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## **4.0 Proposed Mining Plan**

### **4.1 Introduction**

Development of the Dy Project has been structured into two phases - advanced exploration and production. The two phases will be separated by a production decision once the economic feasibility of mining is established. The purpose of the Advanced exploration phase is to gather information required to carry out the feasibility assessment. This includes details of one zone geometry and grade distribution to enhance ore reserve estimate reliability and mine layout; information on rock quality, rock conditions and groundwater hydrology to allow final mine design; bulk sampling to allow bench and pilot plant testing of metallurgical performance and blending characteristics. During the advanced exploration phase, access to the deposit will be gained by excavation of a 1700m long decline. This report deals almost exclusively with the advanced exploration phase; the production phase will be the subject of further investigation and a complete IEE.

The advanced exploration will have four components. Earthwork and construction of the surface facilities will be followed by the excavation of the upper decline through non-acid generating rock. As underground development approaches the ore zone, the decline will yield waste and ore which may be acid generating and will require a variation in waste handling techniques. Concurrent with the exploratory work, construction of an access road will begin to permit the haulage of ore from the initial development through the ore zone and the bulk sample to the Faro processing facilities as well as a permit haulage of potentially acid generating waste to a stockpile, if required.

The following section will provide a description of the exploration process within each of these stages, provide our understanding of the permitting required, and identify the environmental issues and mitigative measures which will be adopted.

### **4.2 Phase I - Advanced Exploration**

#### **4.2.1 Component I, Surface Setup**

##### **4.2.1.1 Description of Activities**

Surface activities have been scheduled to begin in mid January of 1991. Initial dozer work will include the construction of a small vehicle access road, trenching and levelling at the portal site to facilitate collaring and surface infrastructure and excavation of a settling pond below the disturbance.

Infrastructure at the portal site will include shop facilities, diesel power generation, a dry and office trailer complex, fuel storage explosives magazine and possibly a greywater septic system. There will be no camp on-site; personnel will be transported daily from camp accommodation in the town of Faro. This will reduce the need for domestic water and sewage at the portal and will enable the use of an electric toilet system. The very small amount of domestic water required will be pumped from a small drainage

immediately north of the portal.

#### 4.2.1.2 Permitting Required

The area of the Dy Project has been acquired as claims under the Yukon Quartz Mining Act. Surface setup will be conducted under the authority of this legislation. Additionally, Environmental Operating Conditions, similar to those normally part of a Land Use Permit, will be voluntarily adopted by the company to ensure environmental protection is an integral component of the construction design and implementation. These conditions are outlined in Appendix I.

It is recognized that as the project reaches the production phase, a complete Initial Environmental Evaluation (IEE) may be required to enable further screening under the Environmental Assessment and Review Process (EARP). In the exploration phase, however, only a level one screening should be required. Such a screening is normally conducted by the initiating department, in this case, the Federal Department of Indian and Northern Affairs (IANA). The quick turnaround of a level one screening would enable the current scheduling of the project and allow collection of data required to proceed to later stages.

#### 4.2.1.3 Environmental Issues and Mitigative Measures

Development of the decline portal site will cause a limited amount of surface disturbance from the portal collaring and the initial access construction.

Development of the site will also subject the area to the possibility of erosion in the advent of spring freshet or summer rainfalls. The runoff, if allowed to leave the site without mitigation, could have implications on the water quality of Blind Creek and the valuable fisheries habitat which it supports. A settling pond designed to collect and clarify flows up to and including a 1:10 year peak instantaneous rainfall event will be constructed immediately below the portal site along with all required drainage ditches to move site runoff to the pond. The pond will be effective in removing all sediments larger than 15 micron particle size (medium/fine silt) at an inflow rate of 530 IGPM; during lower flow events, it will remove even smaller particle sizes as retention time increases. A qualified professional geotechnical engineer will inspect construction to ensure stability of the pond.

The increased access and site disturbance will have an impact on wildlife habitat of the immediate area. As mentioned earlier in this report, the habitat was changed dramatically by the forest fire in 1969 and is now of substantially lesser value for the production of commercial furbearing species. Disturbance will be limited as much as possible to reduce impact on snowshoe hare and upland game bird populations found to be abundant in the area. A "no hunting" policy will be adopted for all employees and personnel at the site. Native use of the area will not be restricted in any fashion by the personnel or policies at the site.

Fuel and petroleum products will be stored in accordance with the Environmental Operating Conditions. Impermeable containment areas will be constructed which are capable of withholding 110% of the largest tank plus 10% of the remaining contained. Propane will be stored in a safe open area in accordance to the Fire Prevention Act. The inventory of explosives will be stored in a facility approved by the Chief Mines Inspector and the necessary permitting will be obtained.

#### 4.2.2 ~~Component II~~ - Upper Decline, *Access to the Ore Zones* ~~Exploration in Non-Acid Generating Rock~~

##### 4.2.2.1 Description of Activities

Advanced exploration will be carried out over a 75 week period starting in January 1991. Access to the orebody will be gained through a straight -20% trackless decline (dimensions approximately 6.20m wide x 4.12m high) collared at elevation 835m approximately 1 km from Blind Creek (Figure 4- ). This portion of the decline will extend from the portal to a point approximately 1000m north of the portal and will be constructed entirely in phyllites and greenstones which are non-acid generating. These benign waste materials will be disposed of at the portal entrance by dumping off the outside edge of the cleared pad.

Trackless mining equipment will be used. Initially there will be one drill jumbo, two 3.8 cubic metre scoop trams and a 13 tonne truck with further trucks added as the decline lengthens. Exploratory operations will be on 3 shifts of 8 hour duration per day. The mining crew will total approximately 26. Crews will be housed in Faro at a camp facility thus there will be minimal septic requirements at the portal site. Crews will likely be on a 6 weeks in - 2 weeks out rotation.

Groundwater inflows to the decline will initially be minimal and the overall exploration activity will be significantly below the levels which would require a water licence under the Northern Inland Waters Act (NIWA). As the decline lengthens, water usage will remain constant, however, it is anticipated that groundwater inflows will increase. EBA Engineering has estimated that, based on double packer percolation tests in 1990 drill holes, the phyllites will be relatively impermeable ( $10^{-6}$  cm/sec) whereas fault zones will be significantly more permeable ( $10^{-4}$  cm/sec) and water bearing.

##### 4.2.2.2 Permitting Required

Water utilization throughout this segment of development will be limited to the consumption of the jumbo in the drilling exercise. These levels will be well below the 50,000 IGPD specified within the NIWA as requiring a water licence.

The level one screening through IANA should continue to be sufficient for the project at this stage.

##### 4.2.2.3 Environmental Issues and Mitigative Measures

Rock testing is currently underway to verify that waste rock produced from the upper decline will be non-acid generating. This testing program will confirm that waste rock from this segment of the exploration program may be disposed in a dump located at the outside edge of the portal area with no concern for high metal concentrations developing in dump seepage water. Water clarification in the settling pond below the portal will be adequate to contain high suspended sediment discharges from site runoff as well as from the decline and release water of compatible quality to Blind Creek.

The waste dump design will be subjected to the review of a qualified professional geotechnical engineer to ensure it is constructed in a stable manner and it will have no impact on the continued operation of the settling pond immediately below.

Operational guidelines will be devised and enforced on the underground contractors to limit the releases of spilled petroleum products and uncombusted explosives. Contingency plans and clean up techniques will be well defined such that these problems may be prevented or immediately addressed within the underground sump system before the impact reaches the settling pond.

In preparation for the next phase of exploration activity within altered phyllites and the orebody, when potentially acid generating rocks may be excavated and water inflows may be higher, a second and much larger settling facility will be constructed at the surface. It will incorporate a two stage settling system with a small pond to receive the initial inflow and settle out the coarse fraction of the suspended materials. This arrangement will allow flexibility to channel the discharge through a lime treatment plant which will increase the pH levels sufficiently to allow precipitation of the dissolved metals within the second pond which will have a substantially larger surface area and depth. A drill hole 110m deep, located approximately 200m into the decline from the portal, will be reamed out and a major sump established underground beside the drill hole. This will be the main collection sump for the decline and will service the entirety of the remaining underground program. Should a positive decision be made on production, this facility will be suitable for use throughout the mining period. Pumps will be established in the sump and a 15cm diameter dewatering line will be run up the hole to the surface. This arrangement will simplify winter water handling; underground water may be released at the hole collar on surface and will gravitationally find its way to any of several good locations where a large area is available for construction of the settling and secondary treatment facility. A pond will be designed which can be built in stages to handle the required dewatering flows. Capacities up to that required to handle 3000-5000mg/l total suspended solids and 300-500IGPM will be examined. The pond will be designed with the input of a competent geotechnical engineer.

Also in preparation for the next stage of exploration activities, a waste storage area for acid generating rock will be developed. Ore will be stockpiled only for a short time at the portal before being shipped to the Faro concentrator for processing and will likely be stored in a surge bin to facilitate easy loading on the ore haul trucks. It appears that

the most cost effective plan for handling sulphide waste, predominantly altered phyllites, will be to redeposit it underground. In order for this to be accomplished, a storage pad will be required on the surface for the initial volume, estimated at 60000 tonnes, until a suitably large disposal area becomes available underground. At that point, the waste at the surface would be transported back underground and all future waste would be directly placed underground in mined out stopes without coming to the surface. The duration of surface storage is anticipated to be approximately nine months. This plan will ensure no potential exists for long-term chemical impact from the waste rock dumps to Blind Creek. Once the stockpile area is selected the area will be backslotted towards the decline portal and a layer of compacted till will be placed to limit percolation of water down into the groundwater regime. Portal site drainage will be collected in a main sump on the surface and pumped to the secondary treatment facility for processing.

A regular monitoring program will be implemented to ensure that water discharged from the small settling pond which will be operational throughout this period, is suitable for release to the Blind Creek drainage basin.

#### 4.2.2.4 Impacts of Closure

Should something unforeseen occur during the development of the upper decline and operations were permanently discontinued, closure activities would involve the sealing of the decline for public safety and aesthetic reasons and the revegetation of surface disturbance following removal of all infrastructure.

#### 4.2.3 Exploration in <sup>the ore zones</sup> ~~Acid-Generating Rock~~

##### 4.2.3.1 Description of Activities

Entry to the area adjacent to the orebody is currently scheduled for sometime between October and December of 1991. At a point some 1200m from the portal, the decline will be immediately east of a potential ore reserve named the C Zone. Should the C Zone prove encouraging from surface drilling currently underway, drifting to the west into the orebody will be undertaken and the zone will be drilled in detail and developed for initial test mining and bulk sampling from that drift. The development of the lower decline to a point 1700m from the portal will continue concurrently to encounter the main orebody known as the B Zone. A drift to the northwest into the B Zone will then be driven to permit test mining and bulk sampling in this area. Drifting to the far end of the B Zone (approximately 600m) and underground exploratory drilling is expected to be completed by September of 1992. B Zone test mining and bulk sampling will occur in March of 1992. To the extent possible, the drift will be in ore which will be shipped to the Faro concentrator for processing to support the exploration program.

As soon as sufficient ore can be accessed, an initial test mining operation will be established to finalize production mining methods and suitable stope sizes and to secure sufficient ore to assist in determining the metallurgical features of the ore for processing. Optimum blending of Dy and Grum ores (to be mined concurrently) that can be most

effectively handled in the plant must also be assessed. The bulk sampling program for piloting will involve 20,000 tonnes from the C Zone and 100,000 tonnes from the B Zone. The large sample size is in respect of the large pilot plant to be used namely the Faro Concentrator. The initial operation will begin at 1500 tonnes per day. It is likely that much of the initial mining will be by room and pillar in areas of shallow dip. Long hole stoping will probably be developed in fold noses and cut and fill in narrow high grade areas.

Ventilation raises will also be installed during this component of the exploration program; one will be installed on the decline adjacent to the C Zone should drifting into that Zone be undertaken while a second will be constructed at the end of the decline at the point where the drift to the B Zone takes off to the northwest.

It is possible that the conveyor may be installed during this part of the development to facilitate the delivery of ore and waste from the deeper excavation and the bulk sampling operation to the surface. A final decision on the timing of the conveyor has not yet been made.

#### 4.2.3.2 Permitting Required

It is most probable that underground development during this stage will produce ~~significant volumes of~~ groundwater which will have to be discharged from the decline. It is expected that this volume will, at some time, exceed the 50,000IGPD specified by NIWA as the maximum volume which may be used without the acquisition of a water licence. It is further anticipated that, although the water will not be physically "used", the diversion of these volumes from groundwater sources to surface water constitutes the need for a licence. As such, an application will be made to the Yukon Territorial Water Board within the next few weeks for an exploration phase water licence to be in place when discharged volumes of groundwater exceed the limits specified in the Act.

Activities outlined in this phase of operation continue to be exploratory in nature. Results of the diamond drilling, the test mining and the bulk sampling in the C and B Zones will form the basis of a decision to proceed to production mining. Operations may, therefore, proceed under the Quartz Mining Act and the level one screening as provided by IANA.

#### 4.2.3.3 Environmental Issues and Mitigative Measures

The water which will collect in the underground development will contain substantial levels of suspended solids, total lead, zinc, copper and barium. It is also anticipated that pH may be lowered, while ammonia and dissolved zinc may be elevated. The water will be pumped up the decline to the major sump described in Section 4.2.2.3 and up to the surface through the cased drillhole to be discharged to the settling pond and, if containing elevated dissolved metals to the secondary treatment facility. The initial holding pond will remove the coarse fraction of the total suspended solids in an accessible location which may be easily dredged from time to time and will allow the collection of a suitable

volume of effluent to run the secondary lime treatment facility if required . The addition of slurried lime will raise the pH to levels which permit the precipitation of dissolved zinc upon release and containment within the large settling pond. The aeration provided by the pumping and handling through this process coupled with the inherent warm temperatures of the underground waters will assist in reducing ammonia levels to acceptable guideline limits.

The outflow from the large settling pond, following treatment will be monitored on a weekly basis throughout this period to ensure the acceptability of discharges to the Blind Creek system. The small settling pond constructed during the surface setup will continue to operate but inflows will be dramatically reduced and will consist of limited site and road runoff, none of which will drain acid generating rock thus none of which is likely to be contaminated. It will serve to reduce suspended solids content of those flows and will also be monitored on a weekly basis.

The modifications to the ore stockpiling location at the portal as described in Section 4.2.2.3 will be operational during this phase. Drainage will be collected in a small lined sump near the portal where a pump, equipped with automatic water level sensors, will operate on an as required basis to pump the water to the secondary treatment facility. As this system will only be required during the summer months, freeze protection and winter operation contingencies will not be required.

#### 4.2.3.4 Impacts of Closure

Mine closure considerations are greatly simplified by the fact that the entire orebody scheduled for mining and all altered phyllite is below the elevation of Blind Creek. At the cessation of operations, the workings will be allowed to flood with stagnant water. This will eliminate acid generation potential and consequent groundwater contamination as a significant issue. The surface facilities will be removed and underground openings sealed. Since no acid generating waste will be left on the surface, acid generation from mine waste piles will not be a concern. All potentially acid generating mine waste from advanced exploration of the Dy deposit will be replaced underground or removed to another location outside of the Blind Creek drainage basin. Revegetation of surface disturbances will be conducted to reduce the possibility of future erosion.

#### 4.2.4 Access Road

Ore produced during the bulk sampling period will be transported to the Faro concentrator to evaluate its' milling characteristics. In order to get large haulage trucks to the portal site or to the shaft collar, the access road must be upgraded to provide suitable grades and configuration. Various access routes are currently being assessed and a final route selection has not yet been made.

Construction will involve the clearing and disposal of vegetation from the route location and initial layout by dozer utilizing cut and fill techniques. The final road surface will

be standard haulroad configuration with a 30m running surface flanked by 1m safety berms. Crushed rock placement will be required to upgrade and stabilize the final road surface; non-acid generating rock from the Grum operations will be used for this purpose.

The new ore haulroad would join the existing Vangorda Plateau haulroad at the Vangorda deposit. It is possible that a portion of the surface haulage may be by conveyor.

#### 4.2.5 Power Supply

Initial decline excavation will use power generated at the portal by diesel gensets. Eventually given sufficient grid capacity, it will be desirable to tie the Dy minesite into the local power grid. A number of options could be examined including extension of lines from Vangorda, the Faro townsite or the Campbell Highway. Alternatively, the Dy Mine might be a logical candidate to draw its power from small scale Hydro development in the area.

### 4.3 Phase II - Production

#### 4.3.1 Final Mine Development and Production

##### 4.3.1.1 Description of Mining

Test mining operations will determine mining methods and suitable stope sizes. Room and pillar development in combination with long hole stoping techniques will be established to produce a maximum annual output of 2.75 million metric tonnes. This translates to an average of 7800 tonnes daily which will require the use of a shaft to deliver ore to the surface.

Waste rock will be disposed within a mined out section of the workings. Waste volume will be minimal in the production stage.

##### 4.3.1.2 Permitting Required

Due to the continued need to keep active workings dewatered, pumping will be employed to remove from the mine all groundwater inflows. The volume is expected to be in the range of 350 IGPM and will require a water license under NIWA. Water quality is expected to be similar to that encountered in the advanced exploration phase however, volumes will increase as a result of the more extensive underground development. A production water licence will be applied for which permits the increased water volumes and deals with mine rather than exploration project terms and conditions.

All activity preceding Phase II will be instrumental in providing sufficient information to decide whether a mine is feasible. Should this decision be positive, a successful screening under the EARP will be necessary prior to proceeding with the mining phase.

Curragh have been actively collecting baseline environmental information since 1988 and will be preparing an IEE for submission to IANA in mid-1991. This should allocate sufficient time for review and discussion of the impacts of the DY project such that a decision report on the screening may be in the hands of the Minister in late 1992 before a production water licence is required.

#### 4.3.1.3 Environmental Issues and Mitigative Measures

Water handling during the production stage will be identical to that specified for advanced exploration. The major difference is that volumes are anticipated to ~~significantly~~ increase. The lime treatment facility will likely be in continuous use and the final clarification pond may have to be enlarged from its' original design to accommodate increased flow rates.

Acid generating waste will be kept entirely underground during this phase. A ore handling facility will be designed where the shaft surfaces and may require an impermeable base and a collection sump similar to the portal site. Any potentially high metal/suspended solid drainage will be directed to the water treatment area by overland pipeline. Interceptor ditches will be established above the site to direct runoff away from the ore handling facility. Sludge and dredged tails can be removed from the site and disposed of in the mined out Faro or Grum pits.

#### 4.3.1.4 Impacts of Closure

Mine closure will be identical to that specified in Section 4.2.3.4. In addition the shaft will also be closed off.

#### 4.3.2 Conveyor Installation

Underground truck haulage to transport ore from the working faces will not be practical during the production stage as a result of the volume of ore to be delivered to the surface. The ore is very dense and trucking up the 20% decline would be tedious and inefficient. A floor-mounted conveyor system is planned which will be capable of delivering 3500 tonnes per day to the surface.

The actual timing of installation is somewhat uncertain at this point. It may be feasible to install the conveyor earlier once drifting to the C Zone commences so it is available for deeper development as well as during the bulk sampling operation.

#### 4.3.3 Shaft Raising

One of the objectives for the advanced exploration and initial mining phases will be to evaluate the deposit for potential shaft locations close to the deposit centre of gravity. Once a suitable site is established and a sufficient reserve base is established, a shaft will be raised from the underground working to the surface and a head from/hoist system

established sufficient to hoist <sup>up to</sup> 7,600 tonnes per day. It is likely that the Phase II mining stage will not be reached until 1993 or 1994. At that point mining and hoisting of up to 2.75 million tonnes per annum will be possible.

During Phase II shaft mining, the decline will continue to be used for equipment access and ventilation.