appropriate, the distribution system will remain in situ to minimize subsequent surface disturbance associated with removal.

3.3.7 Camp

Portions of the modular camp facilities will be removed as onsite personnel requirements decrease. Facilities will remain for care and maintenance staff and for reclamation crews and monitoring crews until all closure objectives have been met.

3.3.8 Equipment

All fixed equipment with marketable value will be removed from the underground mine workings and sold. Mobile equipment such as scoop trams, and jumbos will be sold. Materials without any marketable value, which are non hazardous, such as piping, wood, and concrete, etc., will be left in place. Electric installation cables will be left in place unless it is determined that they contain levels of hazardous materials. Equipment that cannot be sold will be disposed of in a proper manner.

3.3.9 Industrial Reagents and Hazardous Products

The inventory of chemicals, reagents and hydrocarbon products will be consumed as mine operations are brought to a close. Any remaining materials will be removed from the mine site and returned to the original supplier for credit and reuse, or sold to a third party user subject to the appropriate regulatory requirements. For specialized products, disposal options may include disposal through a licensed waste disposal firm. It is anticipated that such material will be small in volume.

3.3.10 Miscellaneous Materials

All salvageable material will be sold and removed from the site. Material that has no scrap value will be disposed of in the landfill site. Prior to disposal in the landfill all of the materials will be examined to ensure that all hazardous materials have been removed and disposed of in an approved manner.

Decommissioning and demolition activities will generate some non-hazardous waste material that will be disposed of in the landfill area. At the end of closure activities, the landfill area will be covered with a 300 mm thick layer of compactible soil material and graded to encourage the shedding of water. The site will then be revegetated.

3.3.11 All Weather Access Road

Reclamation of the all weather access road will involve the removal of all culverts and drainage structures and decommissioning of the roadbed and staging areas. All culverts and drainage structures will be removed and disposed of off-site at an approved location. The following activities are proposed:

- Trenches resulting from the removal of culverts will be swaled or contoured to match the surrounding terrain
- Where warranted due to fine grain soils, erosion protection will be installed within the remaining swales, to a point where the reclaimed watercourse meets with its original path in undisturbed soil
- Ditch blocks will be removed where this is desirable. There may be instances where cross drainage should be maintained
- Where ditches are to be left intact (some steeper sections) existing ditch erosion protection may be left in place to minimize fine-grained soil erosion
- Riparian habitat enhancement at decommissioned crossing locations where warranted

The roadbed itself will be contoured and rounded throughout its length, and the following activities are proposed:

- In smaller cuts and fills, ditches will be filled in, and the soils shaped to match the surrounding topography
- In large cuts and fills, the embankment or excavation footprint will be reshaped to a lesser extent, but all slopes will be flattened or rounded to better suit the surrounding terrain
- Organic stripping materials placed at the toe of fills during the original construction phase, will be re-contoured along the downhill side to act as a sediment filter, and to re-establish longer term re-vegetation
- Surfaces of gradients less than 25% will be scarified (using scarifiers on bulldozers, excavators and graders) to better accept seeding

Additional details are provided in the *All Weather Access Road Plan Report* (YZC, 2006a).

3.4 Site Remediation

During decommissioning and the early closure periods, any hydrocarbon contaminated soils will be isolated and processed for remediation. All fuel storage areas and refueling stations will be assessed for soil contamination. The contaminated soils will be removed from the area and disposed of in a landfarm near the airstrip. The selected disposal method will be in accordance with the Yukon Environment Act and Special Waste Regulation.

3.5 Site Reclamation

The primary objectives of land reclamation and revegetation at the Wolverine Property will be to provide short and long term erosion control, to ensure land use compatible with surrounding lands, and to leave the area as a self-supporting ecosystem. The overall goal is to prepare the site (including roads) so that the vegetation returns to a state as near as possible to that in existence prior to mining activities.

3.5.1 Progressive Reclamation

The preferred approach to return the site to a productive state is to conduct progressive reclamation throughout the life of the project. The selection criteria for candidate areas for progressive reclamation initiatives will take into account the current use of the sites and the inherent risk to the receiving environment.

Areas that may be considered for progressive reclamation include:

- construction laydown areas
- temporary structures and redundant components
- disturbed areas such as borrow sites

3.5.2 Site-specific Reclamation Research

During the operations phase, additional site information will be acquired to develop a comprehensive closure plan that will be cost effective, and environmentally and technologically feasible. To ensure that reclamation activities have greater success, the results of reclamation research will be incorporated into the plan. Proposed areas of research include the following activities:

- investigate the availability of natural seed or the availability of productive seed material from local surroundings
- develop a custom seed mixture specific to the local climatic and soil conditions
- undertake vegetative trials using native plant species
- undertake clean fill investigations to determine potential sources of non acid generating material for closure
- inventory all organic stockpile areas created during the exploration and construction periods to determine the availability of soils for reclamation cover

- assess nutrient level deficiencies in the available soils to determine necessary amendments
- determine appropriate seed mixes for reclamation through the experimentation of test plots
- determine the potential metal uptake by the plants

The above studies will be implemented during the operational phase to establish the site-specific plans for progressive reclamation and for closure. YZC will work with consultants, First Nations and other technical groups to address potential environmental constraints and overall site issues of concern. Reclamation plans will be revised to ensure that the land is restored to a productive state for alternate future uses.

A summary of projected spatial disturbances for the project area (not including the access road) are provided in Table 3-3. The total disturbed footprint is estimated to be 44 ha. Disturbance area details pertaining to the main access road are provided in Table 3.4.

Table 3-3. Summary of Projected Disturbance Areas and Reclamation Activities for the Project Site

Component	Estimated Area (ha)	Approach
Slope on side of the tailings pond	3.9	Recontour slope and seeded with shallow rooted grass
Landfill and land farm	0.5	Decommission and cover the dump with a 300 mm soil layer and revegetate
Borrow areas	6.7	Scarify, recontour, cover with organic matter and revegetate
Tailings area, slurry, reclaim and discharge pipelines	20	Remove the pipelines, scarify and revegetate corridor and general areas
Camp	1.2	Demobilize portions of the camp progressively and reclaim areas not in use
Industrial complex area	7.8	Isolate contaminated areas and demolish buildings and infrastructure and scarify, recontour and revegetate
Seepage dam and collection pond	1.0	Remove operational spillway and dam; regrade and revegetate
Organic Material Stockpile	0.5	Remove material, assess for soil contamination and reclaim
Onsite Roads	2.4	Stabilize slopes, revegetate and fertilize

Table 3-4. Summary of Projected Disturbance Areas and Reclamation Activities for the All Weather Access Road

Component	Estimated Area (ha)	Approach
Roadway Footprint	20	Recontour roadbed and replace organic stripping, scarify disturbed areas; revegetate
Borrow areas	15	Recontour borrow pits and pit access roads; replace organic stripping and revegetate
Staging area and gate access	5	Recontour area and replace organic stripping; revegetate

The revegetated areas will be subject to periodic inspections that include the monitoring of the metal uptake in vegetation, the inspection of native plant invasion, and the evaluation of plant growth.

Success of the revegetation program will be determined by measuring a number of aspects including growth, survival, density and diversity of perennial species. Monitoring locations will include randomly allocated plots located within areas representative of the reclaimed lands.

Monitoring reports will be submitted to the regulatory agencies, the RRDC and the communities of interest as required to obtain feedback on the success of the reclamation program.

Once all reclamation program objectives have been met and external reviews are complete, YZC will submit an application for a Certificate of Closure under the Yukon Quartz Act.

4 Reclamation and Decommissioning Cost Estimates

Financial security will be required to ensure that the cost of reclamation and closure is covered. The cost summaries provided below include costs associated with project shutdown, the decommissioning of facilities and support infrastructure, reclamation activities, and compliance and reclamation monitoring. The estimated costs are based on the following assumptions, rationale and information:

- Funding for temporary closure will come from the operating budget of the day and therefore, no cost estimates have been assigned.
- Closure of the waste rock pad will be conducted early in the operations phase and cost have been allocated under the operating budget and therefore, no cost estimates have been assigned.
- No salvage value is included in the estimate.
- A contingency of 25% has been included in the total cost estimate.

- Decommissioning and closure phases are assumed to be phased out within a ten-year period.
- Best efforts will be made to control acid rock drainage during construction and operations and therefore, no funds have been assigned to deal with acid rock drainage (ARD) issues beyond the closure phase.
- ARD and metal leaching control methods will function as per design intent beyond a ten year period (the post closure phase) without requiring any perpetual maintenance.
- The water treatment plant will perform as designed and will produce effluent quality that meets the required criteria.
- The closure phase water balance for the tailings facility will have a net positive balance and the water will require treatment before being discharged to Go Creek for an estimated 3-year period. No funds have been allocated beyond the closure phase.
- Non-acid generating fill and waste rock will be available within the project area for closure activities.
- An Environmental Effects Monitoring program designed to meet MMER requirements will produce positive results.
- Reclamation costs are based on the cost of having the work completed by a third party contractor.
- Reclamation costs for the all weather access road are based on the best information at hand, and are subject to forthcoming geotechnical information and *issued for construction* designs[1].
- The seed mixes and application rates proposed by Kennedy (1993) for linear developments, and landfill and borrow pit areas were used to estimate seeding costs.

A summary of the estimated costs to implement the reclamation and closure plans described above are presented in Table 4-1 below. Unit costs were provided in previously submitted reports (YZC 2005; YZC 2006a). Based on the plans presented herein, the total cost to restore the site to a productive state is estimated to be approximately $7.7 million. All costs are reported in 2006 $CDN.

[1] The reclamation costs for the access road are detailed in the *All Weather Access Plan Report* (YZC, 2006a). The cost provided in that report ($750,000) included a 33% contingency and rounding. The value of $562,000 provided herein is the base cost provided by YES in that report, and a 25% contingency has been applied to this and all other site components.

Table 4-1. Estimated Costs to Execute Decommissioning, Closure and Reclamation Plans

Work Item Description	Sub-Total Costs	Total Costs
Mine Workings		**$ 539,400**
1345 and 1360 Portals Barriers	$ 98,300	
Fresh Air Ventilation Raises (2) Barriers	$ 27,400	
Return Air Ventilatin Raise Barrier	$ 13,700	
Installation of Hydraulic Plugs in Access Ramp	$ 200,000	
Installation of Hydraulic Plugs in Ventilation Raises	$ 200,000	
Tailings Management System		**$ 235,000**
Remove Seepage Dam	$ 50,000	
Closure Spillway and Channel Maintenance	$ 50,000	
Decommission Diversion Ditches	$ 14,400	
Remove Tailings Slurry and Reclaim Pipeline	$ 120,600	
Infrastructure		**$ 999,780**
Industrial Complex Buildings and Infrastructure	$ 305,900	
Power House and Power Lines	$ 95,350	
Water Supply	$ 53,100	
Industrial Complex Diversion Ditches and Sumps	$ 19,200	
Explosive and Cap Magazines	$ 5,000	
Camp Misc. Structures	$ 141,230	
Industrial Reagents, Fuels and Waste	$ 65,000	
Remediation Activities	$ 200,000	
Demolition Overheads	$ 115,000	
Reclamation and Revegetation		**$ 828,000**
Main Access Road	$ 562,000	
Onsite Roads	$ 123,700	
Seepage Recovery Pond Area	$ 35,400	
Tailings Facility Slopes	$ 5,200	
Disturbed Sites - Industrial Area, Camp, Borrow Sites	$ 101,700	
Closure Site Management		**$ 3,560,500**
Camp and Support Infrastructure Operation	$ 1,528,400	
Environmental Monitoring	$ 591,600	
Compliance Monitoring	$ 801,500	
Wolverine Creek Biopass Contingency	$ 125,000	
Site Maintenance	$ 14,000	
Water Treatment Plant Operation	$ 500,000	
Estimated Sub-Total Closure Costs		**$ 6,162,680**
25% Contingency		*$ 1,540,670*
Estimated Total Closure Costs		**$ 7,703,350**

5 Summary

The initial plans for decommissioning and closure presented within this report and supporting reports have been based on the best information available at the present time. Following detailed engineering, construction completion and within two years of operations start-up, a comprehensive reclamation and closure plan will be submitted to the Yukon Government for review and approval.

6 References

Yukon Zinc Corporation, 2005. *Wolverine Project Environmental Assessment Report.* October 2005. 3 Vols.

YZC, 2006a. *Wolverine Project All Weather Access Road Plan*. Version 2006-01. Prepared by YZC and Yukon Engineering Services, June 2006.

YZC, 2006b. *Wolverine Project Solid Waste Management Plan*. Version 2006-01. Prepared by YZC, June 2006.

YZC, 2006c. *Wolverine Project Tailings and Infrastructure Design and Construction*. Version 2006-01. Prepared by Klohn Crippen Berger in association with YZC and Hatch, May 2006.