ANVIL RANGE MINING CORPORATION
FARO OPERATIONS

ENVIRONMENTAL MANAGEMENT PLAN FOR TEMPORARY CLOSURE

FOR THE FARO AND VANGORDA PLATEAU MINE SITES

NOVEMBER 1996

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November 28, 1996

Ms. Judi Doering
Yukon Territory Water Board
Suite 106 - 200 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Ms. Doering,

Re. Environmental Management Plan for Temporary Closure of the Faro and Vangorda Plateau Minesites

Enclosed are five bound copies and one unbound original of the report Environmental Management Plan for Temporary Closure of the Faro and Vangorda Plateau Minesites which fulfills the requirements of Water License IN89-001, Part D, Section 12(b).

I trust that this information is self-explanatory. However, if you have any questions please do not hesitate to contact me.

Sincerely,

ANVIL RANGE MINING CORPORATION

Eric Denholm, Senior Environmental Engineer

ed/

SUMMARY

This report outlines the environmental management plan related to the Faro and Vangorda Plateau mine sites during temporary closure. Temporary closure of the Faro mine site relates to temporary cessation of milling while temporary closure of the Vangorda Plateau mine site relates to temporary cessation of mining operations. Information contained in this report fulfills the requirements of Part D Section 12(b) of Water Licence IN89-001 for the Faro site which requires submission of a temporary closure plan for the Faro Main Pit, the Faro Creek Diversion and Related Facilities.

This report is related to a previous temporary closure plan for the Down Valley Tailings Facilities (SRK, 1988) and to the Integrated Comprehensive Abandonment Plan submitted co-incidentally with this report.

In general, the work described for temporary closure represents a continuation of environmental monitoring and surveillance programs performed during the operating period preceding temporary closure. Specifically, the work will prevent the discharge of non-compliant water into the receiving waters.

On-site staff will perform the surveillance and maintenance work with occasional relief as required.

Water quality, biological and physical monitoring will proceed according to the Water Licences at a minimum and, in some areas, will exceed the licence requirements for temporary closure.

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1 INTRODUCTION

1.1 LICENCE REQUIREMENTS

Water Licence IN89-001 for the Faro site requires that Anvil Range Mining Corporation (Anvil Range) submit to the Yukon Territory Water Board (Water Board) by December 31, 1993 an updated plan for the temporary abandonment of the Faro Main Pit, the Faro Creek Diversion and Related Facilities (Part D, Section 12(b)). The plan is to be implemented during any subsequent temporary closure.

The date for submission was proposed to be amended to November 30, 1996 in the Water Licence Amendments proposed by Anvil Range on June 8, 1995. The amendments have not been received at the time of writing. However, written interventions and the screening report regarding the proposed amendments do not indicate any controversy with the proposed submission date and the proposed date is taken as the licenced submission date.

The amendment to the original submission date was required because the previous licensee did not submit the report in accordance with the licence requirement and the new licencee (Anvil Range) required adequate time to research and prepare the report. The proposed date also co-incides with the proposed date for submission of the Integrated Comprehensive Abandonment Plan (ICAP) which provides the measures to be implemented in the case of permanent closure of the Faro site.

1.2 INTENTION

This document is intended to cover the licence requirements described in Section 1.1 as well as to go beyond those requirements and describe the environmental management plan for the entire (Faro and Vangorda Plateau) mine complex during a period of temporary closure.

Temporary Closure status may apply to the Faro and Vangorda Plateau sites independently and at different times. For example, a temporary cessation of mining operations on the Vangorda Plateau may not co-incide with a temporary cessation of mill operations if ore has been stockpiled to allow milling operations to continue.

However, the environmental issues faced during temporary closure are similar for the two mine sites such that it is reasonable to describe them in this single document. Specifically, the environmental management plan is focused on maintaining compliance with the licences.

1.3 TEMPORARY CLOSURE ISSUES

Temporary closure could occur for periods ranging from a few months to a few years. The Faro Water Licence provides that permanent abandonment measures be undertaken

after a temporary closure period of five years. The licencee may apply for an amendment to lengthen this period, if desired.

Temporary closure would occur if there is a reasonable expectancy that the milling or mining operations would re-start. Under such circumstances, the likelihood of re-opening should be maximized by minimizing the cost of such reopening. The measures implemented under the temporary closure plan should not increase the cost of reopening.

An important consideration in developing the temporary closure plan is the level of site supervision and maintenance which will be maintained. The existing structures and facilities must be maintained sufficiently to allow environmental water management systems to function. This is critical to ensuring that licence compliance levels will be maintained.

1.4 RELATED DOCUMENTS

A report titled "Conceptual Plans for Stabilization of Rose Creek Tailings Facilities, Rose Creek Diversion, and North Wall Interceptor in the Event of Temporary Closure (Report 60605), Steffen Robertson Kirsten (SRK), 1988" was previously submitted to the Water Board and is referenced in Part D Section 12(a) of the Water Licence.

The SRK report describes measures to be implemented for stabilization of the structures associated with the Down Valley Tailings Impoundments. In the event of temporary closure, the environmental management plan described here would supersede the previous SRK document although the SRK documents must be used in support of this management plan.

The ICAP which is to be submitted co-incidentally with this report is also relevant to this temporary closure plan in that the ICAP describes in greater detail the operating configuration and status of the structures and facilities described in this report.

1.5 STAFFING DURING TEMPORARY CLOSURE

In the event of temporary closure of the mine or mill facilities, Anvil Range will have available personnel sufficient to perform the surveillance, supervision and maintenance tasks described below:

1. operation of the Faro and Vangorda Plateau Water Treatment Systems if required to ensure that there is no discharge of non-compliant water,
2. performance of monitoring requirements per the licences,
3. security and maintenance of the mill, mine and shop facilities in a moth-balled state to ensure that they do not deteriorate,
4. security to prevent unauthorized public entry including maintenance of a locked gate on the access road,
5. maintenance of roads to enable all items to be performed,

6. maintenance and operation of mobile equipment for routine and emergency maintenance work to be supplemented with contractors as required.

The minimum staffing requirement can only be determined in the context of the circumstances existing at that time. Contractor or project staff could be hired on an as required or project basis as relief or assistance to on-site personnel.

2 FARO MINE SITE - MANAGEMENT PLAN

2.1 FARO MAIN PIT

2.1.1 DESCRIPTION

The Faro Main Pit as illustrated on Figures 1 and 2 encompasses the Zone I and Zone III mining areas. Under AnviRange's ownership, the has been used for deposition of tailings resulting from mining of the Grum and Vangorda ore deposits. The water quality in the Faro Main Pit was well above discharge limits for zinc during 1996 with a neutral pH in the low 7 range.

The water level in the pit is closely monitored and is projected to reach an elevation of 3750 feet UTM by May 1997. This is the elevation at which some seepage out of the Main Pit is expected to occur in either or both of two directions (into the Zone II Pit and/or into the sediments of the Old Faro Creek Channel).

Seepage out of the Main Pit is not expected to result in downstream negatove impacts so long as the seepage is collected and treated or returned to the Main Pit prior to discharge. This is evidenced by the groundwater flow analysis developed in the ICAP which supports a closure water level above the 3750 foot elevation.

Seepage to the Zone II Pit would be pumped back into the Main Pit via the existing pumping well. The quantity of seepage into the Zone II Pit should not exceed the installed pumping capacity as described above and in the ICAP.

Seepage into the Old Faro Creek Channel sediments would likely find a flowpath to the Intermediate Tailings Impoundment via location X23 in the Old Faro Creek channel. This water would then pass through the Intermediate and Cross Valley Ponds where it would be sampled and treated, if necessary, prior to dischage.

Surface overflow from the Main Pit would not occur until an elevation of 3800 feet UTM had been reached. This event has a greater chance of resulting in a non-compliant discharge since overflow would flow directly into the Zone II Pit and this direct inflow combined with increased seepage inflow would eventually exceed the installed Zone II pumping capacity. If no active intervention were taken, then the Zone II Pit would quickly fill to the overflow elevation of 3700 feet UTM and release contaminated water into the North Fork of Rose Creek.

The detailed design of a water recycle system was completed during 1996 which would allow recycle of water from the Faro Main Pit to the mill via a pumping system. This project also included the conceptual design of a water treatment loop in the mill which would inject lime slurry into water bled off of the incoming recycle water pipeline prior to discharge into the Intermediate Impoundment for settlement of solids. This water

would be discharged via location X5 at the outflow of the Cross Valley Pond where it would be monitored according to the existing terms of the licence.

2.1.2 MANAGEMENT PLAN

In the event of temporary closure, tailings deposition into the pit would not be underway thereby removing a large portion of the inflow into the Main Pit. There would remain, however, inflows from precipitation, local area runoff, the old Faro Creek channel below the diversion, and water pumped from the Zone II Pit.

The water level in the Main pit must be monitored closely to allow decisions regarding management options to be made in a timely manner.

Dewatering, treatment and discharge of excess water from the Main Pit must take place during the period of temporary closure if necessary to prevent an uncontrolled overflow of pit water. The dewatering schedule for the Main Pit may be managed such that excess water is treated and discharged during a four to six month "summer" season by drawing down the water level during the treatment season. The most efficient method for treatment and discharge would be utilized. This would likely be the lime treatment process used prior to the temporary closure but could be a variation of this process if circumstances dictate. Regardless, the quality of water discharged from the Main Pit must be controlled such that the water quality at point of entry into the receiving environment (Rose Creek) continues to meet the maximum allowable limits as per the Water Licence.

The water level in the Main Pit should be maintained below 3750 feet UTM in order to prevent seepage losses, if possible. However, the water level must be maintained below 3780 feet UTM at all times in order to prevent an uncontrolled outflow and allow for contingency storage of a breach of the Faro Creek Diversion. A storage volume of 20 feet (6 metres) is based on the storage capacity calculated in the ICAP for emergency containment of inflows resulting from a complete failure of the Faro Creek Diversion during an extreme precipitation event.

Inspection and maintenance of the Main Pit and Related Facilities will be performed by the on-site staff described in Section 1.5 with occasional relief assistance as required. Both routine and emergency maintenance will be performed to keep mechanical equipment in good operating order.

2.2 FARO ZONE II PIT

2.2.1 DESCRIPTION

The Faro Zone II Pit is smaller than the Main Pit and is separated from the Main Pit by a rock wall with a maximum elevation of 3800 feet UTM. The Zone II Pit is illustrated on Figures 1 and 2. The lowest location on the Zone II Pit wall is on the south east side

facing the North Fork of Rose Creek and it is in this direction that any water overflow would flow.

The Zone II Pit is backfilled with waste rock excavated from the Main Pit area which includes acid generating material. The water which accumulates in the backfilled pit is contaminated with metals well above discharge limits (typically around 40 mg/L zinc). The contaminated water is pumped into the Main Pit via a pumping well in order to prevent overflow towards the North Fork of Rose Creek. The pumping well is equipped with level transmitters which automatically control pump operation such that the water level is maintained in a specified range.

2.2.2 MANAGEMENT PLAN

The environmental management plan for the Zone II Pit is to continue to dewater the pit into the Main Pit. This is a direct continuation of the operating procedures prior to temporary closure and is also the same plan as proposed in the ICAP for permanent closure.

The operating range defined for the water level in the Zone II Pit prior to temporary closure will be maintained during the period of temporary closure. This range will have been defined as adequate in preventing overflow towards the North Fork of Rose Creek.

Inspection and maintenance of the Zone II Pit and Related Facilities will be performed by the on-site staff described in Section 1.5 with occasional relief assistance as required. Both routine and emergency maintenance will be performed to keep mechanical equipment in good operating order.

2.3 FARO CREEK DIVERSION

2.3.1 DESCRIPTION

The original Faro Creek channel passed through the Main Pit, to the east of the plantsite and joined Rose Creek in the Down Valley near the Original Impoundment. For operations reasons during mining of the Faro Pits, the creek was diverted around the north east side of the Main Pit and associated rock dumps and into the North Fork of Rose Creek as illustrated on Figure 1. This type of surface water diversion is a typical open pit operating procedure which reduces the amount of clean water which may be contaminated in the active pits and also reduces the dewatering requirements of the active pits.

The diversion channel is approximately 3.35 km long in total. Parts of the channel are seated in bedrock with other parts cut into local soils. The channel is known to leak water in two directions. Water leaks from the diversion channel into the Old Faro Creek Channel and flows into the Main Pit through the Faro Valley Rock Dump (Figure 1).

Water also leaks from the diversion channel along the north east wall of the Main Pit area.

The north east wall of the Main Pit area was monitored closely during active mining due to rock movements and sloughing. It is conceivable that the pit wall may continue to fail over time such that the Faro Creek diversion channel is breached into the Main Pit. This event is accounted for through a reserved storage capacity in the Main Pit.

Occasionally, ice blockage of the diversion channel causes temporary overflow into the Main Pit while the blockage is being removed. This is typically an early spring event and is of short duration. This event is accounted for through a reserved storage capacity in the Main Pit.

2.3.2 MANAGEMENT PLAN

The diversion of Faro Creek around the Main Pit area will continue during the period of temporary closure. This will prevent the clean water in Faro Creek from becoming contaminated upon entry in the Main Pit and will also minimize the volume of water requiring handling in the Main Pit.

The operating water level for the Main Pit (Section 2.1.2) takes into account a contingency storage capacity which will contain a short duration breach of the Faro Creek diversion during an extreme precipitation event. Such an event is considered highly unlikely but conceivable, nonetheless

Inspection and maintenance of the Faro Creek Diversion will be performed by the on-site staff described in Section 1.5 with occasional relief assistance as required. Both routine and emergency maintenance will be performed to keep the channel in good operating condition up to the standard existing prior to temporary closure.

In the unlikely event of a major breach of the diversion channel, then the necessary bypass, repairs or relocation would be performed such that the diversion of Faro Creek around the Main Pit was re-instated as soon as possible. The work to be performed would be decided based on the circumstances and would represent the most efficient manner of restoring the diversion.

2.4 CROSS VALLEY (POLISHING) POND

2.4.1 DESCRIPTION

Outflow from the Cross Valley Pond represents final effluent which must meet the discharge limits specified in the licence. The outflow is sampled as location X5. During normal operations, the outflow might be either overflow or syphon discharge. The syphon discharge is used to lower the pond water level to create increased storage capacity for

spring run off as a contingency against unforeseen events which could otherwise result in a non-compliant discharge.

It has been speculated that the Cross Valley Pond turns over in the spring and that this event is responsible for brief "upset conditions" during the spring. Water quality in the pond must be monitored closely as the water temperature rises to 4^0C.

Outflow from the Intermediate Pond into the Cross Valley Pond is treated during normal operations with lime slurry delivered to the overflow spillway from the mill via an overland pipeline. The quantity of lime delivered is controlled from the mill. This method is effective and efficient in the spring, summer and fall seasons. The lime treatment is typically not performed during the winter due to freezing in the pipeline. The water level in the Intermediate Pond may be lowered below the overflow elevation during the fall using a syphon outflow which eliminates the need to run the lime slurry system during the winter. This also creates a storage volume for spring freshet such that the spring flush through the Cross Valley Pond is delayed and spread out over a longer interval.

2.4.2 MANAGEMENT PLAN

The water quality at the outflow of the Cross Valley Pond must meet the discharge limits specified in the Water Licence. Treatment of either the pond itself or of the contaminated inflows must be carried out as required to achieve the discharge limits.

The treatment method used during temporary closure may be the same as that employed during normal operations or some variation which proves more efficient under the existing circumstances. Some possible variations on the current treatment method could be use of sodium hydroxide in place of lime, lime treatment of the entire pond with discharge on a "batching" basis, alternate source and delivery of slurried lime.

2.5 WATER CONTROL STRUCTURES

2.5.1 FRESHWATER RESERVOIR

The Freshwater Reservoir (Figure 1) has been used to store water for winter operation of the mill. This practice involves raising the reservoir level by placing stop logs in the overflow spillway during the fall. Water is released from the reservoir during the winter via a low level outlet pipe.

The practice of raising the reservoir water level for winter water storage may not be continued beyond the winter of 1996/97 because of the implementation of the Faro Main Pit recycle system described in Section 2.1. Under the recycle system, the water required for operation of the mill would come from the Main Pit such that the water requirement from Rose Creek would be reduced to a relatively small amount for potable use.

The Water Licence requires that a minimum flow be released to the Rose Creek diversion channel during the winter in order to protect fish habitat. The sources of this water are the Freshwater Reservoir and the North Fork of Rose Creek via location X2 with supplementary water supplied form the groundwater pumping wells located near the pumphouse pond.

The Freshwater Dam is a till core dam and, as such, the water level must be maintained below the top of the till core at all times. Golder Associates summarized the maximum allowable operating water level as six stop logs high which maintains a contingency freeboard below the top of the internal core (Golder, 1996a). Longitudinal cracking along the crest has been the subject of detailed investigations and annual inspections by Golder Associates. The cracks have been relatively stable for several years prior to 1996 and are not believed to be indicative of imminent failure of the dam (Golder, 1996b in progress).

During a period of temporary closure, no more than six stop logs may be placed in the overflow channel as is the current practice during normal operations. If possible, the water level should not be raised with any stop logs since this minimizes the potential for a build up of water pressures within the dam.

In addition, a sufficient outflow must be maintained during the winter season to meet the minimum allowable flow requirement for the Rose Creek Diversion channel in combination with other sources of flow into the Diversion.

2.5.2 NORTH FORK ROCK DRAIN

The rock drain was incorporated into construction of the Vangorda Haul Road and allows passage of the North Fork of Rose Creek through the haul road (Figure 1). The rock drain has performed without incident. The rock dump adjacent (north west) to the rock drain has been identified as containing ice lensing near the toe and has undergone some movement in the past but is not considered in imminent danger of failure (Golder, 1996b in progress). Curragh Resources performed some resloping work on this dump which reduced the potential for movement or failure.

The rock drain is monitored visually for indications of plugging or blockage on the upstream side. The pond level above the haul road is monitored for unusual increases.

During a period of temporary closure, surveillance of the rock drain should be continued as per the practice during normal operations.

2.5.3 ROSE CREEK DIVERSION CHANNEL

The Rose Creek Diversion channel (Figure 1) passes Rose Creek (combined North and South Forks) around the Down Valley tailings impoundments which occupy the original Rose Creek channel.

The Rose Creek Diversion channel has performed adequately during normal operations. Some settlement of the containment dyke along the north side of the channel has occurred in the past due to thawing of permafrost lenses but this has not resulted in a failure or an imminent failure of the dyke (Golder, 1996b in progress). The dyke contains a designed "low spot" near the south end of the Second Impoundment which would allow the release of extreme flood flows into the Intermediate Pond rather than through the lower portion of the channel.

During normal operations, the channel is monitored closely during the spring break up period for indications of ice blockage and potential breaching of the dyke. The desired formation of ice cover with an underlying water channel is enhanced by maintaining strong flows during the fall and early winter. If flows are reduced too much in the fall, then an adequately sized opening may not form below the ice cover which may increase the flood potential in the spring. Also, experience gained through normal operations indicates that trenching in the ice cover should be avoided if possible. Trenching or digging into the ice cover (to investigate flow conditions for example) results in an ice dam frozen to the channel bottom which increases the chance of flooding during spring break up.

The diversion channel is instrumented with piezometers, thermistors, slope indicators and survey monuments which are read according to Schedule C of the Water Licence and the geotechnical consultant's recommendations. To date, Golder Associates, Calgary office have performed the annual geotechnical inspections of the channel and the interpretation of instrumentation data. In 1996, the instrumentation readings were performed by Anvil Range environmental staff.

During a period of temporary closure, surveillance of the channel should continue with particular emphasis during the spring break up period. Monitoring of the geotechnical instrumentation and the annual geotechnical inspection should continue according to the licence.

2.6 FARO WATER QUALITY AND SURVEILLANCE PROGRAM

Water Licence IN89-001 for the Faro site includes a schedule of water quality monitoring during a period of temporary closure (Schedule A, Part II). This schedule must be followed.

This schedule does not, however, include any stations directly related to the Main Pit. Specifically, stations X22, X22b, X22c (all three in Main Pit) are excluded from the temporary closure surveillance program. Information regarding the Main Pit water quality and water level is important, nonetheless, for managing the facilities during a period of temporary closure. Water quality and water level monitoring for the Faro Main Pit should be performed during the period of temporary closure with monthly recording of the water level and quarterly water quality sampling..

Water quality monitoring for the groundwater wells associated with the North Fork of Rose Creek (BH-1, BH-2 and BH-4) and the Zone II Pit (X26) are described in Part C of the licence and monitoring of these locations should continue during the period of temporary closure.

The annual seep surveys conducted during mine operations include samples in the Faro Creek Diversion as well as other locations around the Main and Zone II Pits. These annual seep surveys should be continued during temporary closure. The scope and performance of these seep surveys may be amended from time to time to reflect current conditions.

In conjunction with the annual seep survey, key groundwater installations should also be monitored. These key wells (Figure 1) provide information useful for closure planning and research purposes. The list of key wells is as follows:

- BH-12, BH-13 and BH-14 associated with the north east rock dump,
- wells #1, #2 and #3 associated with the sulphide cell,
- wells 96-06, 96-07 and 96-08 associated with the main and intermediate rock dumps, and
- well 81-04 on the Second Tailings Impoundment.

The biological and physical monitoring programs described in Schedules B and C of the licence should be followed during the period of temporary closure. These programs include benthic monitoring and inspections of the physical structures on the site.

The monthly and annual reporting requirements should be maintained during the period of temporary closure. Monthly reports to the Water Board should contain available water quality data and a brief overview of the environmental activities performed. The annual report to the Water Board should contain the information described in Part A of the licence.

3 VANGORDA PLATEAU MINE SITE - MANAGEMENT PLAN

3.1 WATER TREATMENT SYSTEM

3.1.1 DESCRIPTION

The Grum/Vangorda Water Treatment System is illustrated in Figure 3 and is comprised of the following components:

1. Little Creek Dam, pumphouse and buried pipeline
2. holding pond ("Groucho" Pond)
3. treatment plant, clarification pond and outflow ditch
4. Sheep Pad Ponds, outflow ditch and contingency syphon line
5. contingency pipeline

The Mine Dept. dewatering crew operates the treatment plant and associated facilities during normal operations. The dewatering crew is responsible for maintaining pond water levels within acceptable ranges and for operating the plant according to guidelines provided by the designer and, from time to time, from the Environmental Service Dept. Water quality monitoring is performed by the Environmental Dept. The treatment plant does not run continuously except during the high flow periods during spring freshet. During the winter, the treatment plant may be operated less than one day per week.

Water pumped from the Grum Pit is pumped into the holding pond. From this location, water is either pumped to the treatment plant or, on occasion during winter, fed by gravity down the buried pipeline to Little Creek Dam. The latter option is occasionally performed during winter in order to minimize start up and shut down of the treatment plant during the low flow winter season and to keep the pipelines free of ice.

Water pumped from the Vangorda Pit is pumped into Little Creek Dam. Water seepage from the Vangorda Rock Dump is directed into Little Creek Dam via the seepage collection ditch. Conceptual planning is underway to allow for the possibility of pumping seepage water from the Grum Rock Dump to Little Creek Dam as well. This would depend on the water quality of seepage water which has, to date, shown no signs of contamination requiring treatment. From Little Creek Dam, water is pumped to the treatment plant via the buried pipeline.

The treatment plant is a conventional lime and flocculant addition process with settlement of solids in the clarification pond. Water quality is required to meet licenced discharge limits at the outflow of the clarification pond. Discharge from the clarification pond is via an outflow ditch which joins the Grum Interceptor Ditch and passes water into the Sheep Pad ponds. A 20" overland pipeline is currently in place (although disconnected in several locations) which can be used as a contingency discharge from the clarification pond to Vangorda Creek bypassing the Sheep pad Ponds. There are currently no operational reasons or plans to utilize the pipeline.

The Sheep Pad Ponds provide for settlement of suspended solids prior to entry into Vangorda Creek. Flocculants are added as required into the Main Sheep Pad Pond to enhance the settlement of fine clayey particles. During operations, a combination of ferric sulphate and Percol E10 flocculants was found to be effective in removing fine particles from the water during the spring freshet period.

The application for licence amendment currently under review includes the addition of a new monitoring location in the Sheep Pad Pond outflow ditch upstream of entry into Vangorda Creek. This location may also have licence discharge limits applied to it.

3.1.2 MANAGEMENT PLAN

The management plan for the water treatment system during a period of temporary closure will depend on the requirement for pit dewatering.

If the Grum and Vangorda Open Pits are being dewatered during the temporary closure, then the requirement to operate the treatment system exists. This would require that experienced operators be kept available to operate the treatment plant and associated facilities during the temporary closure. The staffing requirement can only be determined under the existing circumstances.

If the open pits or even if only one of the open pits are not being actively dewatered, then the opportunity exists to defer operation of the treatment system by using one or both of the open pits as storage areas for contaminated water. In this event, personnel would be required to monitor pond levels and water systems and to operate some pumps as required to direct contaminated water to the storage locations. For example, water accumulating in Little Creek Dam might be pumped into the Vangorda Open Pit. The staffing requirements for these circumstances would be less than for the active dewatering and treatment scenario described above.

If the treatment plant is operated during the period of temporary closure, then provisions must be made for supply of pulverized lime and flocculant. Provision must also be made for maintenance (mechanical, instrumentation and electrical) as required to maintain the plant in good operating condition. In addition, the power requirement for operation of the treatment plant must be accounted for. In the case of operating only some pumps to direct water to storage facilities, then the advantages of electrical power versus generators or gas powered pumps must be evaluated.

Monitoring of suspended solids exiting the Sheep Pad Ponds must be monitored closely during the spring freshet period and measures taken to prevent a non-compliant discharge to Vangorda Creek as required.

3.2 GRUM OPEN PIT

The Grum Open Pit is designed in three phases. At the time of writing, phase 1 development and ore removal was near completion and phase 2 development (waste stripping) was well underway. The Grum Open Pit is scheduled to supply all of the mill ore feed for the remainder of the mine life with very minor volumes of ore remaining to be excavated from the Vangorda Open Pit.

In the event that the Grum Open Pit is being actively dewatered during a period of temporary closure, then pit water would be pumped either to the treatment plant holding pond as per normal operating practice or to the Vangorda Open Pit for storage, thereby deferring the requirement to operate the treatment plant.

In the event that the Grum Open Pit is not being actively dewatered during the period of temporary closure, then no action is required at this location save monitoring the filling rate for research and closure planning purposes.

3.3 VANGORDA OPEN PIT

The ore available in the Vangorda Open Pit had been nearly exhausted at the time of writing (November 1996). The water balance and permanent closure options developed for the ICAP describe the water levels which must be maintained in the pit in order to allow sufficient contingency storage capacity for extreme flood events.

If the Vangorda pit is not being actively dewatered during the period of temporary closure, then it could be utilized as a storage or containment location for contaminated water from other sources. This must be done within the constraints of maintaining acceptable storage for extreme flood events. In this event, no action would be required beyond monitoring the water level and rate of filling.

If the Vangorda Pit is being actively dewatered, then water would be pumped to Little Creek Dam as is the normal operating practice.

3.4 GRUM ROCK DUMP

3.4.1 DESCRIPTION

The Grum Rock Dump is illustrated on Figure 3. The rock dump is under construction for the duration of mining activities in the Grum Open Pit. The rock dump is composed of material excavated from the Grum Open Pit which is segregated during mining into sulphides or non-sulphides. The non-sulphide group is predominantly composed of calcareous phyllite which has a strong acid consuming potential.

The sulphide material is placed into designated areas on the rock dump which in total will form the "sulphide cell" outlined on Figure 3. The material segregated to the

sulphide cell includes sulphidic material as well as phyllite (non-sulphide) material which can not be separated during the course of mining activities (ie. the haul trucks contain some sulphides and some phyllites).

The purpose of creating the sulphide cell is to minimize the areal extent of the ARD source such that collection and treatment efforts are minimized. A seepage collection ditch at the toe of the rock dump is intended but not yet designed in detail. The ditch concept (Figure 3) is that the ditch will be seated in bedrock or appropriate soils and will include three sumps. These sumps will allow for the separate handling of water which drains directly from the sulphide cell from water which does not. It is anticipated that, if seepage requires treatment, only water draining directly from the sulphide cell will be non-compliant with the discharge limits defined in the Water Licence.

Two nested piezometers were installed in the location of the conceptual sulphide cell sump during 1996. The drill hole was 20 metres deep to bedrock and identified two distinct water bearing horizons into each of which a standpipe piezometer was installed.

To date (November 1996), there has been no indication of contaminated surface or ground water related to acid generation from the Grum Rock Dump.

3.4.2 MANAGEMENT PLAN

During a period of temporary closure, no specific actions are required at the Grum Rock Dump beyond routine water quality and physical stability monitoring. The 1996 piezometers are not included in the licence but should be sampled twice per year in conjunction with other groundwater monitoring programs.

3.5 VANGORDA ROCK DUMP

3.5.1 DESCRIPTION

The Vangorda Rock Dump is illustrated on Figure 3. Construction of the dump is complete with the exception of reclamation activities. The dump is composed of material excavated from the Vangorda Open Pit which is primarily sulphide material and phyllite material, each of which has the potential to generate acid rock drainage (ARD) although the ARD potential for the sulphide material is much greater than that for the phyllites.

The two dominant material types were segregated during mining and placed into separate areas of the rock dump. The northern, smaller area of the rock dump contains the sulphide material while the southern, larger part contains the phyllites. This is true in a general sense with the understanding that a small quantity of each rock type may have been misplaced into the wrong area during the course of active mining.

A till berm was constructed within the rock dump as a measure to control internal drainage. The till berm separates the two dump areas (sulphides from phyllites). Unfortunately, this berm was not fully completed and was constructed to a partial height rather than to the top of the dump.

A till berm was also constructed around the lower perimeter of the dump toe in order to direct seepage from the dump to one of six drains through the berm. The drains greatly enhance the opportunities to collect good water quality and flow information since seepage is collected in centralized locations. Drains #1 through #3 are generally below the phyllite area of the dump while drains # 4 through #6 are generally below the sulphide area of the dump. Drain #3 is in the most centralized location and consistently flows which may indicate that this drain is the most representative of overall seepage from the rock dump.

Seepage water flowing out of the drains is collected in a collection ditch which drains the perimeter of the dump toe into the Little Creek Dam (Figure 3) where it becomes part of the water collection and treatment system. In this way, all surface seepage from the dump is captured within the mine site collection and treatment system.

Four drill holes with a total of nine piezometer installations are installed in the till toe berm as a means of monitoring seepage through the berm and water pressures in the berm. Neither significant seepage nor significant water pressures are anticipated in the toe berm. Five groundwater monitoring wells are installed below the collector ditch to monitor for groundwater seepage not collected by the surface drains and ditch.

3.5.2 MANAGEMENT PLAN

During a period of temporary closure, no specific actions are required at the Vangorda Rock Dump beyond routine water quality and physical stability monitoring. The application for licence amendment currently under review includes the proposal to include all of the drains and groundwater wells in the licence under normal operations.

The drains and groundwater wells should be monitored at the frequency proposed for normal operations if possible through the period of temporary closure. That is, quarterly monitoring for the drains and semi-annual monitoring for the groundwater wells should be performed. The information collected is useful for geotechnical assessments of the performance of the drains, for research purposes regarding contaminant release from the dump and for monitoring the deep seepage not collected by the surface collection system.

3.6 VANGORDA PLATEAU WATER QUALITY AND SURVEILLANCE PROGRAM

Water Licence IN89-002 for the Vangorda Plateau site includes a schedule of water quality monitoring during a period of temporary closure (Schedule A, Part III). This schedule must be followed.

The annual seep surveys conducted during mine operations and described in the report "Vangorda Plateau Minesite, Seepage Monitoring Plan and Groundwater Monitoring Plan" submitted co-incidentally with this document should be continued during temporary closure. The scope and performance of these seep surveys may be amended from time to time to reflect current conditions.

The biological, sediment and physical monitoring programs described in Part B of the licence should be followed during the period of temporary closure. These programs included benthic monitoring and inspections of the physical structures on the site.

The monthly and annual reporting requirements should be maintained during the period of temporary closure. Monthly reports to the Water Board should contain available water quality data and a brief overview of the environmental activities performed. The annual report to the Water Board should contain the information described in Part A of the licence.

4 REFERENCES

1. Anton, Campion, MacDonald and Phillips, June 1995, "Amendment Application for IN89-001, Amendment Application for IN89-002"
2. Anvil Range Mining Corporation, July 1996, "Updated Amendment Application for Licences IN89-001 (Faro) and IN89-002 (Vangorda Plateau)"
3. Anvil Range Mining Corporation, November 1996, "Vangorda Plateau Minesite, Seepage Monitoring Plan and Groundwater Monitoring Plan"
4. Department of Indian and Northern Development, Water Resources Division, November 1996, "Re. Application QZ95-004, Anvil Range Mining Corporation, Amendment of Vangorda/Grum Licence, IN89-002"
5. Department of Indian and Northern Development, Water Resources Division, November 1996, "Canadian Environmental Assessment Act, Level I Screening, Water Licence Application - QZ95-004"
6. Environment Canada, November 1996, "Re: Amendment of Anvil Vangorda Licence IN89-002"
7. Gilchrist, H.G., September 13, 1996, memo to E. Denholm, Anvil Range Mining Corporation, "Re: Faro Mine Fresh Water Supply Dam - Allowable Maximum Water Level"
8. Golder Associates, in progress, "1996 Annual Geotechnical Performance Evaluation, Faro Mine"
9. Jilson, G., Access Mining Consultants Ltd., personal communication
10. Robertson Geoconsultants Inc., Draft Document 033001, October 1996, "(Draft) Anvil Range Mining Complex Conceptual Closure Plan"
11. Steffen Robertson and Kirsten, Report 60605, April 1988, "Conceptual Plans for Stabilization of Rose Creek Tailings Facilities, Rose Creek Diversion and North Wall Interceptor in the Event of Temporary Closure"
12. Sterriah, N., Chief, Ross River Dena Council, November 1996, "Re: Application No. QZ95-003 by Anvil Range Mines Corporation to Amend Water Use Licence IN89-001 - Notice of Intent to Intervene at Public Hearing by Ross River Dena Council"
13. Yau, W., Proton International Engineering Corp., July 17, 1996, memo to Ken Ball, Anvil Range Mining Corporation, "Re: Anvil Range Mining Corp. Faro Pit Reclaim Water System"
14. Yukon Territory Water Board, "Water Licence IN89-001, Faro", Amendment #4
15. Yukon Territory Water Board, "Water Licence IN89-002, Vangorda Plateau"

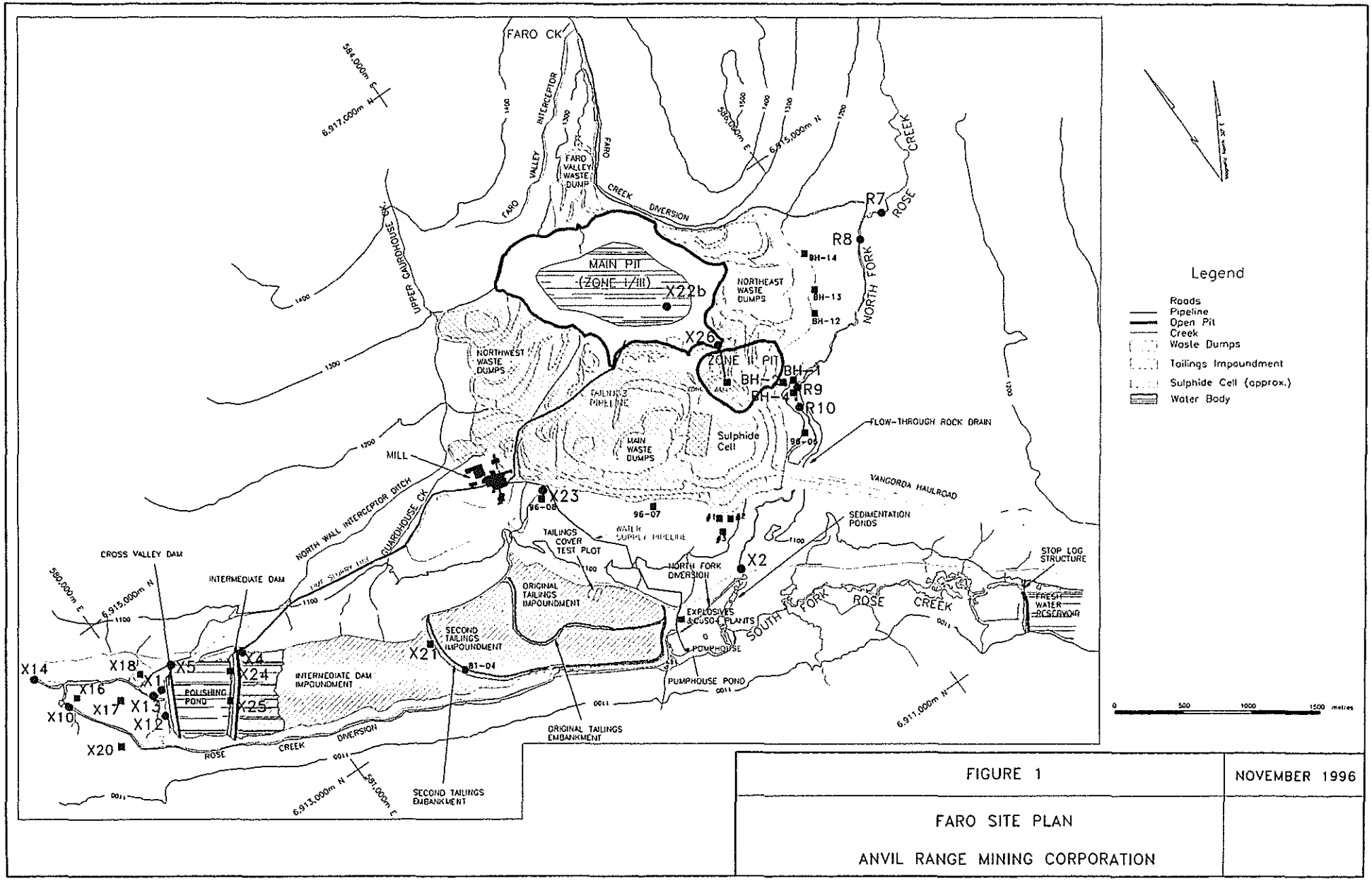


FIGURE 1	NOVEMBER 1996
FARO SITE PLAN	
ANVIL RANGE MINING CORPORATION	

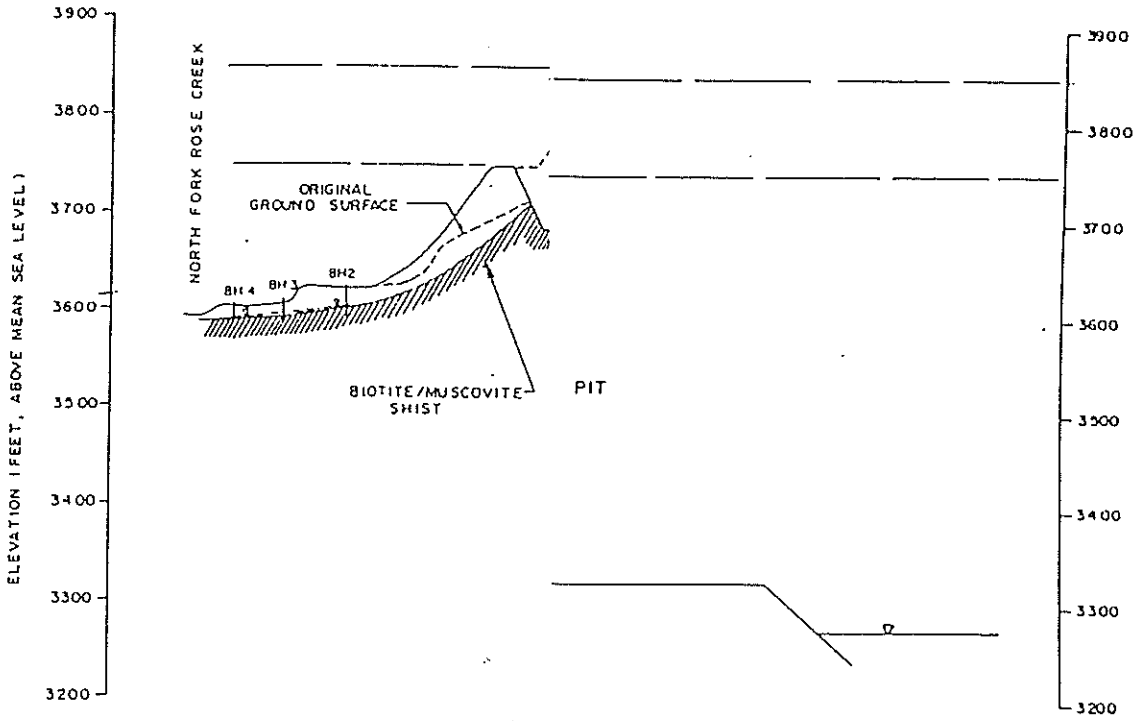


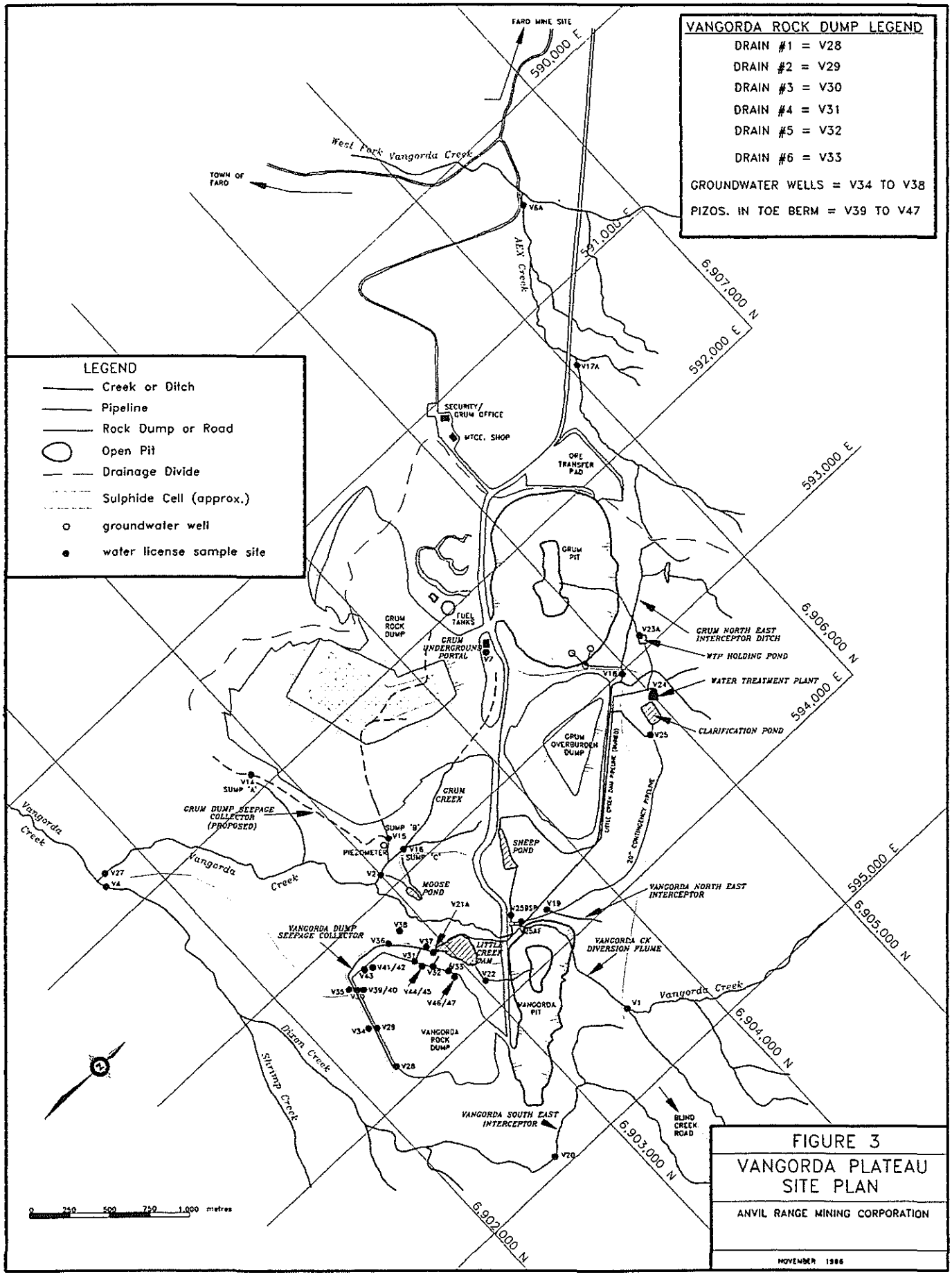
FIGURE 2

OF FARO MAIN AND ZONE II PITS

ANGE MINING CORPORATION

NOVEMBER 1996

CE: KILBORN INC., JUNE 1991,
LE AND TAILINGS DEPOSITION PLAN"


VANGORDA ROCK DUMP LEGEND
DRAIN #1 = V28
DRAIN #2 = V29
DRAIN #3 = V30
DRAIN #4 = V31
DRAIN #5 = V32
DRAIN #6 = V33
GROUNDWATER WELLS = V34 TO V38
PIZOS. IN TOE BERM = V39 TO V47
LEGEND
Creek or Ditch
Pipeline
Rock Dump or Road
Open Pit
Drainage Divide
Sulphide Cell (approx.)
groundwater well
water license sample site
FARO MINE SITE
TOWN OF FARO
West Fork Vangorda Creek
AEX Creek
590,000 E
591,000 E
592,000 E
593,000 E
594,000 E
595,000 E
6,907,000 N
6,906,000 N
6,905,000 N
6,904,000 N
6,903,000 N
6,902,000 N
V6A
V17A
SECURITY/ GRUM OFFICE
MTCC. SHOP
ORE TRANSFER PAD
GRUM PIT
GRUM ROCK DUMP
FUEL TANKS
GRUM UNDERGROUND PORTAL
V7
V23A
GRUM NORTH EAST INTERCEPTOR DITCH
WTP HOLDING POND
V16
V24
WATER TREATMENT PLANT
V25
CLARIFICATION POND
GRUM OVERBURDEN DUMP
20" CONTINGENCY PIPELINE
V14
SUMP 'A'
GRUM DUMP SEEPAGE COLLECTOR (PROPOSED)
GRUM CREEK
SUMP 'B'
V15
PIEZOMETER
SUMP 'C'
V16
SHEEP POND
V27
V4
V2
MOOSE POND
V21A
V25BSP
V19
VANGORDA NORTH EAST INTERCEPTOR
V38
VANGORDA DUMP SEEPAGE COLLECTOR
V36
V37
V25AF
LITTLE CREEK DAM
VANGORDA CK DIVERSION FLUME
V31
V41/42
V43
V52
V35
V22
V39/40
V44/45
V46/47
V1
Vangorda Creek
VANGORDA PIT
V34
V29
VANGORDA ROCK DUMP
Dixon Creek
Shrimp Creek
V28
VANGORDA SOUTH EAST INTERCEPTOR
V20
BLIND CREEK ROAD
0 250 500 750 1,000 metres
FIGURE 3
VANGORDA PLATEAU
SITE PLAN
ANVIL RANGE MINING CORPORATION
NOVEMBER 1986