Anvil Range Mine Adaptive Management Plan - Annual Review for 2006

Prepared for:
Deloitte & Touche Inc.
(acting as the Court Appointed Interim Receiver for Anvil Range Mining Corporation)

Prepared by:
Gartner Lee Limited

Reference:
GLL 60588

Date:
February 2007

Distribution:
6 Yukon Water Board (plus electronic)
10 Deloitte & Touche Inc.
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Executive Summary

The Water Licence for the Anvil Range Mine (QZ03-059) provides primarily for the continuation of environmental care and maintenance activities to the end of 2008, when a Final Closure and Reclamation Plan is scheduled to be in place. In addition to water and facilities that will receive active management, there are other waters and facilities on the mine site that are recognized as representing potential environmental risks but which do not require immediate intervention. Long term management of these waters and facilities will be addressed in the Final Closure and Reclamation Plan. However, a short term management strategy is required to monitor for potential degradation of conditions to the point where active intervention might be necessary prior to the end of 2008 and to provide a framework for ensuring that appropriate management actions are implemented.

Such a strategy is provided for in the Water Licence through the Adaptive Management Plan ("AMP"). A conceptual AMP was developed and reviewed by parties to the Environmental Assessment and Water Licencing processes through 2002 and 2003. The Water Licence then required that a detailed AMP Implementation Protocol be developed that follows from the conceptual plan. The AMP Implementation Protocol was filed with the Water Board in June 2004. The Implementation Protocol also requires that an annual review of the AMP program be undertaken. The annual review provides a mechanism whereby any necessary or beneficial modifications to the AMP program can be identified and proposed to the Water Board on a regular basis.

Eight AMP "events" were developed through the Environmental Assessment and Water Licence Renewal processes. These events represent possible future environmental conditions that would require a management response, if they were to occur.

The eight events are as follows with a summary for 2006 activities:

1. Degraded Groundwater Quality in Rose Creek Valley Aquifer;
   Four new triggers activated in 2006 at the 2003 Multi-level Wells: sulphate at P03-09-3 and P03-04-4 and dissolved zinc at P03-04-2 and P03-04-3.
2. Degraded Water Quality in Vangorda Creek Downstream of the Mine Facilities;
   Two triggers were activated in 2006 for sulphate and TSS. Data analysis demonstrated that the sulphate trigger was due to winter low-flow conditions resulting in elevated levels of sulphate. Assessment of the TSS trigger confirmed that the elevated TSS was originating from "non-mining sources" downstream of the old ski hill.
3. Degraded Water Quality in Rose Creek Downstream of the Mine Facilities;
   One trigger was activated in 2006 for sulphate. Data analysis demonstrated that this was due to elevated sulphate concentrations during the winter low flow period, consistent with historical trends at this location.

4. Degraded Seepage Quality from the Grum Rock Dump;
   No new triggers at V2 in 2006. A consistent rise in dissolved zinc concentration observed at V15 in 2006. The transfer of water from station V15 to station V2A will be in implement 2007, via Grum Creek diversion.
5. Degraded Water Quality in the North Fork of Rose Creek;
   Two triggers activated in 2006 for sulphate and zinc. Specifically projected continued elevated winter sulphate concentrations and increasing zinc concentrations, both above their respective thresholds. A comprehensive analysis of these triggers is presently underway, incorporating new information that has been generated as part of the ongoing development of the Final Closure and Reclamation Plan by the Faro Mine Closure Planning Office. Based on this analysis, an appropriate response plan will be developed and filed with the Water Board.
6. Water level in Grum Pit Reaches Maximum Desired Elevation;
   No triggers were activated in 2006.
7. Disruption of Fannin Sheep Migration Through the Mine Site; and
   No triggers were activated in 2006.
8. Wind Dispersed Tailings Result in Adverse Effects in the Terrestrial Environment.
   No triggers were activated in 2006.

Other than the specific recommendations listed above, the AMP program functioned in 2006 as intended and no other changes should be made.

Table of Contents

List of Figures

List of Tables

List of Appendices

1. Introduction

1.1 Background

The Anvil Range Mine, inclusive of both the Faro and Vangorda Plateau mine sites, is located near the Town of Faro, Yukon. The mine produced lead and zinc mineral concentrates from 1969 to 1998 and was, at one time, the largest open pit, lead-zinc mines in the world. All mining and processing operations ceased permanently in early 1998 when the mine owner, Anvil Range Mining Corporation, entered into receivership. The mine has been under the management of a court appointed interim receiver, Deloitte & Touche Inc., since April 1998.

The Water Licence for the Anvil Range Mine (QZ03-059) provides primarily for the continuation of environmental care and maintenance activities to the end of 2008, when a Final Closure and Reclamation Plan is scheduled to be in place. The licenced care and maintenance activities address specifically water and facilities that require active management to ensure that adequate environmental protection is provided in the short term (i.e., to 2008).

In addition to water and facilities that will receive active management, there are other waters and facilities on the mine site that are recognized as representing potential environmental risks but which do not require immediate intervention. Long term management of these waters and facilities will be addressed in the Final Closure and Reclamation Plan. However, a short term management strategy is required to monitor for potential degradation of conditions to the point where active intervention might be necessary prior to the end of 2008 and to provide a framework for ensuring that appropriate management actions are implemented.

Such a strategy is provided for in the Water Licence through the Adaptive Management Plan ("AMP"). A conceptual AMP was developed and reviewed by parties to the Environmental Assessment and Water Licencing processes through 2002 and 2003. The Water Licence then required that a detailed AMP Implementation Protocol be developed that follows from the conceptual plan. Part F, Item 54 of the Water Licence reads:

> *An Adaptive Management Plan for the facilities authorized by this licence shall be prepared and submitted to the Board by June 30, 2004. The plan shall identify the indicators and triggers for action, the measures of statistically significant changes to be tracked, the monitoring locations and parameters, the sampling frequencies, the methods to be used to analyze and evaluate the data, and the actions to be taken.*

The AMP Implementation Protocol was filed with the Water Board in June 2004. The Implementation Protocol provided all of the information that was required by the Water Licence for the eight AMP "events" that had been developed in the conceptual plan.

The Implementation Protocol also requires that an annual review of the AMP program be undertaken. The annual review provides a mechanism whereby any necessary or beneficial modifications to the AMP program can be identified and proposed to the Water Board on a regular basis. The annual review also ensures that all of the year's activities under the AMP program are compiled and documented.

1.2 AMP Events

Eight AMP "events" were developed through the Environmental Assessment and Water Licence Renewal processes. These events represent possible future environmental conditions that would require a management response, if they were to occur.

The eight events are as follows:

1. Degraded Groundwater Quality in Rose Creek Valley Aquifer;
2. Degraded Water Quality in Vangorda Creek Downstream of the Mine Facilities;
3. Degraded Water Quality in Rose Creek Downstream of the Mine Facilities;
4. Degraded Seepage Quality from the Grum Rock Dump;
5. Degraded Water Quality in the North Fork of Rose Creek;
6. Water level in Grum Pit Reaches Maximum Desired Elevation;
7. Disruption of Fannin Sheep Migration Through the Mine Site; and
8. Wind Dispersed Tailings Result in Adverse Effects in the Terrestrial Environment.

Each of the AMP events is described according to nine common elements. This ensures that a consistent approach is followed for each event that achieves the general objectives of the AMP Implementation Protocol. The common elements are as follows:

1. Description of the event and possible environmental consequences;
   As developed through the Environmental Assessment and Licence Renewal Processes
   The possible environmental consequences will lead to the narrative trigger and specific thresholds
2. Discussion of event-specific information or issues;
   Any unique issues or information that have a direct influence for applying the AMP
3. Narrative response trigger;
   As developed through the Environmental Assessment and Licence Renewal Processes
   The narrative trigger will lead to the specific indicators

4. Specific indicators;
   The environmental parameters to be monitored and assessed
5. Specific Thresholds;
   Defines the conditions, in terms of the specific indicators, when management actions should be taken
   There may be a series of staged thresholds for an individual event
6. Monitoring requirements;
   The frequency and means for monitoring of the specific indicators
7. Evaluation of monitoring results;
   The means of evaluating whether any specific thresholds have been crossed
8. General approach to responses; and
   As developed through the Environmental Assessment and Licence Renewal Processes
   Describes the general approach to management responses, if necessary
9. Specific thresholds and responses.
   Describes the specific responses to be implemented if any specific thresholds have been crossed

The details of these AMP elements are not provided in this report. Readers are referred to the AMP Implementation Protocol for this level of detail (Gartner Lee Limited on behalf of the Interim Receiver, June 2004).

1.3 Approach to the Annual Review

This report provides the annual review of the AMP for the year 2006, as described in the AMP Implementation Protocol. The prime purpose of the annual review is to assess the adequacy and appropriateness of the elements of each event, such as trigger locations, specific indicators and thresholds, and monitoring requirements. Updates, amendments or other changes to the AMP may be recommended based on the annual review.

Each AMP Event includes a routine management review of the monitoring data against the triggers and thresholds. The results of these reviews are reported to the Water Board as part of the Monthly Reports submitted under Part A, Item 15 of the Water Licence. The results of these reviews are summarized as part of the Annual Review. Where required for some of the AMP Events, the results of the annual review are also summarized.

Each AMP event is reviewed individually in the following sections of the report.

2. AMP Event 1, Degraded Groundwater Quality in Rose Creek Valley Aquifer

2.1 Description

Groundwater in the Rose Creek Valley aquifer collects seepage and contaminants released from the surface tailings impoundments and has the potential to become contaminated to the degree where discharge from the aquifer to Rose Creek may result in a sustained adverse effect in Rose Creek. The groundwater quality in the Rose Creek Valley aquifer is presently measured twice per year, in spring and fall, at various locations within the tailings facility and downstream of the tailings facility. Samples are analyzed for dissolved metals, pH, temperature, conductivity, total dissolved solids, sulphate, and alkalinity as per the Water Licence (YWB 2004). Additional groundwater quality data is also provided for through a series of monitoring wells which were installed in 2003 as part the ongoing hydrogeological and geochemical investigations of the Rose Creek Tailings Facility and the Rose Creek Valley Aquifer.

Since degradation of groundwater quality is anticipated to occur progressively from the source area (tailings deposit) in a downgradient direction (Cross Valley Dam and downstream), the trigger locations for the implementation of the AMP are designed to provide for the early detection of emerging trends or "plumes". The trigger locations include locations downgradient of the tailings deposit as well as location directly underlying the tailings deposit as follows:

- Groundwater quality downgradient of the Cross Valley Dam (location P03-09);
- Groundwater quality at the Intermediate Dam, below the downstream extent of the tailings deposit (locations X24 and X25);
- Groundwater quality (i.e. the aquifer underlying the tailings deposit) approximately mid-length of the Intermediate Impoundment (location P03-08); and
- Groundwater quality at the Second Impoundment Dam, approximately mid-length of the tailings facility (location P03-04).

The environmental consequences of degraded water quality in the Rose Creek Valley aquifer are the potential exposure of aquatic resources, terrestrial resources and human resource users to increased levels of contaminants in Rose Creek, Anvil Creek and the Pelly River. Zinc is currently the primary contaminant of concern and zinc and sulphate are currently the primary indicators of acid rock drainage.

A substantial amount of work has been carried out to characterize the environmental conditions in the Rose Creek Valley aquifer. This work serves to provide information that is important to the Adaptive Management Plan as well as the long term needs of the Final Closure and Reclamation Plan that is

currently being developed. The results of the ongoing studies of the Rose Creek Valley aquifer need to be continually incorporated into the AMP.

2.2 Summary of Implementation Protocol Information

The following is a summary of the AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Monitoring
$Zn_{(D)}$, SO_4	X24, X25	• 3 consecutive results > upper 75 percentile of reference period; or • statistically significant trend projects > 75th percentile of reference period within 3 years.	Quarterly
	P03-04, -08 and -09	• statistically significant trend.	Quarterly

Dissolved iron was initially identified as an indictor in the Rose Creek Valley Aquifer AMP but was removed after 2005 due to issues related to the sensitivity of dissolve iron concentrations on sampling methodology in samples collected during the reference period.

Note that there was insufficient data for monitoring wells P03-04, -08 and -09 to form a "reference period" because these wells were installed in 2003.

2.3 Follow Up to 2004/2005 Review

As documented in the 2004 Adaptive Management Plan Annual Report the following triggers were activated at the toe of the Intermediate Dam for zinc, sulphate and iron:

1. *Sulphate in monitoring wells X24A, X24C and X24D;*
2. *Dissolved zinc in X24D; and*
3. *Dissolved iron in monitoring wells X25A and X25B.*

In response to the activation of these triggers the procedures described in the Adaptive Management Plan Implementation Protocol (AMPIP) were initiated. The following four action steps are described in the AMPIP and, as stated in the AMPIP, were initiated in 2004:

1. *Verification of the monitoring information followed by notification to the YG Water Inspector (completed 2004);*
2. *Additional monitoring, if necessary (completed 2004);*
3. *Data analysis and predictive impact modeling, if necessary; and*
4. *Mitigation (Response) plan, if necessary.*

The first two steps outlined above were completed in 2004 and summarized in the 2004 Annual Adaptive Management Annual Report. In early 2005 a data analysis of the related monitoring results was carried out, incorporating new information that has been developed for development of the Final Closure and Reclamation Plan. The results of this analysis indicated that the increased concentrations being seen at the AMP trigger locations, specifically X24, may in part be due to contaminant loading to the aquifer from drainage in the Old Faro Creek Channel, including loading from the Faro rock dumps (location X23) and the Emergency Tailings Area.

Data analysis was then carried out in February 2005 using predictive modeling to assess the potential for contaminant loading to the receiving environment and any associated impacts. This was done using the aquifer loading balance model that has developed by Robertson Geoconsultants as part of the closure planning studies. The fundamental outcome of this modeling exercise was to determine if the current groundwater conditions are having an effect on Rose Creek and, further, provide an indication of the rate and development of contaminant loading, if any, to the receiving environment. The following provides a summary of the results of predictive modeling. Details of the modeling were summarized in a letter to Government of Yukon, Water Resources Branch in May 2006 (Appendix A).

The predictive model was run based on the fall 2004 groundwater quality data for X24 (A, B and C) and X25 for sulphate and dissolved zinc. The following four scenarios were run using the calibrated Rose Creek Water and Load Balance Model to estimate the loading to Rose Creek from groundwater and subsequent sulphate and dissolved zinc concentrations in Rose Creek.

- "Base Case" using fall 2004 concentrations;
- Sensitivity Run 1 – 20% increase in sulphate and dissolved zinc concentrations at X24 and X25;
- Sensitivity Run 2 – 50% increase in sulphate and dissolved zinc concentrations at X24 and X25; and
- Sensitivity Run 3 – 100% increase in sulphate and dissolved zinc concentrations at X24 and X25.

The results of this predictive modeling exercise indicate that the present groundwater conditions (base case) are not predicted to have a detrimental effect on the water quality in Rose Creek in the near future. Predicted concentrations of dissolved zinc for the four scenarios (0.03 – 0.041 mg/L) are with in the range of concentrations presently seen in Rose Creek downstream of the Cross Valley Dam (X14). Based on these results there is no need for the development of a short-term response plan, other than ongoing monitoring and assessment of all related water quality data. Furthermore the degradation of water quality

in the Rose Creek Valley aquifer and subsequent impacts Rose Creek, Anvil Creek and the Pelly River continues to be a major area of investigation as part of the ongoing development of the Faro Closure and Reclamation Plan.

In September 2005 an additional trigger was activated at X24A for dissolved iron. An assessment of the water quality data and sampling techniques was carried out which indicated that the elevated levels of iron may be due to slight variation in sampling methodology during the reference period. The sensitivity of dissolved iron concentrations to minor variations in sampling methodology introduces some uncertainty in the interpretation of the results prior to 2002. Furthermore, through the ongoing aquatic risk assessment work being carried out as part of closure planning, iron was not identified as a contaminant of concern in the receiving environment. Therefore, it was recommended that dissolved iron no longer be an indicator in the AMP Protocol for the Rose Creek Aquifer. This recommendation was subsequently adopted in 2006.

Therefore, at the end of 2005, the triggers for dissolved zinc and sulphate at X24 and X25 remained "activated" because concentrations were above the threshold values; however, the determination had been made that no immediate response was required pending the analysis of future monitoring results.

2.4 2006 Review

2.4.1 Wells X24 and X25

The ongoing management review in 2006 of the relevant groundwater quality data from X24 and X25 at the toe of the Intermediate Dam was carried out on four occasions in 2006: June, July, September and November. This data review included assessment of the two following specific thresholds for dissolved zinc and sulphate:

- Three consecutive monitoring results greater than the upper 75th percentile of the reference period (1998 – 2002); or
- A statistically significant trend in the monitoring results (from 2003 and on) which, when extrapolated forward three years, would result in values greater than the upper 75th percentile of the reference period.

The results of the review are summarized in Table 2-1 and Table 2-2. Based on the 2006 data there were no new triggers at location X24 and X25 above those already identified. As carried forward from 2004/05, sulphate concentrations in X24-A and D and dissolved zinc concentrations in X24-D are still present above their respective threshold values.

Table 2-1. Sulphate and Zinc Data for Rose Creek Valley Aquifer - X24 (2006)

Date	X24A		X24D	
	Sulphate (mg/l)	Zinc (mg/L)	Sulphate (mg/l)	Zinc (mg/L)
June 2006	1140	*0.24*	*1410*	*0.29*
August 2006	n/s	*n/s*	*1650*	*0.068*
Sept. 2006	*1400*	<0.005	*1710*	*0.0926*
Nov. 2006	*1400*	*1.84*	*1700*	*<0.1*
Threshold	**729**	**0.01**	**1057**	**0.03**

Table 2-2. Sulphate and Zinc Data for Rose Creek Valley Aquifer – X25 (2006)

Date	X25A		X25B	
	Sulphate (mg/L)	Zinc (mg/l)	Sulphate (mg/L)	Zinc (mg/l)
June 2006	260	*0.041*	274	*0.03*
August 2006	289	<0.01	n/s	n/s
Sept. 2006	*326*	0.0132	388	<0.005
Nov. 2006	*296*	<0.025	363	<0.025
Threshold	**294**	**0.03**	**395**	**0.02**

Due to ongoing sampling issues at location X24 (A/B/C) an investigation was conducted in August 2006 to assess the present conditions of the wells and determine the cause of the previous sampling difficulties. Problems at these wells were first encountered at X24-B where sand heaved within the well to above the water table. This problem seems to be progressing in the area, and issues are now being encountered at X24-A and X24-C. The following is a summary of the major observations and recommendations after the 2006 monitoring program.

- X24-A – This well has a 1 m thick sand layer at the bottom. It can be sampled but the presence of this sand layer suggests that the well has been compromised or that sediment is accumulating in the well. It is recommended that this well be investigated further in 2007 and attempts made to remove the sediment from the well. Caution should be used when using the monitoring results from this well.

- X24-B – Sand has accumulated in this well to 3.7 m below the top of the casing and above the water table. Consequently this well could not be sampled in 2005 and 2006. Data collected to date from this well should be applied with caution until it is determined what has caused sand to accumulate in the well. It has been recommended that this well be removed from the routine monitoring program.

- X24-C – This well is blocked at a depth of approximately 12 m, which is 5 m above the actual bottom of the well. Clogging of the foot valve with sand during sampling prevents the collection of a sample. It was not possible to sample this well in 2006. Similar to X24-B, data collected to date from this well should be applied with caution until it is determined what has caused sand to accumulate in the well. It has been recommended that this well be removed from the routine monitoring program.

- X24-D - Although there have not been any issues regarding sampling at X24-D, it is recommended that it be investigated in 2007 with a downhole camera to determine the present condition of the well and identify any issues.

Given the above noted issues, caution needs to be taken when using the data from the X24 wells and in any subsequent interpretation as part of the AMP. In response to this issue, upon completion of the proposed investigation of X24-A and X24-D, an update will be provided to the Water Board and Government of Yukon, Water Resources Branch outlining the results of the investigation and recommending any necessary modifications to AMP Event 1, Degraded Groundwater Quality in Rose Creek Valley Aquifer. This update will summarize the results of the investigation of X24-A and X24-D along with proposed alternatives for the ongoing monitoring and assessment of changes in groundwater quality in the Rose Creek Valley aquifer. It is anticipated that the field investigations will be carried out in June and that the subsequent data analysis and recommendations will be available by the end of July, 2007. Until that time, the conclusions reached in 2005 remain valid, that no immediate response is required pending the analysis of future monitoring results.

2.4.2 P03 Multi-Level Wells

A management review consisting of the relevant groundwater quality data from the three AMP multi-level wells installed in 2003 (P03-04, P03-08 and P03-09) was conducted in 2006.. This data review included an assessment of the following specific threshold for dissolved zinc and sulphate:

- A statistically significant trend in the groundwater monitoring results with a requirement of a minimum of 4 results.

Ongoing trends previously the limited number of data points (degrees of freedom) resulted in a low level of confidence in any predicted trends. At the end of 2006, sufficient data points were provide for a

statistically significant determination. Annual review of the 2006 multi-level data against the threshold indicated that the following thresholds for sulphate and dissolved zinc have been reached:

1. *Increasing trend in zinc concentrations at P03-04-2 and P03-04-3; and*
2. *Increasing trend in sulphate concentrations at P03-09-3 and P03-09-4.*

As outlined in the procedures described in the AMPIP, the next step in response to activation of a trigger is verification and notification of the AMP Trigger to Government of Yukon, Water Resources Branch. This would be followed up by a detailed assessment of the trigger location including any associated water quality data. Given restrictions in the collection of groundwater samples in winter conditions, the earliest a verification sample can be collected in spring 2007. In the interim, to expedite the response to these triggers, the detailed assessment of the multi-levels triggers will be carried out prior to the spring sampling event. The results of this assessment will be provided to Government of Yukon, Water Resources Branch upon completion.

3. AMP Event 2, Degraded Water Quality in Vangorda Creek Downstream of Mine Facilities

3.1 Description

The water quality in Vangorda Creek downstream of the Vangorda Plateau mine facilities could be negatively affected by surface water runoff from the mine facilities and groundwater seepage. The water quality in Vangorda Creek downstream of the mine facilities is measured monthly at Station V8 at the foot bridge in the Town of Faro for total metals, dissolved metals, pH, temperature, conductivity, total suspended solids, sulphate, ammonia and hardness (YWB 2004). Water quality in Vangorda Creek is also monitored monthly farther upstream in the main stem of Vangorda Creek at Station VGMAIN.

The environmental consequences of degraded water quality in Vangorda Creek is the potential exposure of aquatic resources, terrestrial resources and human resource users to increased levels of contaminants in Vangorda Creek and, possibly, the Pelly River. Zinc is currently the primary contaminant of concern and zinc and sulphate are currently the primary indicators of acid rock drainage. However, the consideration of degraded water quality should include other metals and contaminants which could source from the rock dumps, open pits and other mine facilities.

3.2 Summary of Implementation Protocol Information

As part of the 2005 Annual AMP Review, an assessment was carried out to determine if there are any statistically significant seasonal differences in the sulphate concentrations at V8, and if necessary determine seasonally based threshold values for sulphate at V8 based on the reference period (1998 – 2002). Concentrations of sulphate during the reference period were found to exhibit seasonal variability. Using the Analysis of Variance and Multiple Comparisons (Least Significant Difference) at a 5 % significance level, statistically higher concentrations are observed in the winter months (November – April) compared to the open water months (May – October). Given this seasonal variability in the concentrations of sulphate in Vangorda Creek at V8, it was recommended that the AMP Protocol for V8 be modified for sulphate to include two seasonal components: open water season (May – October) and winter (November – April). The following is a summary of the modified AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Period
$Zn_{(T)}$, $Cu_{(T)}$, and TSS	V8	• 3 consecutive results > 75th percentile of reference period; or • statistically significant trend projects > 75th percentile of reference period within 3 years.	January - December
SO_4	V8	• 3 consecutive results > 75th percentile of reference period (75 mg/L); or • statistically significant trend projects > 75th percentile of reference period within 3 years.	May - October
SO_4	V8	• 3 consecutive results > 75th percentile of reference period (171 mg/L); or • statistically significant trend projects > 75th percentile of reference period within 3 years.	Winter (Nov. – April)

3.3 Review

A management review of the relevant water quality data from V8 was carried out on a monthly basis in 2006. This data review included assessment of the two following specific thresholds for total copper, total zinc, total suspended solid (TSS) and sulphate:

- Three consecutive monitoring results greater than the upper 75th percentile of the reference period (1998 – 2002); or
- A statistically significant trend in the monitoring results (from 2003 and on) which, when extrapolated forward three years, would result in values greater than the upper 75th percentile of the reference period.

For sulphate, the data review included the assessment based on two seasonal components: open water season (May – October) and winter (November – April).

The results of the review are summarized in Table 3-1 and in Figure 3-1, Figure 3-2, and Figure 3-3. In 2006, there were two triggers activated at V8: for sulphate and TSS.

Table 3-1. Summary of AMP Data for V8 (2006)

Date	Total Zinc	Total Copper	Total Suspended Solids	Sulphate
1/24/2006	0.015	<0.001	<1	166
2/13/2006	0.017	<0.001	<1	*191*
3/24/2006	0.019	<0.001	<1	*204*
4/25/2006	0.013	<0.001	<1	*184*
5/17/2006	0.022	0.006	*54*	51.9
6/19/2006	0.011	0.003	*24*	35
7/17/2006	0.010	0.002	*12*	
8/21/2006	0.010	0.002	*13*	61.5
9/11/2006	0.010	<0.001	4	58.7
10/16/2006	0.011	0.001	11	*84*
11/14/2006	0.013	<0.001	1	130
12/13/2006	0.028	<0.001	<1	144
Trigger	**0.042**	**0.022**	**8**	**75[a]/171[b]**

Note: *Italics* = Exceeds Trigger Value

a) Open Water Trigger

b) Winter Trigger

Figure 3-1. Vangorda Creek (V8) Sulphate (2003 – 2006)

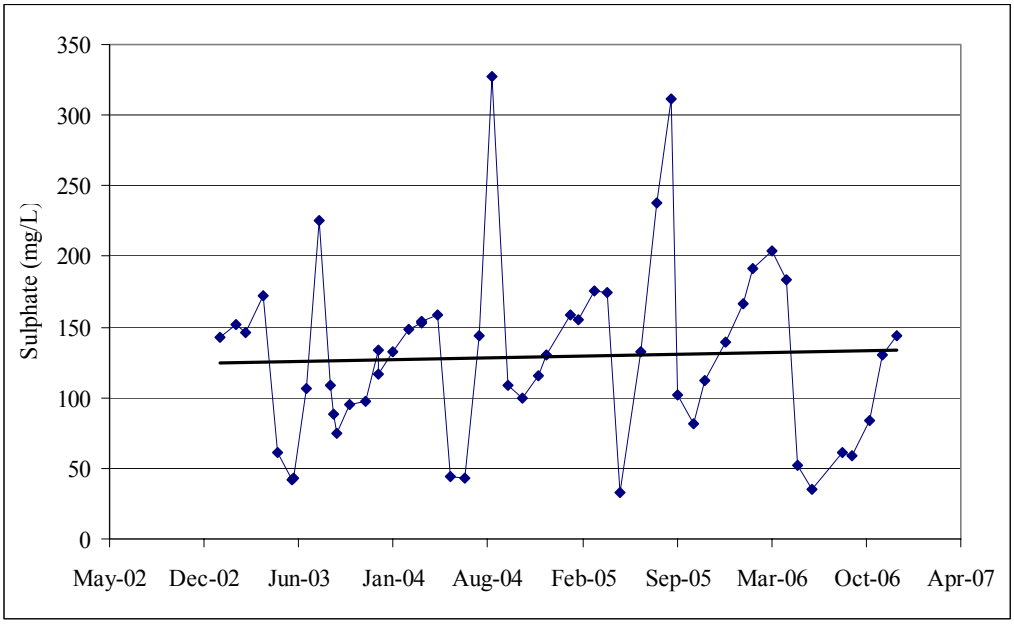


Figure 3-2. Vangorda Creek (V8) Total Suspended Solids (TSS) (2003 – 2006)

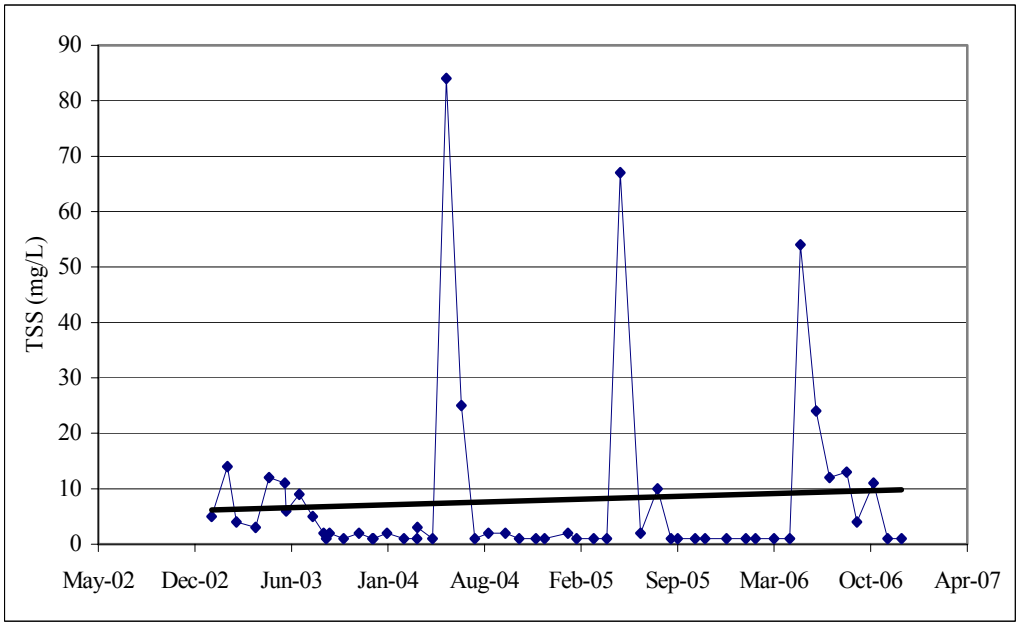
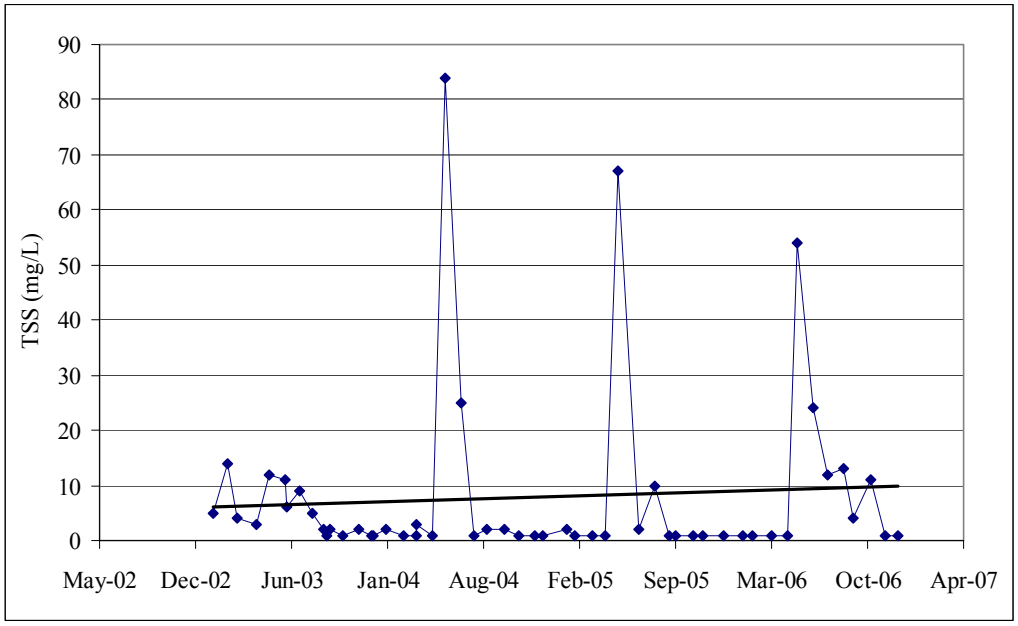


Figure 3-3. Vangorda Creek (V8) Total Zinc (2003 – 2006)



Review of the March water quality data from V8 against the winter seasonal threshold (171 mg/L) indicated that the concentration of sulphate was greater than the trigger level for three consecutive monthly samples (February 13th, March 24th and April 25th). This was documented in the monthly data report to the Yukon Water Board dated May 29, 2006.

The following short term management plan was outlined for this trigger event:

> *Upon receipt and analysis of the upcoming monthly samples for May at location V8, an assessment will be provided to the Water Inspector if the trigger continues (per the AMP Protocol).*

This trend in elevated sulphate concentrations during the winter low flow months is consistent with historical trends and a seasonal variation is known to occur at this location as well as other locations in the Vangorda Creek Drainage due to influence of groundwater "baseflow" during the winter season. Although these sulphate concentrations are above the winter seasonal threshold value, the levels are within the range of those seen historically during the winter months at V8 (1998 to present). As expected the May 2006 data showed that with the onset of spring freshet the concentrations of sulphate at V8 dropped to 51.9 mg/L well below the open-water threshold of 75 mg/L, confirming that the trigger was caused by seasonal winter low-flow effects.

Review of the June water quality data from V8 against the threshold for total suspended solids (8 mg/L) indicated that the concentration of TSS was greater than the trigger level for three consecutive monthly

samples (May 17th, June 19th, and July 17th). This was documented in the monthly data report to the Yukon Water Board dated August 29, 2006. In August, TSS were still present at concentrations above the trigger level.

These elevated TSS concentrations were a result of a corresponding elevated TSS concentration upstream in the Vangorda Creek watershed at V5, located in the West Fork of Vangorda Creek upstream of the confluence with the Main Fork. Elevated levels of TSS are commonly seen at V5 during periods of elevated flow, primarily due to "non-mining" sources such as the old ski hill and a exposed landslide area. Site personnel flew the West Fork of Vangorda Creek on August 29, 2006 and confirmed that the elevated TSS was originating from "non-mining sources" downstream of the old ski hill.

4. AMP Event 3, Degraded Water Quality in Rose Creek Downstream of Mine Facilities

4.1 Description

Water quality in Rose Creek downstream of the mine facilities could be negatively affected by surface runoff from the mine facilities and groundwater seepage from the Rose Creek Tailings Facility. The water quality in Rose Creek immediately downstream of the Mine Facilities is presently measured monthly at Station X14, and weekly during periods of effluent release (location X5), for total metals, dissolved metals, pH, temperature, conductivity, total suspended solids, sulphate, ammonia and hardness (YWB 2004). Water quality in Rose Creek is also monitored twice per year, winter and summer, in the receiving environment farther downstream at R3, mid length of Rose Creek, and at R4, upstream of the confluence with Anvil Creek.

The environmental consequences of degraded water quality in Rose Creek is the potential exposure of aquatic resources, terrestrial resources and human resource users to increased levels of contaminants in Rose Creek, Anvil Creek and the Pelly River. Zinc is currently the primary contaminant of concern and zinc and sulphate are currently the primary indicators of acid rock drainage. However, the consideration of degraded water quality should include other metals and contaminants which could source from the rock dumps, open pits, tailings and other mine facilities.

4.2 Summary of Implementation Protocol Information

The following is a summary of the AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Monitoring
$Zn_{(T)}$, $Cu_{(T)}$, SO_4	X14	• 3 consecutive results > upper 75 percentile of reference period; or • statistically significant trend projects > 75th percentile of reference period within 3 years.	Monthly and Weekly when discharging

Given the variations in sample frequency at X14 from monthly to weekly during periods of discharge, the AMP Protocol for X14 was modified to ensure consistency with the reference period sample frequency and the basis for the determination of the thresholds. When carrying out the assessment of consecutive weekly samples during periods of discharge, the weekly concentrations are averaged for the month. This subsequent monthly average value is then assessed as per the AMP Protocol.

4.3 Review

A management review of the relevant water quality data from X14 was carried out on a monthly basis in 2006. This data review included assessment of the two following specific thresholds for total copper, total zinc and sulphate:

- Three consecutive monitoring results greater than the upper 75th percentile of the reference period (1998 – 2002); or
- A statistically significant trend in the monitoring results (from 2003 and on) which, when extrapolated forward three years, would result in values greater than the upper 75th percentile of the reference period.

The results of the review are summarized in Table 4-1 and in Figure 4-1 and Figure 4-2.

In 2006, there was one trigger activated, for sulphate. Review of the March water quality data from X14 against the pre-defined thresholds indicated that the concentrations of sulphate were greater than the trigger levels for three consecutive monthly samples (January 23rd, February 14th and March 24th).

This was documented in the monthly data report to the Yukon Water Board dated April 30, 2006. The following short term management plan was outlined for this trigger event:

> *Upon receipt and analysis of the upcoming monthly samples for April and May at X14, an assessment will be provided to the Water Inspector (per the AMP Protocol). If appropriate, the assessment may propose a modification of the threshold values that provides recognition of the natural seasonal variation in sulphate.*

This trend in elevated sulphate concentrations during the winter low flow period is consistent with historical trends at this location where elevated concentrations of sulphate are known to occur due to the predominance of groundwater baseflow during the winter season, , including seepage to surface at location X13. As expected the sulphate concentration at X14 in April continued to exceed the threshold value due to ongoing low flow conditions. Assessment of the May 2006 data showed that with the onset of spring freshet and higher flow volumes in Rose Creek, the sulphate concentrations dropped to an average of 112 mg/L, less than the trigger value of 166 mg/L.

In early May, prior to the increase of flow due to freshet, one of the weekly sulphate concentrations in Rose Creek was 339 mg/L with an associated zinc concentration of 0.17 mg/L. During this period compliant effluent was being discharged to Rose Creek from the Cross Valley Pond (location X5) and this elevated concentrations were due to the release of effluent during a period of low creek flow.

The contemplated assessment of natural seasonal variability was not completed. Such an assessment might result in recommending a two-part seasonal threshold value in the manner that was previously recommended for location V8. However, such an assessment for location X14 would be confounded by a number of complicating factors such as potentially changing groundwater discharges and releases of (sulphate-rich) effluent. Therefore, this assessment has been deferred at this time.

Table 4-1. Summary of AMP Data for X14 (2006)

Date	Total Zinc	Total Copper	Sulphate
1/23/2006	0.062	<0.001	*181*
2/14/2006	0.04	<0.001	*254*
3/24/2006	0.044	<0.001	*259*
4/25/2006	0.045	<0.001	*225*
5/9/2006	0.17	0.002	*339*
5/18/2006	0.03	0.003	16.8
5/23/2006	0.035	0.003	34.5
5/30/2006	0.028	0.002	56.8
6/6/2006	0.022	<0.002	43.6
6/19/2006	0.027	0.001	63.5
6/20/2006	0.026	0.001	73.5
7/11/2006	0.016	0.001	70.9
7/17/2006	0.023	0.001	107
7/18/2006	0.033	0.001	109
7/25/2006	0.028	<0.001	137
8/1/2006	0.023	<0.001	104
8/15/2006	0.028	<0.001	94.7
8/21/2006	0.026	0.001	82.2
8/22/2006	0.027	0.001	83.3
8/29/2006	0.039	<0.001	117
9/12/2006	0.018	<0.001	32.8
10/17/2006	0.032	0.001	65.4
11/14/2006	0.049	<0.001	111
12/13/2006	0.06	<0.001	164
Trigger	**0.08**	**0.022**	**166**

Note: *Italics* = Exceeds Trigger Value

Figure 4-1. Rose Creek (X14) Sulfate (2003 – 2006)

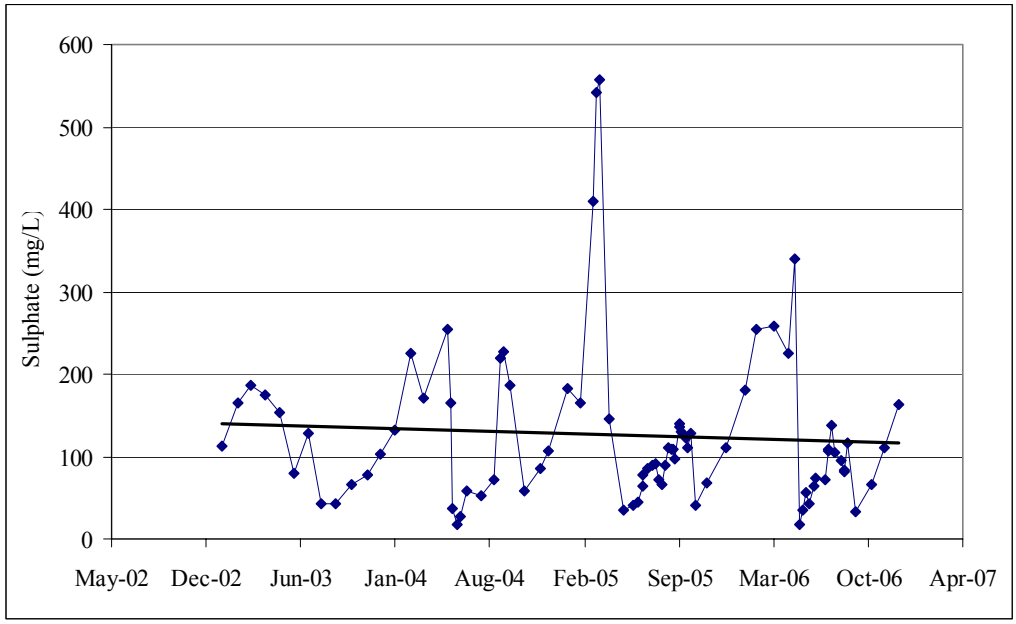
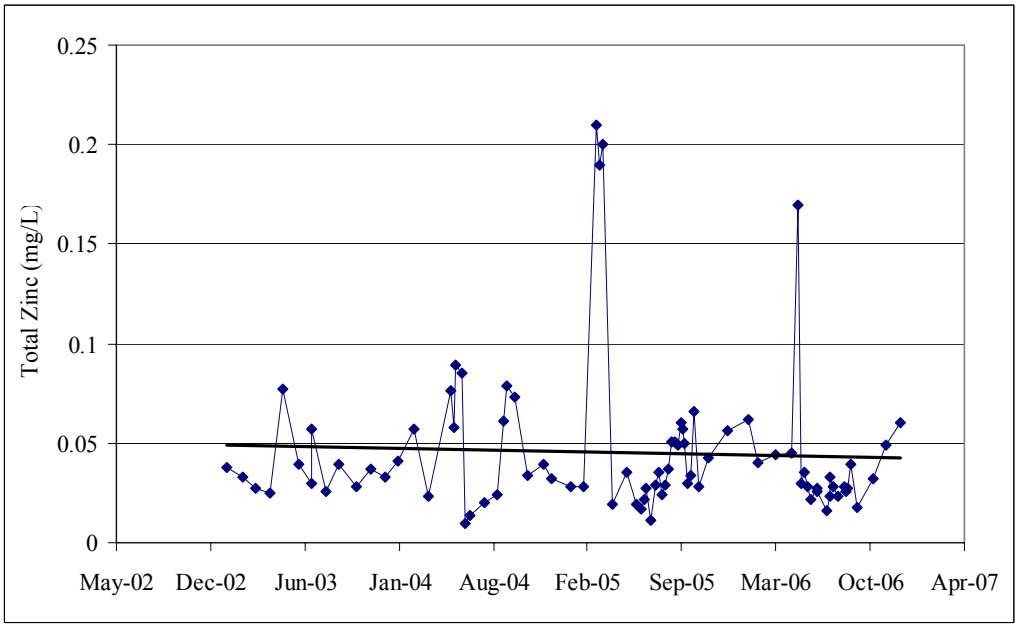


Figure 4-2. Rose Creek (X14) Total Zinc (2003 – 2006)



5. AMP Event 4, Degraded Seepage Quality from the Grum Rock Dump

5.1 Description

Surface and subsurface seepage from the Grum Rock Dump contains contaminants that are released from the waste rock dump. The water quality of Grum Dump seepage is measured monthly at V2 for total metals, dissolved metals, pH, temperature, conductivity, total suspended solids, sulphate, ammonia and hardness (YWB 2004). This seepage water flows into Vangorda Creek and has the potential to become contaminated to the degree where the receiving environment in Vangorda Creek is adversely affected. The trigger for the implementation of contingency measures is proposed to be surface water quality in Grum Creek prior to discharging into Vangorda Creek.

5.2 Summary of Implementation Protocol Information

The following is a summary of the AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Monitoring
$Zn_{(T)}$, $Cu_{(T)}$, SO_4	V2	• 3 consecutive results > upper 75 percentile of reference period; or • statistically significant trend projects > 75^{th} percentile of reference period within 3 years.	Monthly and Weekly during discharge

5.3 Follow Up to 2004/2005 Review

Review of the reference period data (1998 to 2002) carried out as part of the development of the AMP Implementation Protocol indicated that both statistical water quality thresholds had been exceeded for sulphate at Station V2 below the Grum Rock Dump. Since 2000, the concentrations of sulphate at V2 have remained elevated. This resulted in the immediate triggering of the AMP as of the date of implementation, July 1, 2004. A letter of notification was provided to the Government of Yukon, Water Resources Branch, on July 15, 2004 from SRK Consulting on behalf of the Interim Receiver.

On August 16, 2004 an additional notification was provided to the Government of Yukon from SRK Consulting, outlining the proposed response plan to address this issue. The response plan outlines a

staged approach to investigating the increase sulphate concentrations at V2. The following outlines the key components of the response plan:

- Collection of Routine Water Quality Samples;
- Review of Existing Water Quality Record;
- Detailed Contaminant Pathway Survey;
- Installation of Flow Monitoring Station on Grum Creek;
- Groundwater Monitoring Well Installation; and
- Preparation of Status Report.

In May 2005, a status report was submitted to Government of Yukon, Water Resources Branch, on from SRK Consulting on behalf of the Interim Receiver the Water Inspector which address five of the six key components of the response plan. The main findings in the status report were as follows:

- Sulphate and zinc concentrations at V2 and V2A have increased over a period of several years;
- Flow from V2A infiltrates into the base of Moose Pond. Downgradient seepage at Moose Seep was noted to have elevated sulphate and low zinc concentrations, which indicated that zinc attenuation was occurring along the groundwater flow path;
- Sampling at the toe of the Grum Dump indicates that dump is generating zinc loads on the order of 1700 kg/year;
- Sampling downgradient of the dump showed that zinc loading from Grum Dump into Vangorda Creek is about 5 kg/year. Significant attenuation was noted along of the potential surface and shallow subsurface flow paths that were monitored;
- Monitoring of Vangorda Creek at V1, upstream of the mine site, has shown that background concentrations of zinc loads in Vangorda Creek are on the order of 140 kg/year; and
- Monitoring of Vangorda Creek at V27, downstream of the mine site, has had variable concentrations of zinc and sulphate, with no discernable trends since the start of mining.

Based on the review of water quality and available discharge data for Grum Dump catchments and Vangorda Creek, the May 2005 status report recommended the following actions:

- Increase surface and groundwater monitoring downgradient of Grum Dump;
- Discuss options for collection and transfer or surface water with site management;
- Adopt a zinc concentration of 0.5 mg/L in three consecutive samples as an interim threshold for the implementation of water collection activities;
- Continue Spring/Fall monitoring of seepage and surface water locations downgradient of Grum Dump that are not sampled as part of routine or AMP monitoring programs;
- Install additional monitoring wells, including a well downgradient of Moose Pond; and
- Continue Grum Creek flow monitoring.

During 2005, all the actions listed above were implemented. Frequency of surface water monitoring at AMP reference water quality stations V15, V2, and V2A was increased to bi-weekly, and bi-weekly sampling of Moose Seep was initiated, in September 2005. Results of this sampling were screened as part of the monthly review of site-wide routine water quality data, to identify exceedances of thresholds for implementation of water collection. No thresholds were exceeded in 2005. A detailed summary of 2005 response activities was submitted to the Water Board and Government of Yukon, Water Resources Brand in October 2006 and is presented in Appendix B.

5.4 2006 Review

The ongoing management review of the relevant water quality data from the Grum Dump area was carried out monthly in 2006. Full details of the water quality data are presented in the AMP Event #4 Response: 2006 Status Report prepared by SRK Consulting and presented in Appendix C.

In 2006, water quality at Station V2 continued to show that sulphate concentrations continue to exceed the initial trigger established in the AMP. There were no additional triggers beyond that identified for sulphate in 2004, and zinc concentrations did not show the same increasing trend observed for sulphate. Results of 2006 dump toe seepage surveys indicate that zinc concentrations in dump seepage may be stabilizing, with dissolved zinc concentrations at all toe seepage stations within the previously-observed ranges. In particular, zinc concentrations in Grum Creek (the largest discharge from Grum Dump) in 2006 were within the previously observed range.

Downgradient monitoring stations east of V2 below Moose Pond and west of V2 near Vangorda Creek show similar elevated sulphate concentrations, but zinc concentrations are typically at or near detection levels (0.005 mg/L). The monitoring data thus shows that zinc loading from Grum Dump to Vangorda Creek continues to be minimal (~5 kg/yr, as estimated from the water and load balance) and that significant attenuation is occurring along surface and shallow subsurface flowpaths.

However, the dramatic and consistent rise in dissolved zinc concentration observed at V15 in 2006 is noteworthy. The data appear to show a classic case of breakthrough of attenuated chemical species, and the results reviewed to date do not suggest that the breakthrough process has run its course. It is reasonable to expect to see some measure of continued increase in zinc concentrations at V15, and that increases at V15 will lead to an increase in zinc concentrations observed at V2.

Diversion of water from station V15 to station V2A via the Grum Creek diversion would reduce zinc load that reports to station V2. As the most recent monitoring results from V15 indicate that Grum Creek (measured at V2A) has similar zinc concentrations and higher flow volumes, this diversion would not cause zinc concentrations in Grum Creek to increase beyond the range observed over the 2004 to 2006

period. This diversion of water from V15 to V2A would take advantage of the attenuation that has been observed to occur between Moose Pond and Vangorda Creek during that period.

The following summarizes recommendations for continued monitoring of water quality downgradient of Grum Dump, and for implementation of additional water management if zinc concentrations exceed acceptable levels. Details are provided in Appendix C.

1. Continue monitoring Reference Water Quality Stations, as required under the AMP, by site environmental staff on a twice-monthly basis.
2. Implement transfer of water from station V15 to station V2A in 2007, via Grum Creek diversion, as a pro-active short-term mitigation strategy to minimize zinc concentrations at station V2 until a final closure plan can be implemented.
3. Implement collection and transfer of water to Vangorda Pit if zinc concentrations exceed acceptable levels at station V2, at Moose Seep, or at Moose Well.

    a. In the absence of site specific water quality objectives, the discharge water quality criteria of 0.5 mg/L zinc will be used as an interim threshold for implementation of water collection activities. Surface water collection and transfer would be implemented if three consecutive samples either at Station V2, at Moose Seep, or at Moose Well 2 exceed 0.5 mg/L zinc.

    b. Once a site-specific water quality objective has been developed for Vangorda Creek, the threshold for implementation of contingency measures should be re-evaluated to ensure that loading from this flow pathway is within acceptable limits.

    c. In the event that the interim threshold is exceeded, notification will be sent to the Water Board within 30 days.
4. Continue Spring/ Fall downgradient pathway and dump toe seepage surveys.
5. Continue monitoring and maintenance of Grum Creek weir flow-monitoring instrumentation.
6. Review monitoring data on an ongoing basis. Results of the Reference Water Quality Station monitoring data should continue to be included as part of the regular monthly report to the Water Board.
7. Summarize the 2007 monitoring results in the AMP annual report prepared by GLL. There will be no stand-alone Event #4 Status Report prepared for 2007 unless water quality thresholds are exceeded that necessitate additional management response.

6. AMP Event 5, Degraded Water Quality in the North Fork of Rose Creek

6.1 Description

Water quality in the North Fork of Rose Creek could be negatively affected by rock dump seepage, seepage or overflow from the Zone 2 Pit, seepage from the disturbed area between the creek and the Zone 2 Pit and the rock drain at the haul road crossing, and contaminated groundwater from the Main/Intermediate waste rock dumps. The water quality in the North Fork of Rose Creek is measured monthly at Station X2 (YWB 2004) for total metals, dissolved metals, pH, temperature, conductivity, total suspended solids (TSS), sulphate, hardness and ammonia. The flow rate is also measured monthly at X2.

The environmental consequence of degraded water quality in the North Fork of Rose Creek is the potential exposure of aquatic resources, terrestrial resources and human resources to increased levels of contaminants in the North Fork, Rose Creek Diversion canal and, possibly, further downstream in Rose Creek, Anvil Creek and the Pelly River. Zinc is currently the primary contaminant of concern and zinc and sulphate are currently the primary indicators of acid rock drainage. However, the consideration of degraded water quality should include other metals and contaminants which could source from the rock dumps, open pits and other mine facilities.

6.2 Summary of Implementation Protocol Information

As part of the 2005 Annual Review, an assessment was carried out to determine if there were any statistically significant seasonal differences in the sulphate concentrations at X2, and if necessary determine seasonally based threshold values for sulphate at X2 based on the reference period (1998 – 2002). Concentrations of sulphate during the reference period were found to exhibit seasonal variations. Using the Analysis of Variance and Multiple Comparisons (Least Significant Difference) at a 5 % significance level, statistically higher concentrations are observed in the winter months (November – April) compared to the open water months (May – October). Given this seasonal variability, it was recommended that the AMP Protocol for X2 be modified for sulphate to include two seasonal components: open water season (May – October) and winter (November – April). The following is a summary of the modified AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Period
$Zn_{(T)}$ and $Cu_{(T)}$	X2	• 3 consecutive results > 75th percentile of reference period; or • statistically significant trend projects > 75th percentile of reference period within 3 years.	January - December
SO_4	X2	• 3 consecutive results > 75th percentile of reference period (14.8 mg/L); or • statistically significant trend projects > 75th percentile of reference period within 3 years.	May - October
SO_4	X2	• 3 consecutive results > 75th percentile of reference period (29.5 mg/L); or • statistically significant trend projects > 75th percentile of reference period within 3 years.	Winter (Nov. – April)

6.3 Review

A management review of the relevant water quality data from X2 was carried out on a monthly basis in 2006. This data review included assessment of the two following specific thresholds for total copper, total zinc and sulphate:

- Three consecutive monitoring results greater than the upper 75th percentile of the reference period (1998 – 2002); or
- A statistically significant trend in the monitoring results (from 2003 and on) which, when extrapolated forward three years, would result in values greater than the upper 75th percentile of the reference period.

For sulphate, the data review included the assessment based on two seasonal components: open water season (May – October) and winter (November – April).

The results of the review are summarized in Table 6-1 and in Figure 6-1 and Figure 6-2. In 2006, there were two triggers activated at X2: sulphate and zinc.

Table 6-1. Summary of AMP Data at X2 (2006)

Date	Total Zinc	Total Copper	Sulphate
1/23/2006	*0.094*	<0.001	*37.2*
2/14/2006	0.035	<0.001	*39.7*
4/25/2006	0.14	<0.001	*38.8*
5/17/2006	0.042	0.003	4.85
6/19/2006	0.017	0.001	8.95
7/18/2006	0.02	0.001	11.7
8/21/2006	0.023	0.001	12.2
9/11/2006	0.023	<0.001	12.8
10/16/2006	*0.065*	0.001	*27.4*
11/14/2006	*0.064*	<0.001	*31.1*
Trigger	**0.06**	**0.028**	**15[a]/30[b]**

Note: *Italics* = Exceeds Trigger Value

a) Open Water Trigger

b) Winter Trigger

Figure 6-1. North Fork Rose Creek (X2) Sulphate (2003 – 2006)

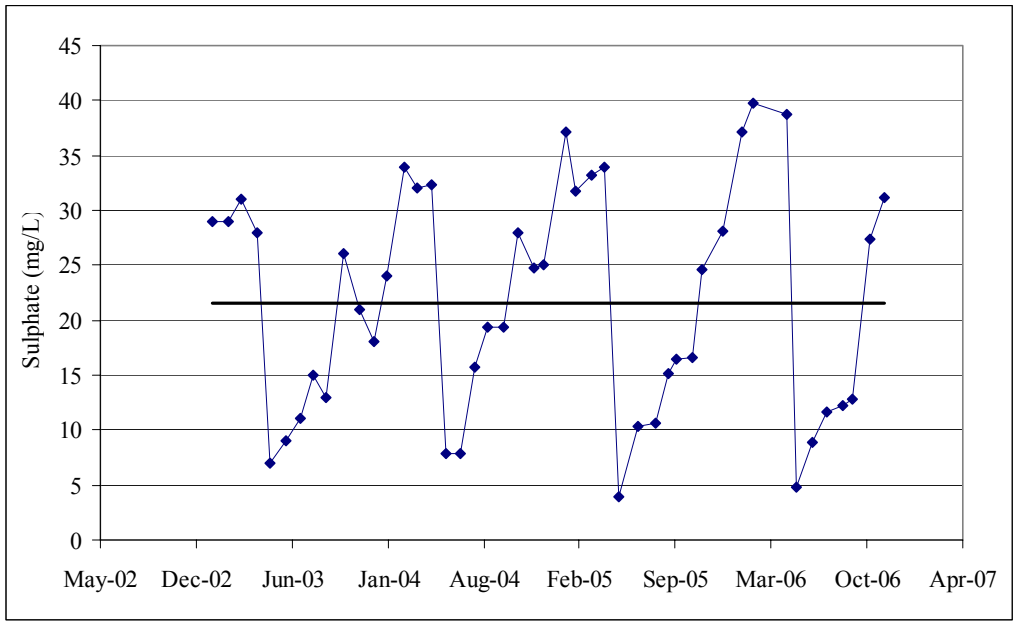
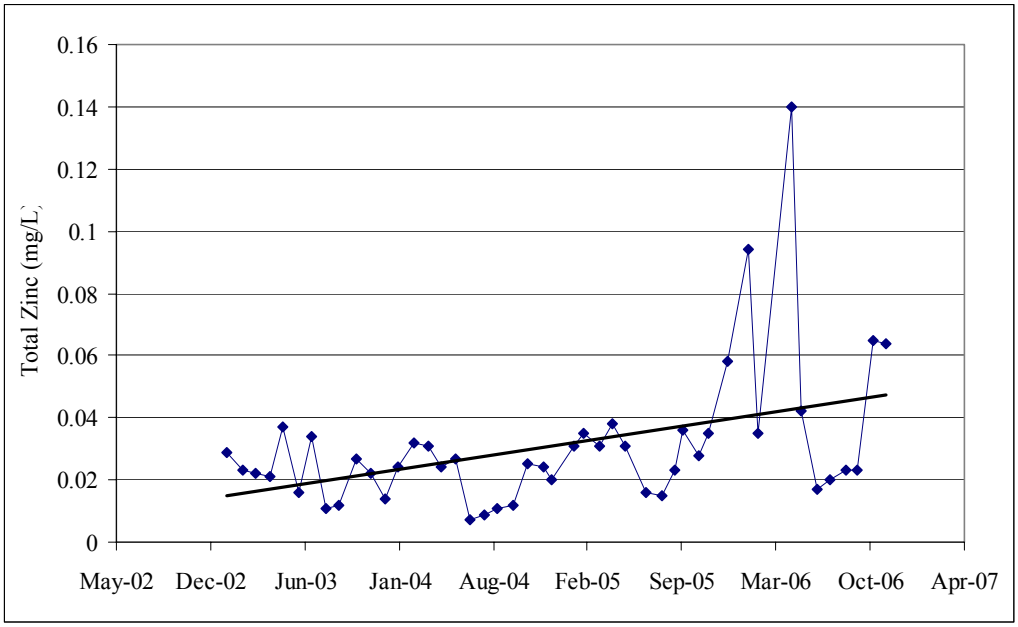


Figure 6-2. North Fork Rose Creek (X2) Zinc (2003 – 2006)



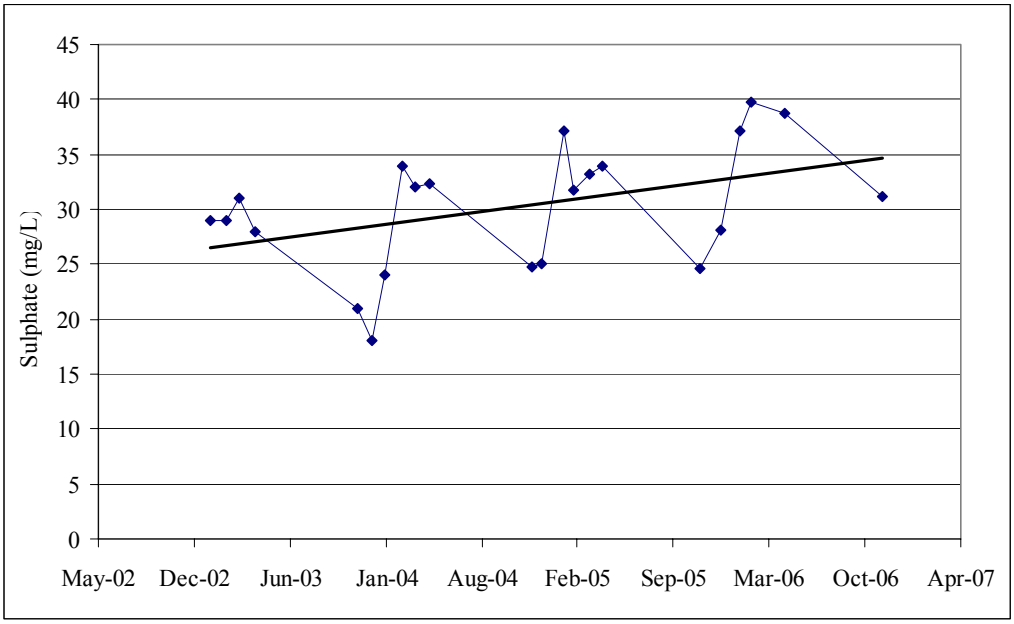
Review of the April water quality data from X2 against the winter seasonal threshold indicated that the concentration of sulphate was greater than the trigger level for three consecutive monthly samples (January 23rd, February 14th and April 25th). No sample was collected in March due to the sample location being frozen. This was documented in the monthly data report to the Yukon Water Board dated May 29, 2006. This trend in elevated sulphate concentrations during the winter low flow months is consistent with historical trends due to influence of groundwater "baseflow" during the winter season. Although present at concentrations above the winter seasonal threshold value, the levels are within the range of those seen historically during the winter months at X2 (1998 – present).

The following short term management plan was outlined for this trigger event:

> *Upon receipt and analysis of the upcoming monthly samples for May at location X2, an assessment will be provided to the Water Inspector if the trigger continues (per the AMP Protocol).*

As expected the sulphate concentration at X2 in May showed that with the onset of spring freshet the concentrations of sulphate dropped to 4.85 mg/L, well below the open water threshold value of 15 mg/L. Trend analysis carried out on the 2003 to 2006 winter low-flow sulphate data indicates that there is a statistically significant increasing trend in sulphate concentrations at X2 (Figure 6-3). When carried forward, this trend indicates that winter sulphate concentrations will remain above the threshold of 30 mg/L. This same trend is not seen in the corresponding open water sulphate data (2003 to 2006).

Figure 6-3. North Fork Rose Creek (X2) Winter Sulphate (2003 – 2006)



In May, another trigger was identified at X2 for zinc. This was documented in the monthly data report to the Yukon Water Board dated June 29, 2006. After incorporating the May 2006 data, there was a statistically significant increasing trend in the concentration of total zinc that estimates the concentration of total zinc will exceed the threshold concentration of 0.06 mg/L in April 2007. In response to this trigger the following short term management plan was outlined:

> *Upon receipt and analysis of the upcoming monthly samples for June at location X2, an assessment will be provided to the Water Inspector if the trigger continues (per the AMP Protocol).*

Subsequent analysis of monthly samples for total zinc at location X2 confirmed the continuation of this trigger and in October 2006 concentration of total zinc reached the threshold value.

There are, therefore, two confirmed and outstanding triggers for location X2, projected continued elevated winter sulphate concentrations and increasing zinc concentrations. As described below, these two triggers are being investigated together.

As outlined in the AMPIP, after confirmation of a trigger, the next action is to carry out a comprehensive analysis of other related monitoring results. The goal of this analysis is to provide for a preliminary identification of the dominant source of the increase concentrations. This analysis is presently underway,

incorporating new information that has been generated as part of the ongoing development of the Final Closure and Reclamation Plan by the Faro Mine Closure Planning Office, specifically the ongoing seepage investigation in the area below the Faro Waste Rock Dump. Based on this analysis, an appropriate response plan will be developed and filed with the Water Board, the timing of which is dependent on the closure planning process.

7. AMP Event 6, Water level in Grum Pit Reaches Maximum Desired Elevation

7.1 Description

Water quality in the Grum Pit is currently non compliant with the discharge criteria in Water Licence QZ03-059 for the Faro and Vangorda Plateau mine sites (YWB 2004) and can not, therefore, be directly released to the receiving environment. The water elevation in the Grum Pit has been rising since mine shut down in 1998 but remained safely below an overflow level at the end of 2006. Further, a report has been completed (GLL 2003a) that indicates that it is unlikely that the pit will fill to a level requiring active management before 2011, under a conservative long-term projection. Nonetheless, it remains possible that a series of extreme natural events could cause the in-pit water level to rise to a maximum desired operating range during the term of the current Water Licence and, therefore, an AMP is required to ensure that appropriate responses are implemented if necessary.

The environmental consequences of the water elevation in the Grum Pit reaching the maximum desired elevation could result in the absence of adequate emergency storage capacity for containment of a flood event and, ultimately, a release of non-compliant water to the receiving environment, Vangorda Creek. This could result in the exposure of aquatic resources, terrestrial resources and human resource users to increased levels of contaminants in Vangorda Creek and the Pelly River.

Zinc is currently the primary contaminant of concern and zinc and sulphate are currently the primary indicators of acid rock drainage. However, the consideration of degraded water quality should include other metals and contaminants that could source from the pit.

7.2 Summary of Implementation Protocol Information

The following is a summary of the AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Monitoring
Pit water elevation; and Projected timeframe to maximum desired water elevation.	Grum Pit	• Water level of 1210.8 m asl; or • Projected timeframe of 1 year or less.	• Monthly; or • Annual.

7.3 Review

Water elevations were measured by mine personnel through 2006 as illustrated on Figure 7-1. The maximum measured elevation was 1196.33 m asl, which is well below the threshold elevation of 1210.8 m asl. Therefore, the first trigger for pit water elevation was not activated in 2006. The threshold elevation was previously determined as a "safe" elevation that is below the level where any surface or subsurface seepages would occur. As illustrated on Figure 7-1, this is approximately 21.5 m below the elevation at which surface outflow would occur. This is planned to allow adequate time to develop management plans for the pit water prior to any water releases.

The timeframe for reaching the maximum desired elevation was projected using the observed rate of increase from 2003 through 2006 and the measured precipitation at the Faro airport over the available period of record, 1978 to 2006. The measured rate of rise is illustrated on Figure 7-2, as are a best-fit power function and the projected rate of rise used for assessment of the AMP trigger.

The "incremental" line on Figure 7-2 indicates the rate of rise for each individual (primarily monthly measurement). The "cumulative" line on Figure 7-2 indicates the cumulative rate of rise for each measurement as compared to the initial survey in 2003. The "power" curve illustrated on Figure 7-2 is a best fit curve based on the cumulative rate of rise data, which shows the "best fit" rate of rise projected into the future. Finally, the "long term projection used" curve illustrated on Figure 7-2 shows the projected rate of rise that has been used to project future water levels (as illustrated on Figure 7-1). The power curve and the long-term projection curve both begin at the most recent water level measurement, December 2006. Figure 7-2 demonstrates that the projected rate of rise that was used for this assessment is more conservative (i.e., a greater rate of rise) than would be projected from the best-fit power curve.

The precipitation measured from 2003 to 2006 has ranged from 90% (2006) to 121% (2005) of the 28-year record (Table 7-1). The overall precipitation for the four-year period is the same (103%) as the

"normal" precipitation would be anticipated to be over four years. These observations suggest that the four years of observed inflows that support the long-term projection represent overall normal conditions.

The projection for the pit water level is illustrated on 1 and demonstrates that the timeframe for reaching the AMP threshold elevation of 1210.8 m asl is in the order of greater than 4 years, well beyond the threshold value of 1 year. Therefore, no trigger was activated in 2006 regarding the projected filling timeframe.

The projection is considered to be conservative (i.e., overestimating the rate of rise) because it does not fully account for a decreasing rate of rise over time due to the increasing area of the pit. Additional information is being developed regarding the water balance for the Grum pit through the studies that are underway for development of the Final Closure and Reclamation Plan. However, the information is not available for reporting at this time. Regardless, the conservative projection provided here is considered to provide a lower "bound" for the timeframes required to reach the stated elevations.

Table 7-1. Precipitation at the Faro Airport, 1978 to 2006

Year	Jan	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (mm)
1978	0.4	**miss.**	trace	4.1	11.6	27.0	38.1	41.6	7.8	32.4	20.2	19.0	
1979	8.9	18.3	20.2	6.7	10.5	68.2	55.4	13.8	13.4	11.6	12.4	34.4	273.8
1980	19.7	2.4	11.7	12.5	10.5	11.1	95.4	33.2	46.7	**miss.**	21.3	13.3	
1981	6.5	23.1	4.0	4.5	7.8	42.8	41.3	22.5	41.9	21.5	17.0	5.4	238.3
1982	10.2	18.0	9.5	4.1	18.2	14.3	58.3	47.3	47.2	42.3	11.8	13.6	294.8
1983	35.7	6.6	9.8	2.2	20.6	55.6	49.1	65.8	21.2	16.3	11.4	3.9	298.2
1984	27.6	24.1	5.9	2.4	38.8	49.0	16.6	64.9	5.5	10.8	10.7	22.5	278.8
1985	22.5	24.8	2.2	13.8	17.2	28.1	62.6	80.8	46.3	20.0	22.2	26.1	366.6
1986	8.4	4.7	34.6	12.9	35.1	12.8	81.8	77.4	44.4	22.7	15.9	5.6	356.3
1987	3.1	14.0	2.8	10	40.1	50.8	92.4	63.5	30.2	26.6	17.8	6.2	357.5
1988	7.0	10.4	17.2	8.2	38.0	37.3	97.2	25.5	43.8	29.0	17.9	16.5	348.0
1989	19.8	3.6	19.8	2.0	17.9	41.0	51.7	16.9	30.8	46.3	39.8	13.8	303.4
1990	14.4	25.8	5.0	7.0	23.4	45.4	30.0	64.4	66.2	22.7	25.4	24.8	354.5
1991	17.2	22.6	16.6	2.8	22.4	30.2	115.4	33.0	48.2	49.6	43.4	40.0	441.4
1992	22.8	24.6	7.6	15.8	14.4	11.4	66.1	34.4	47.8	13.8	18.8	13.0	290.5
1993	22.2	15.0	1.6	6.0	76.7	48.6	50.2	56.0	50.8	35.7	**miss.**	**miss.**	
1994	20.2	8.4	11.4	5.0	39.8	24.2	19.6	25.2	45.6	41.6	24.4	8.0	273.4
1995	8.4	7.8	18.4	5.2	10.9	33.9	73.4	63.4	28.8	12.2	22.3	15.4	300.1
1996	10.2	9.1	27.1	7.2	13.4	20.0	64.4	70.8	52.7	34.8	3.5	5.9	319.1
1997	6.6	8.7	1.4	14	16.5	39.3	86.4	33.2	trace	25.2	6.4	12.4	250.1
1998	7.0	2.8	4.8	4.2	14.4	29.6	19.2	24.2	23.4	24.0	4.6	8.2	166.4
1999	24.4	10.0	15.4	1.8	44.4	64.8	42.0	33.8	27.0	22.4	12.8	21.6	320.4
2000	12.2	2.0	trace	6.0	9.6	39.6	48.1	116.2	102.2	8.6	19.4	5.8	369.7
2001	7.4	3.0	4.0	14.6	30.8	35	58.4	14.2	44.6	28.6	12.2	15.4	268.2
2002	9.2	5.8	9.0	7.0	19.6	19.4	34.9	64.1	38.4	18.2	9.6	9.4	244.6
2003	22.4	8.0	16.0	0.4	7.6	45.2	63.2	30.4	30.8	12.8	32.8	19.9	289.5
2004	31.1	11.4	45.0	4.0	15.6	34.0	13.5	38.0	48.5	33.6	9.8	45.0	329.5
2005	26.7	12.4	2.6	19.5	58.6	41.0	83.8	38.6	36.6	13.0	30.0	10.8	373.6
2006	11.0	7.0	18.5	21.6	16.2	38.0	33.4	33.3	35.6	21.0	33.1	8.3	277.0
Max	35.7	25.8	45	21.6	76.7	68.2	115.4	116.2	102.2	49.6	43.4	45	
Year	1983	1990	2004	2005	1993	1979	1991	2000	2000	1991	1991	2004	
Mean	**15.3**	**11.9**	**12.7**	**7.8**	**24.2**	**35.8**	**56.6**	**45.7**	**39.5**	**24.9**	**18.8**	**15.9**	**307.1**
Min	0.4	2	trace	0.4	7.6	11.1	13.5	13.8	trace	8.6	3.5	3.9	
Year	1978	2000	1978	2003	2003	1980	2004	1979	1997	2000	1996	1983	
St.Dev	9.2	7.9	10.7	5.0	16.6	15.2	26.6	24.2	19.0	11.5	9.9	10.6	

All values expressed in mm as compiled by BGC Engineering Inc.

Figure 7-1. Grum Pit Water Elevations and Projection

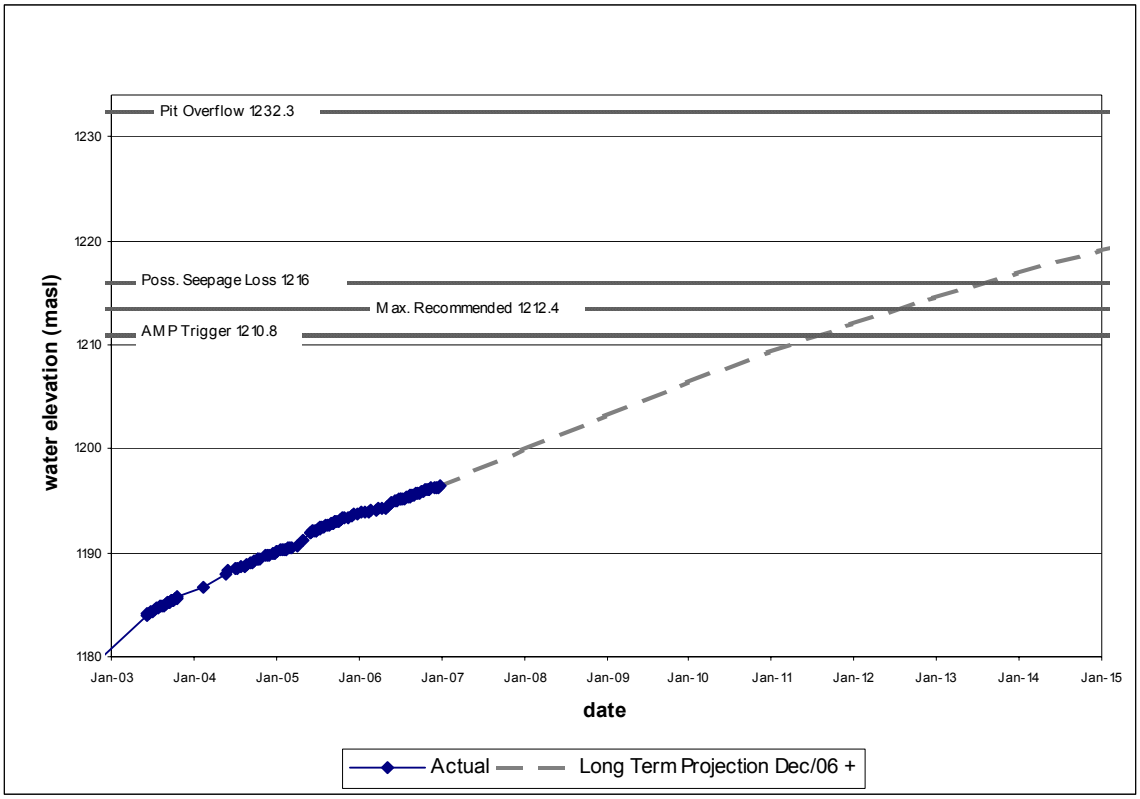
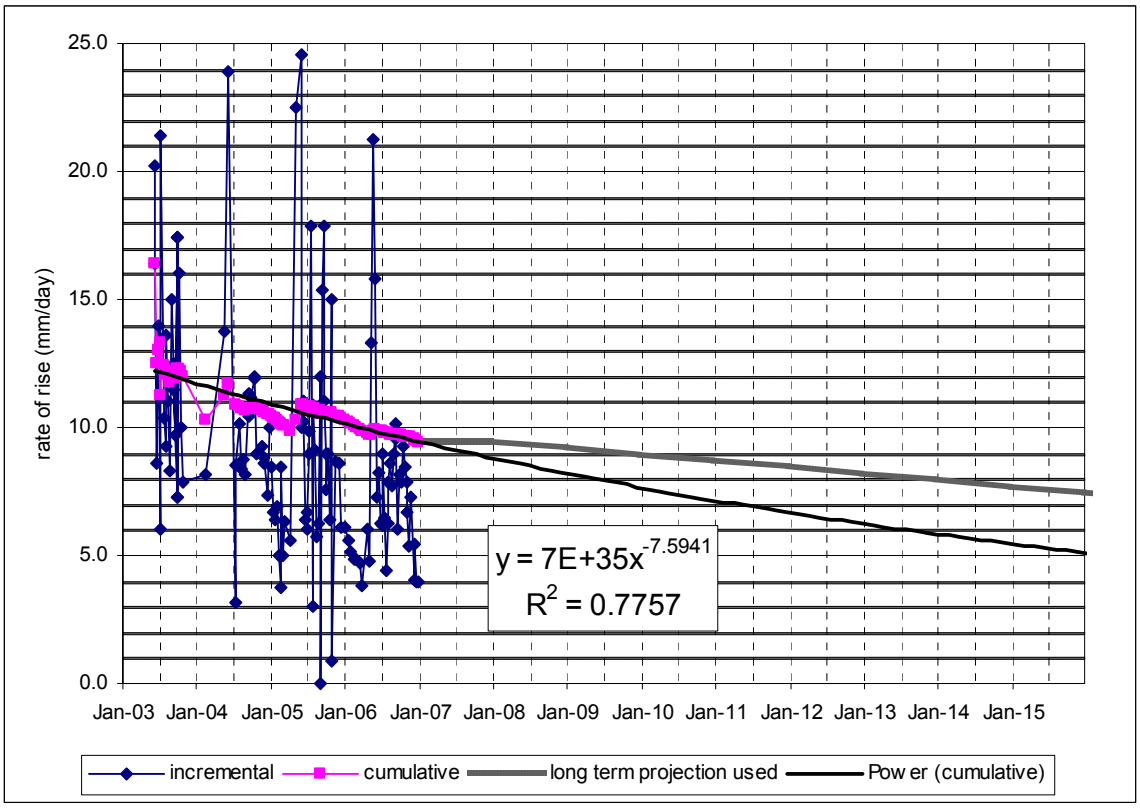


Figure 7-2. Grum Pit Water, Rate of Rise



8. AMP Event 7, Disruption of Fannin Sheep Migration Through the Mine Site

8.1 Description

It is well documented that the Fannin sheep seasonal migration route between winter and summer areas passes through the Vangorda Plateau mine site and that the sheep have continued their migration pattern through the period of mine operations and care and maintenance activities. Mine personnel routinely observe the sheep migration during the course of their activities on the mine site.

The experience gained during the 1998 to 2002 care and maintenance period indicates that the proposed continuation of care and maintenance activities to 2008 should not disrupt the sheep migration patterns. The wide ranging land use by the Fannin sheep suggests that a disruption or irregularity in the migration pattern would more likely be caused by off-site effects.

However, regardless of the source, an irregularity or disruption in the migration pattern could negatively affect the health of the herd by delaying or preventing their established pattern of land use. Alternatively, an irregularity in the sheep migration could be an indicator of a previously unidentified affect on the health of the herd.

8.2 Summary of Implementation Protocol Information

The following is a summary of the AMP Implementation Protocol information for this event to serve as a quick reference for the review that follows.

Indicators	Locations	Thresholds	Monitoring
Locations, time and conditions of Fannin Sheep sightings, number and behaviour of animals	Vangorda Plateau	Determination of specific thresholds will be done by the licencee in conjunction with YG DOE	On-going

8.3 Review

Wildlife observations at the site are recorded in a "Wildlife Observations Logbook". The information recorded was passed on the YG DOE Conservation Officer on a monthly basis, with no triggers being activated.

9. AMP Event 8, Wind Dispersed Tailings Result in Adverse Effects in the Terrestrial Environment

9.1 Description

At the time the AMP Implementation Protocol was originally developed, the available information demonstrated that wind dispersed contaminants (i.e. heavy metals) were present in the terrestrial environment near the mine site. This information is described in the Water Licence Renewal Environmental Assessment Report. However, at that time, this data did not clearly identify the source of the contaminants (i.e. tailings, waste rock, mining activities or emissions from the concentrator during operating periods, for example), the extent of their distribution, or whether the effects have increased, diminished or remained static through the care and maintenance timeframe (i.e. post-1998) in comparison to the operating period of the mine.

In response to concerns with respect to this issue, the Terrestrial Effects Study was initiated under the recommendation of the Environmental Assessment conducted for the Water Licence Renewal for ongoing care and maintenance activities at the Anvil Range Mine Complex (Deloitte & Touche Inc. and Gartner Lee Limited 2003). The broad goal of the study is to answer two fundamental questions:

1. Are there any existing and ongoing impacts to the terrestrial environment (i.e. animals, vegetation and land users) that need to be addressed during the care-and-maintenance phase, while the Final Closure and Reclamation Plan is being prepared?
2. What are the impacts of the past mining operations on the terrestrial environment (animals, vegetation and land users) that should be addressed in the Final Closure and Reclamation Plan?

9.2 Summary of Implementation Protocol Information

The trigger for implementation of contingency measures under the AMP is "the 2005 Terrestrial Effects Study Report concludes that current and on-going wind dispersion of tailings is having a negative effect of the environment such that short term (i.e. 2008) mitigation measures for a reduction in wind dispersion are recommended".

9.3 Review

In September 2006, the two following reports were submitted to the Water Board as per Part F, Item 49 of Water Licence QZ03-059:

1. *Anvil Range Mine Complex – Terrestrial Effects Study: Investigation into Metal Concentration in Vegetation, Wildlife and Soils*, prepared by Gartner Lee Limited; and
2. *Summary Report Anvil Range Mine Tier 2 Risk Assessment of Current Conditions*, prepared by SENES Consultants Ltd.

The two combined reports fulfill the requirements of the Water Licence. The first report presented the findings of a two-year study for gathering information on terrestrial resources (such as animals, soil, vegetation and air). The second report assessed that information for potential risks to people and wildlife. These reports, along with attached cover letter, provided a comprehensive summary of the results of the studies with respect to the requirements of the Water Licence. A copy of the cover letter is provided in Appendix D. The key findings are presented below.

The specific objectives of the Terrestrial Effects Study were:

1. Definition of the spatial distribution of elevated metal concentrations in the terrestrial environment;
2. Determination of whether the elevated metal levels are related to historic mine activities and/or current care and maintenance activities;
3. Improvement of the characterization of natural background (reference) metal concentrations;
4. Investigation of metal levels in vegetation species of importance to humans and wildlife;
5. Investigation of metal levels in wildlife tissues, including species of importance to humans;
6. Determination of ambient air metal concentrations (required information for the Human Health and Ecological Risk Assessment (HHERA)); and
7. Identification of potential sources of ongoing metal deposition.

This work relied on the participation provided by the Ross River Dena, Selkirk First Nation, Town of Faro and scientific experts to guide the collection of information, including metal levels, in small mammals, large animals, soil, vegetation, berries and air quality.

The information collected in the terrestrial environment shows that past operations at the Anvil Range Mine have resulted in metal concentrations in the mine area that are greater than the reference/background levels. For example, lead concentrations near the mine are up to 450 times those at reference sites and the lead isotope analysis indicates that the majority of the lead deposited in the study area was from mine ores. The concentrations of metals that originated from the mine site are generally higher near the mine and decline with distance from the mine. Deposition of some metals from the mine site is still occurring in the immediate area, mostly during the snow-free period.

Metal concentrations that were greater than the reference/background levels were detected in plants, small mammals and other wildlife in the area. This information does not necessarily indicate a high risk to wildlife or people but reinforces the appropriateness of conducting a human health and ecological risk assessment, as described below

The HHERA for the current conditions at the site was developed using the information collected at the Anvil Range mine as supplemented by other general information where necessary to complete the assessment. The assessment was based on the current care and maintenance activities being carried out at the site, as is appropriate to the requirements of the Water Licence.

The results of the ecological risk assessment indicate that no adverse health effects are expected in fish and animals that are currently present on the site. The human health risk assessment indicates that humans who use the site for approximately 1.5 months per year to gather berries and trap animals and also hunt and eat animals from the site are not at risk from adverse health effects.

Given the results of the HHERA, there is no need for short-term mitigation to ensure animals and people are adequately protected from risks associated with on-going wind dispersion of tailings while the Final Closure and Reclamation Plan is being developed.

10. Recommendations

Based on the information assessed and described in this report, we feel that the AMP program is functioning as intended.

As outlined in Section 2 we recommend that the following modifications be implemented at this time, specifically:

- AMP Event 1 – pending the results of the investigation of X24-A and X24-D, possible modifications to AMP Event 1, Degraded Groundwater Quality in Rose Creek Valley Aquifer.

Other than these specific recommendations, the AMP program functioned as intended in 2006 and no other changes should be made.

Appendices

Appendix A. May, 2006 Letter to Government of Yukon, Water Resources Branch – AMP 1 Response

Gartner Lee Limited

May 25, 2006

Tony Polyck, Manager Water Inspections Section
Department of Environment
Water Resources Branch
Yukon Government
Box 2703
Whitehorse, YT Y1A 2C6

Dear Mr. Polyck:

Re: Anvil Range Mine, Wrap-Up of Various Triggers Under the Adaptive Management Plan

Introduction

An Adaptive Management Plan (AMP) for the Anvil Range Mine was considered and discussed through the Water Licence renewal process in 2003. The Water Licence (#QZ003-059) required the submission of a final AMP by June 2004. In response to this requirement, an Adaptive Management Plan Implementation Program (AMPIP) was filed by Gartner Lee on behalf of the Interim Receiver and was implemented immediately.

The AMPIP defines eight events and requires that specified monitoring data is compared against pre-determined thresholds on a routine basis, generally monthly for water quality data. If AMP thresholds are exceeded, then follow up monitoring, assessment and reporting is typically required. Several water quality triggers covering five AMP Events have been activated since June 2004 and all were reported to the Yukon Water Board (YWB) and/or the Water Inspector as appropriate.

Another requirement of the AMPIP is the preparation of an annual AMP review report as part of the site Annual Environmental Report submitted by March 1 of each year. Two annual reviews have now been submitted for the 2004 and 2005 reporting years. These reports provide various recommended refinements to the AMPIP, some of which are elaborated upon herein.

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The purpose of this letter is to formally "wrap-up" with the Water Inspector's office four of the events for which water quality triggers have been previously reported. The fifth AMP Event for which a water quality trigger has been activated, AMP Event #4 regarding Grum Creek, is under investigation by others and is to be reported separately.

The four AMP Events discussed in this letter are as follows:

1. AMP Event #1, Groundwater Quality in the Rose Creek Valley Aquifer;
2. AMP Event #2, Water Quality in Vangorda Creek Downstream of the Mine Facilities;
3. AMP Event #3, Water Quality in Rose Creek Downstream of the Mine Facilities; and
4. AMP Event #5, Water Quality in the North Fork of Rose Creek.

For each of these four AMP events, a brief summary of the history of the trigger(s) is provided followed by a "wrap-up" statement.

AMP Event #1, Groundwater Quality in the Rose Creek Valley Aquifer;

The events related to this AMP Event is summarized as follows:

1. In August 2004, two triggers were identified, for sulphate in monitoring wells X24A/C/D and iron in monitoring wells X25A/B;
2. This was reported to the YWB in the monthly data report for August 2004;
3. Per the AMPIP, follow up samples were collected in September;
4. The follow up samples verified the initial triggers and identified an additional trigger for zinc in monitoring well X24D;
5. All of the above was reported to the Water Inspector in a letter dated October 28, 2004;
6. Per the AMPIP, data review and assessment of potential impacts was initiated;
7. Additional sampling in November again verified the triggers;
8. All of the above was documented to the YWB in the 2004 Annual AMP Review;
9. From September 2004 through February 2005, the data review was completed which demonstrated that there was no anticipated impact to the surface environment in Rose Creek from the observed metal levels and that no short-term mitigation was necessary;
10. Through the remainder of 2005, the monitoring results continued to be assessed for any indicated changes to the initial assessment;
11. Through 2005, the existing trigger for iron in monitoring well X25A was eliminated due to declining iron concentrations;
12. In September 2005, an additional trigger was identified, for iron in monitoring well X24A;
13. This was reported to the YWB in the monthly data report for September;
14. All of the above was documented to the YWB in the 2005 Annual AMP Review;

15. The 2005 Annual AMP Review provides recommendations, based on the information assessed through this process, for amending the thresholds for this AMP Event (see below);
16. The cover letter for the 2005 Annual Environmental Report/Annual AMP Review informs the YWB that the Interim Receiver will carry forward with implementation of those recommendations unless directed otherwise;
17. This letter wraps-up all of the above for the Water Inspector's file.

The recommended amendment to the AMPIP is to remove iron as an indicator element for groundwater. The rationale, as expressed in the 2005 Annual AMP Review is as follows:

> *Assessment of the water quality data and sampling techniques indicates that the elevated levels of iron may be due to slight variations in sampling methodology during the reference period. Iron concentrations in groundwater are very susceptible to oxidation/reduction and slight variations in sampling protocols can result in different dissolved iron concentrations. For example, if a well is not properly purged prior to sampling, the sample volume in the tube may be exposed to oxidizing conditions, resulting in iron precipitating out of solution. Once the sample is brought to the surface and filtered, this sample could have a lower concentration of dissolved iron. The sensitivity of iron concentrations, particularly at these low levels, to minor variations in sampling methodology creates some uncertainty in the interpretation of the results prior to 2002 when the sampling method was reviewed and updated. Furthermore, iron has not been identified as a contaminant of concern in the receiving environment through the ongoing aquatic risk assessment work being carried out as part of closure planning. Therefore it is recommended that dissolved iron no longer be an indicator in AMP Protocol for the Rose Creek Aquifer.*

The triggers for zinc and sulphate at the toe of the Intermediate Dam (monitoring wells X24 and X25) have been determined as not requiring the initiation of short-term mitigation responses at this time. This is based on predictive modeling work that utilized the groundwater model developed by Robertson Geoconsultants Inc. for the Final Closure and Reclamation Plan. Through 2006, the monitoring data will continue to be assessed for trends. Further, the assessment of potential impacts on Rose Creek and the need for short-term mitigation responses will be renewed in the 2006 AMP Annual Review.

AMP Event #2, Water Quality in Vangorda Creek Downstream of the Mine Facilities;

The events related to this AMP Event is summarized as follows:

1. In March 2005, a trigger was identified for sulphate at location V8;
2. This was reported to the YWB in the monthly data report for March;
3. At the time, the initial expectation was that the trigger was related to natural seasonal variations in Vangorda Creek water;
4. The subsequent data review, including assessment of subsequent monthly samples, verified that the cause of the trigger was natural seasonal variations in Vangorda Creek water;
5. This was reported to the YWB in the monthly data report for May;
6. The 2005 Annual AMP Review provides recommendations, based on the information assessed through this process, for amending the thresholds for this AMP Event (see below);
7. The cover letter for the 2005 Annual Environmental Report/Annual AMP Review informs the YWB that the Interim Receiver will carry forward with implementation of those recommendations unless directed otherwise;
8. This letter wraps-up all of the above for the Water Inspector's file.

The recommended amendment to the AMPIP is that the threshold values for sulphate should be expressed as two seasonal thresholds (open-water and winter) to better reflect the natural variations in Vangorda Creek water. The rationale, as expressed in the 2005 Annual AMP Review is as follows:

> *An assessment was carried out to determine if there are any statistically significant seasonal differences in the sulphate concentrations at V8, and if necessary determine seasonally based threshold values for sulphate at V8 based on the reference period (1998 – 2002). Concentrations of sulphate during the reference period were found to exhibit seasonal variability as illustrated in Figure 3-1. Using the Analysis of Variance and Multiple Comparisons (Least Significant Difference) at a 5 % significance level, statistically higher concentrations are observed in the winter months (November – April) compared to the open water months (May – October). A statistical summary of the seasonal sulphate concentrations for the defined reference period (1998 – 2002) is presented in Table 3-2.*

Figure 3-1 Vangorda Creek (V8) Sulphate (2003 – 2005)

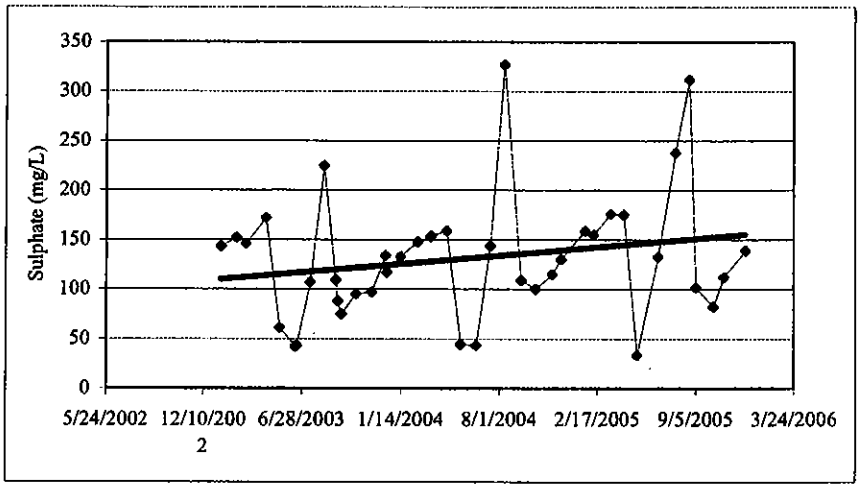

Table 3-2 Vangorda Creek (V8) Summary of Seasonal Statistics

	Winter (November – May)	***Open Water Season (May – October)***
Number of Samples	*31*	*34*
Minimum	*46.0*	*12.0*
25th Percentile	*110.0*	*34.5*
Median	*136.0*	*58.0*
Mean	*140.9*	*71.7*
75th Percentile	*171.0*	*74.8*
Maximum	*274.0*	*328.0*

Given this seasonal variability in the concentrations of sulphate in Vangorda Creek at V8, it is recommended that the AMP Protocol for V8 be modified for sulphate to include two seasonal components: open water season (May – October) and winter (November – April).

Indicators	*Locations*	*Thresholds*	*Period*
$Zn_{(T)}$, $Cu_{(T)}$, and TSS	*V8*	• *3 consecutive results > 75th percentile of reference period; or* • *statistically significant trend projects > 75th percentile of reference period within 3 years.*	*January - December*
SO_4	*V8*	• *3 consecutive results > 75th percentile of reference period (75 mg/L); or* • *statistically significant trend projects > 75th percentile of reference period within 3 years.*	*May - October*
SO_4	*V8*	• *3 consecutive results > 75th percentile of reference period (171 mg/L); or* • *statistically significant trend projects > 75th percentile of reference period within 3 years.*	*Winter (Nov. – April)*

AMP Event #3, Water Quality in Rose Creek Downstream of the Mine Facilities

The events related to this AMP Event is summarized as follows:

1. In March 2005, two triggers were identified, for sulphate and zinc at location X14;
2. This was reported to the YWB in the monthly data report for March;
3. At the time, the initial expectation was that the triggers were related to the release of (compliant) effluent from the Cross Valley Pond during a period of proportionally low creek flow, compounded by the assessment of trends based on the increased (weekly versus monthly) sampling schedule that is implemented during periods of effluent release;
4. The subsequent data review, including assessment of subsequent samples, verified that the cause of the trigger was the release of (compliant) effluent from the Cross Valley Pond during a period of proportionally low creek flow, compounded by the assessment of trends based on the increased (weekly versus monthly) sampling schedule that is implemented during periods of effluent release;
5. This was reported to the YWB in the monthly data reports for April and May;

6. The 2005 Annual AMP Review provides recommendations, based on the information assessed through this process, for amending the thresholds for this AMP Event (see below);
7. The cover letter for the 2005 Annual Environmental Report/Annual AMP Review informs the YWB that the Interim Receiver will carry forward with implementation of those recommendations unless directed otherwise;
8. This letter wraps-up all of the above for the Water Inspector's file.

The recommended amendment to the AMPIP is that the monitoring data be assessed against thresholds values on a consistent (monthly) basis, using monthly averages during periods of effluent release. The rationale, as expressed in the 2005 Annual AMP Review is as follows:

> *As anticipated the concentrations of both zinc and sulphate concentrations in April returned to levels below the threshold values following the temporary period of effluent release from the Cross Valley Pond in March. Given the variations in sample frequency at X14 from monthly to weekly during periods of discharge, the AMP Protocol for X14 was modified to ensure consistency with the reference period sample frequency and the basis for the determination of the thresholds. When carrying out the assessment of consecutive weekly samples during periods of discharge, the weekly concentrations are averaged for the month. This subsequent monthly average value is then assessed as per the AMP Protocol. It is recommended that this modified procedure be permanently adopted into the AMP.*

AMP Event #5, Water Quality in the North Fork of Rose Creek

The events related to this AMP Event is summarized as follows:

1. In March 2005, a trigger was identified for sulphate at location X2;
2. This was reported to the YWB in the monthly data report for March;
3. At the time, the initial expectation was that the trigger was related to seasonal variations in North Fork water that were present through the AMP reference period;
4. The subsequent data review, including assessment of subsequent monthly samples, verified that the cause of the trigger was seasonal variations in North Fork water that were present through the AMP reference period;
5. This was reported to the YWB in the monthly data report for May;
6. The 2005 Annual AMP Review provides recommendations, based on the information assessed through this process, for amending the thresholds for this AMP Event (see below);

7. The cover letter for the 2005 Annual Environmental Report/Annual AMP Review informs the YWB that the Interim Receiver will carry forward with implementation of those recommendations unless directed otherwise;
8. This letter wraps-up all of the above for the Water Inspector's file.

The recommended amendment to the AMPIP is that the threshold values for sulphate should be expressed as two seasonal thresholds (open-water and winter) to better reflect the seasonal variations in North Fork water that were present through the AMP reference period. The rationale, as expressed in the 2005 Annual AMP Review is as follows:

> *An assessment was carried out to determine if there are any statistically significant seasonal differences in the sulphate concentrations at X2, and if necessary determine seasonally based threshold values for sulphate at X2 based on the reference period (1998 – 2002). Concentrations of sulphate during the reference period were found to exhibit seasonal variability as illustrated in Figure 6-1. Using the Analysis of Variance and Multiple Comparisons (Least Significant Difference) at a 5 % significance level, statistically higher concentrations are observed in the winter months (November – April) compared to the open water months (May – October). A statistical summary of the seasonal sulphate concentrations for the defined reference period (1998 – 2002) is presented in Table 6-2.*

Figure 6-1 North Fork Rose Creek (X2) Sulphate (2003 – 2004)

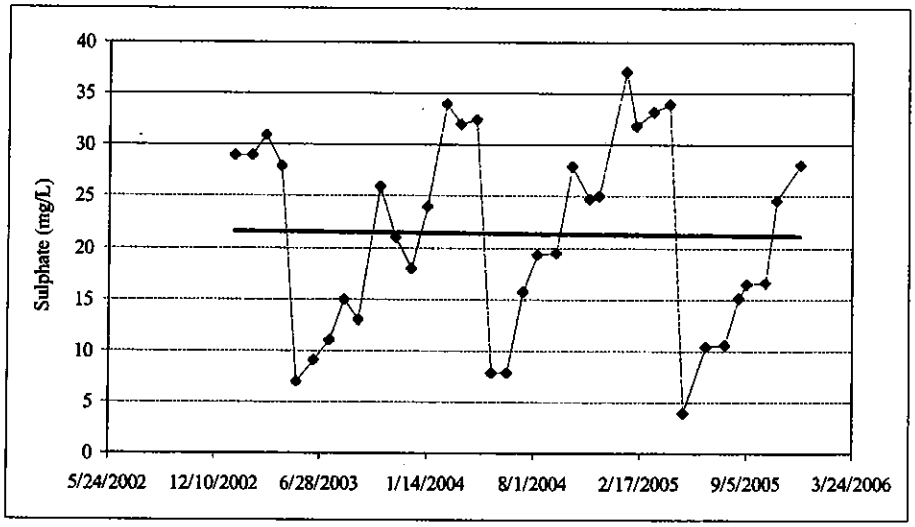

Table 6-2 North Fork Rose Creek (X2) Summary of Seasonal Statistics

	Winter (November – May)	***Open Water Season (May – October)***
Number of Samples	*31*	*30*
Minimum	*7.0*	*4.0*
25th Percentile	*22.0*	*8.3*
Median	*26.0*	*11.5*
Mean	*26.6*	*11.9*
75th Percentile	*29.5*	*14.8*
Maximum	*52.0*	*22.0*

Given this seasonal variability in the concentrations of sulphate in the North Fork of Rose Creek at X2, it is recommended that the AMP Protocol for X2 modified for sulphate to include two seasonal components: open water season (May – October) and winter (November – April).

Indicators	*Locations*	*Thresholds*	*Period*
$Zn_{(T)}$ and $Cu_{(T)}$	*X2*	• *3 consecutive results > 75th percentile of reference period; or* • *statistically significant trend projects > 75th percentile of reference period within 3 years.*	*January - December*
SO_4	*X2*	• *3 consecutive results > 75th percentile of reference period (14.8 mg/L); or* • *statistically significant trend projects > 75th percentile of reference period within 3 years.*	*May - October*
SO_4	*X2*	• *3 consecutive results > 75th percentile of reference period (29.5 mg/L); or* • *statistically significant trend projects > 75th percentile of reference period within 3 years.*	*Winter (Nov. – April)*

Closing

We trust that this letter is helpful and clear. Please let us know if you have any questions regarding the information provided in this letter.

Sincerely,
GARTNER LEE LIMITED

Leslie Gomm, P.Eng., Ph.D., Senior Environmental Scientist
Eric Denholm, Senior Mining Consultant

c.c.: Doug Sedgwick, Interim Receiver
Valerie Chort, Interim Receiver
Dana Haggar, Site Manager

Appendix B. 2005 AMP #4 Status Report- SRK

Appendix C. 2006 AMP #4 Status Report- SRK

Appendix D. September 29, 2006 Letter to YWB - Terrestrial Effects Study: Investigation into Metal Concentration in Vegetation, Wildlife and Soils

Gartner Lee Limited

September 29, 2006

Yukon Water Board
106-409 Range Road
Whitehorse, Yukon
Y1A 3V1

Dear Board:

Re: Anvil Range Mine, Terrestrial Effects Study

Introduction

On behalf of Deloitte & Touche Inc. (in its capacity as court-appointed Interim Receiver of Anvil Range Mining Corporation), we are pleased to submit the enclosed reports that fulfill the requirements for a study of Terrestrial Effects, per Part F, Item 49 of Water Licence QZ03-059. There are two reports, each of which is submitted as five bound copies plus one unbound original plus one electronic copy. The two reports are:

1. *Anvil Range Mine Complex – Terrestrial Effects Study: Investigation into Metal Concentration in Vegetation, Wildlife and Soils*, prepared by Gartner Lee Limited; and
2. *Summary Report Anvil Range Mine Tier 2 Risk Assessment of Current Conditions*, prepared by SENES Consultants Ltd.

The two combined reports fulfill the requirements of the Water Licence. The first report presents the findings of a two-year study for gathering information on terrestrial resources (such as animals, soil, vegetation and air). The second report assesses that information for potential risks to people and wildlife. This letter summarizes the overall results of the two reports with respect to the requirements of the Water Licence.

This Terrestrial Effects study was initiated under the recommendation of the Environmental Assessment conducted for the Water Licence Renewal for ongoing care and maintenance activities at the Anvil Range Mine Complex (Deloitte & Touche Inc. and Gartner Lee Limited 2003). The broad goal of the study is to answer two fundamental questions:

1. Are there any existing and ongoing impacts to the terrestrial environment (i.e. animals, vegetation and land users) that need to be addressed during the care-and-maintenance phase, while the Final Closure and Reclamation Plan is being prepared?

2. What are the impacts of the past mining operations on the terrestrial environment (animals, vegetation and land users) that should be addressed in the Final Closure and Reclamation Plan?

The Water Licence (QZ03-059) requires submission of a project report that responds to the care and maintenance related issues represented in the first question above.

We provided written updates to the Board on the status of the project, with respect to the requirements of the Water Licence, in December 2005 and June 2006. As outlined in the June 2006 update, the following steps needed to be completed to prepare this submission to the Board:

1. Complete the analysis of the information on the terrestrial resources;
2. Complete a preliminary assessment of risks to animals and people through an HHERA;
3. Assess the need for short-term mitigation actions to ensure that animals and people are adequately protected from risks;
4. If necessary, develop a short term action plan to be implemented while the Final Closure and Reclamation Plan is being developed and approved;
5. Meet with the Ross River Dena Council, Selkirk First Nation, Town of Faro, Faro Mine Closure Project Office and governmental representatives and incorporate their feedback; and
6. Present the above work to the Yukon Water Board on September 30, 2006.

All of the steps outlined above have been successfully completed with the exception of Step 5 (community meetings with the Ross River Dena Council, Selkirk First Nation, and the Town of Faro). This next stage of the project is more appropriately being managed by the Faro Mine Closure Planning Office (FMCPO), where these reports can be discussed in the context of the development of the Final Closure and Reclamation Plan.

That initiative by the FMCPO is important but does not delay our submission of these observations and conclusions regarding the requirements of the Water Licence.

Summary of the Investigation of Terrestrial Resources

The specific objectives for the investigation of terrestrial resources are as follows:

1. Definition of the spatial distribution of elevated metal concentrations in the terrestrial environment;
2. Determination of whether the elevated metal levels are related to historic mine activities and/or current care and maintenance activities;

3. Improvement of the characterization of natural background (reference) metal concentrations;
4. Investigation of metal levels in vegetation species of importance to humans and wildlife;
5. Investigation of metal levels in wildlife tissues, including species of importance to humans;
6. Determination of ambient air metal concentrations (required information for the Human Health and Ecological Risk Assessment (HHERA)); and
7. Identification of potential sources of ongoing metal deposition.

This work relied on the participation provided by the Ross River Dena, Selkirk First Nation, Town of Faro and scientific experts to guide the collection of information, including metal levels, in small mammals, large animals, soil, vegetation, berries and air quality.

The information collected in the terrestrial environment shows that past operations at the Anvil Range Mine have resulted in metal concentrations in the mine area that are greater than the reference/background levels. The concentrations of metals that originated from the mine site are generally higher near the mine and decline with distance from the mine.

Deposition of some metals from the mine site is still occurring in the immediate area, mostly during the snow-free period.

Metal concentrations that were greater than the reference/background levels were detected in plants, small mammals and other wildlife in the area. This information does not necessarily indicate a high risk to wildlife or people but reinforces the appropriateness of conducting a human health and ecological risk assessment, as described below.

Summary of Human Health and Ecological Risk Assessment (HHERA)

The HHERA for the current conditions at the site was developed using the information collected at the Anvil Range mine as supplemented by other general information where necessary to complete the assessment. The assessment was based on the current care and maintenance activities being carried out at the site, as is appropriate to the requirements of the Water Licence.

The results of the ecological risk assessment indicate that no adverse health effects are expected in fish and animals that are currently present on the site. The human health risk assessment indicates that humans who use the site for approximately 1.5 months per year to gather berries and trap animals and also hunt and eat animals from the site are not at risk from adverse health effects.

Conclusion

Given the results of the HHERA, there is no need for short-term mitigation to ensure animals and people are adequately protected from risks while the Final Closure and Reclamation Plan is being developed.

Closing

We trust that this letter and the accompanying reports are clear and understandable. Please contact the undersigned if you have any questions regarding the information presented.

Sincerely,
GARTNER LEE LIMITED
(on behalf of the Interim Receiver)

Leslie Gomm, P.Eng., Ph.D.
Senior Environmental Engineer

c.c: Valerie Chort, Deloitte & Touche Inc.
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