

**ANVIL RANGE MINING CORPORATION
FARO OPERATIONS**

**VANGORDA PLATEAU MINESITE
SEEPAGE MONITORING PROGRAM AND
GROUNDWATER MONITORING PROGRAM**

FOR THE GRUM AND VANGORDA ROCK DUMPS

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. Vangorda Plateau Minesite, Seepage Monitoring Program and Groundwater Monitoring Program

Enclosed are five bound copies and one unbound original of the report Vangorda Plateau Minesite, Seepage Monitoring Program and Groundwater Monitoring Program as required by Water License IN89-002, Part B, Sections 4(a) and 4(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

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SUMMARY

This report outlines the work to be performed related to seepage and groundwater monitoring at the Grum and Vangorda Rock Dumps. This information fulfills the requirements of Part D Sections 4(a) and 4(b) of Water Licence IN89-002 for the Vangorda Plateau.

In general, the seepage monitoring program comprises an annual survey of surface seeps from the toe areas of the rock dumps in excess of the monitoring requirements incorporated into the Water Licence. This is similar in scope to the annual seep survey performed at the Faro site. The groundwater monitoring program is also complementary to monitoring required in the Water Licence.

The data gathered from these monitoring programs will provide valuable information regarding the specific locations and natures of seepage water which may reflect back to their sources.

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FIGURE 1 VANGORDA PLATEAU SITE PLAN

1 INTRODUCTION

Water Licence IN89-002 for the Vangorda Plateau (Water Licence) requires that Anvil Range Mining Corporation (Anvil Range) submit to the Yukon Territory Water Board (Water Board) a seepage monitoring program within 6 months of construction of the waste dumps and that the program shall be implemented within a reasonable time thereafter (Part D, Section 4(a)). The Water Licence further requires that Anvil Range submit a groundwater monitoring program within 6 months of activating the seepage monitoring program and that this program shall be implemented within a reasonable time thereafter (Part D, Section 4(b)).

The date for submission of the seepage monitoring program 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 has been taken as the licenced submission date for this report.

The amendment to the original submission timeframe was required because of the uncertainty regarding when a rock dump is deemed to have been constructed since the dump is continually under construction during active mining. The proposed date also coincides with the proposed date for submission of the Integrated Comprehensive Abandonment Plan which provides the measures to be implemented in the case of permanent closure of the Vangorda Plateau site.

The groundwater monitoring program is included here as opposed to delaying submission to 6 months from activation of the seepage monitoring program since current information is adequate to define the groundwater program.

2 VANGORDA ROCK DUMP

2.1 DESCRIPTION

The Vangorda Rock Dump is illustrated on Figure 1. 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 1) 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.

2.2 WATER LICENCE REQUIREMENTS

The Water Licence includes the requirement to sample dump seepage in the toe perimeter collection ditch on a monthly basis (station V21) including flow measurement.

The proposed amendments to the Water Licence (June 1995 and July 1996) expand upon the seepage and groundwater monitoring requirements by proposing requirements to monitor the drains, groundwater wells below the collector ditch and standpipe piezometers in the till toe berm.

The drains would be monitored quarterly (stations V28 through V33) while the groundwater wells and piezometers would be monitored semi-annually (stations V34 through V47). The written interventions and screening report regarding these proposed amendments do not indicate any controversy regarding the proposed monitoring schedule and the proposed schedule described here is taken as a licence requirement.

Water quality results and a brief description of sampling activities are reported monthly to the Water Board as defined in the Water Licence. An annual report is also required by the Water Licence which contains all water quality results for the year and an interpretation of trends.

2.3 SEEPAGE AND GROUNDWATER MONITORING PROGRAMS

The seepage and groundwater monitoring programs will adhere to the requirements defined in the Water Licence as described in Section 2.2. In the event that the amended Water Licence includes a different monitoring schedule than that described in Section 2.2, then the seepage and groundwater monitoring programs will adhere to the more rigorous of the two schedules.

In addition to the Water Licence requirements, an annual survey of any additional surface seeps will be performed as an additional information gathering effort. The survey will be performed during or shortly following spring freshet. Samples and flow measurements will be collected at all surface seeps which are in the vicinity of the toe of the rock dump. The timing of the survey will coincide with sampling of the drains and the collection ditch and samples will be analysed for all parameters normally included in analysis of the drains.

The results of the seepage and groundwater surveys in excess of the Water Licence requirements will be reported along with corresponding Water Licence information. The monthly reports to the Water Board will include water quality results and a brief description of sampling activities. The annual report will include all water quality results for the year and an interpretation of trends.

The seepage and groundwater monitoring programs described here will be initiated in 1997.

3 GRUM ROCK DUMP

3.1 DESCRIPTION

The Grum Rock Dump is illustrated on Figure 1. 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 1. 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 1) 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.

Work was performed during 1996 as an information gathering effort prior to detailed design of the ditch and sumps. A ground penetrating radar survey, a series of test pits, and a series of drill holes up to 12 metres deep were completed along the conceptual right of way which provided information on soils and the depth to bedrock. One area was identified near conceptual sump 'B' where the bedrock profile drops sharply to greater than 12 meters below surface.

An additional drill hole was drilled in the identified bedrock "deep spot" as a means of determining the depth to bedrock (Figure 1). Bedrock was located at a depth of 20 metres below surface and one piezometer was installed within each of two distinct water bearing soil horizons.

A preliminary ditch (not to bedrock) was constructed by a bulldozer along the conceptual right of way which will provide additional soils information and will also assist with water sampling during the 1997 spring freshet.

3.2 LICENCE REQUIREMENTS

The Water Licence includes the requirement to sample dump seepage at three locations on a monthly basis (stations V14 through V16) including flow measurement. These

locations are intended to be the three sumps conceptually illustrated on Figure 1 once the sumps are constructed. Until that time, the samples are collected in the general areas intended for the sumps with allowances for varying locations of surface flows.

In addition to stations V14 through V16, Grum Creek is included as a Water Licence requirement at station V2 sampled on a monthly basis (Figure 1). Grum Creek currently receives seepage from some of the area of the sulphide cell via the area near conceptual sump 'B' as well as seepage and surface flow from the eastern rock dump area.

Water quality results and a brief description of sampling activities are reported monthly to the Water Board as defined in the Water Licence. An annual report is also required by the Water Licence which contains all water quality results for the year and an interpretation of trends.

3.3 SEEPAGE AND GROUNDWATER MONITORING PROGRAMS

The seepage and groundwater monitoring programs will adhere to the requirements defined in the Water Licence as described in Section 3.2.

In addition to the Water Licence requirements, an annual survey of any additional surface seeps will be performed as an additional information gathering effort. The survey will be performed during or shortly following spring freshet. Samples and flow measurements will be collected at all surface seeps which are in the vicinity of the toe of the rock dump. The timing of the survey will coincide with sampling of stations V14 through V16 and samples will be analysed for all parameters normally included in analysis of samples V14 through V16.

Also in addition to the Water Licence requirements, the piezometers (2) installed near the conceptual location of sump 'B' (Figure 1) will be monitored semi-annually in conjunction with the piezometers and groundwater wells associated with the Vangorda Rock Dump (Section 2). Samples will be analysed for all parameters normally included in analysis of samples from the Vangorda piezometers and groundwater wells.

The results of the seepage and groundwater surveys in excess of the Water Licence requirements will be reported along with corresponding Water Licence information. The monthly reports to the Water Board will include water quality results and a brief description of sampling activities. The annual report will include all water quality results for the year and an interpretation of trends.

The seepage and groundwater monitoring programs described here will be initiated in 1997.

4 REFERENCES

Anton, Campion, MacDonald and Phillips, June 1995, "Amendment Application for IN89-001, Amendment Application for IN89-002"

Anvil Range Mining Corporation, May 1996, "Notice of Proposed Modification to the Grum Pit Design and Notice of Modification to the Grum Rock Dump Design"

Anvil Range Mining Corporation, July 1996, "Updated Amendment Application for Licences IN89-001 (Faro) and IN89-002 (Vangorda Plateau)"

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"

Department of Indian and Northern Development, Water Resources Division, November 1996, "Canadian Environmental Assessment Act, Level I Screening, Water Licence Application - QZ95-004"

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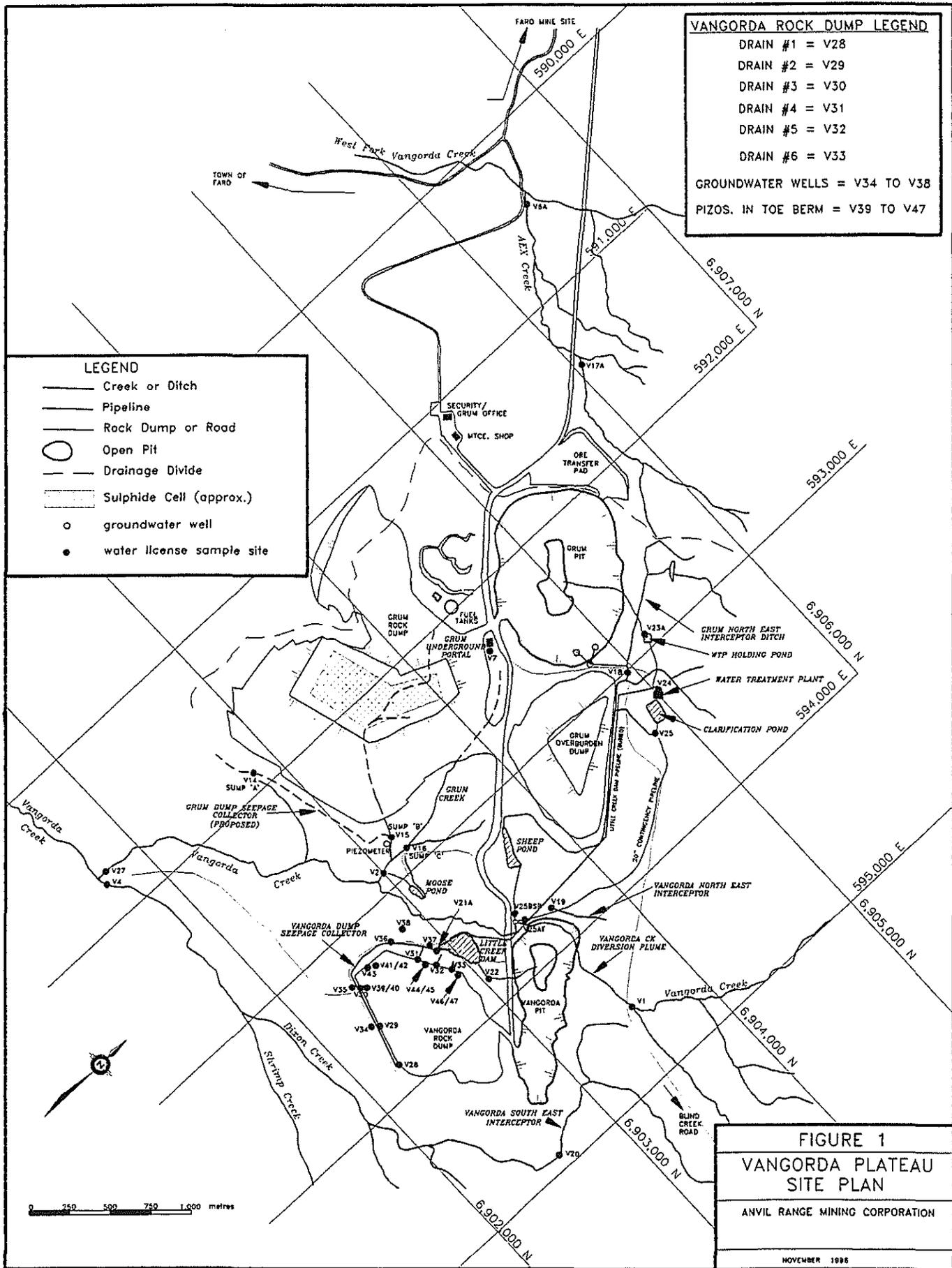
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VANGORDA ROCK DUMP LEGEND	
DRAIN #1	= V28
DRAIN #2	= V29
DRAIN #3	= V30
DRAIN #4	= V31
DRAIN #5	= V32
DRAIN #6	= V33
GROUNDWATER WELLS = V34 TO V38	
PIZOS. IN TOE BERM = V39 TO V47	

LEGEND	
	Creek or Ditch
	Pipeline
	Rock Dump or Road
	Open Pit
	Drainage Divide
	Sulphide Cell (approx.)
	groundwater well
	water license sample site

FIGURE 1
VANGORDA PLATEAU
SITE PLAN
 ANVIL RANGE MINING CORPORATION
 NOVEMBER 1996

0 250 500 750 1,000 metres

