Deloitte
& Touche

AMP Event #4 Response:
2005 Status Report

Prepared for:

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1 Introduction

As required under Water Licence QZ03-059, an Adaptive Management Plan (AMP) for the Anvil Range Mine was submitted to the Yukon Territory Water Board on June 30, 2004 (GLL, 2004). The AMP outlines the short-term mine management strategies that have been instituted to ensure environmental protection during the period leading up to the implementation of a Final Closure and Reclamation Plan.

The AMP specifies eight events that, if triggered, would require a management response to ensure maintenance of acceptable environmental conditions. Event #4, *"Degraded Seepage Quality from the Grum Rock Dump"*, addresses the potential for increased contaminant loadings from Grum Dump to levels, which could have an adverse impact on the receiving environment in Vangorda Creek. The initial trigger for the implementation of the AMP was a sustained and statistically significant increase in concentrations of sulphate, copper or zinc in seepage from the Grum Dump, over the 1998 to 2002 reference period. This trigger was intended to provide an indication that oxidation products are being released from the dump, and that increased monitoring and surveillance is now required to ensure protection of Vangorda Creek.

Loadings from Grum Dump to Vangorda Creek have historically been monitored at station V2, on Tributary A of Grum Creek (Figure 1.1). As indicated in the July 16, 2004 letter of notification to the Water Board (SRK 2004a), the specific threshold for total sulphate at V2 was exceeded on the date of AMP implementation (July 1, 2004).

Although increased sulphate concentrations do not in themselves present a threat to Vangorda Creek, a management response is required as part of the AMP. On August 16, 2004, SRK Consulting (SRK) submitted a letter to the Water Board, on behalf of Deloitte and Touche, outlining the proposed response plan to address this issue (SRK 2004b). The plan included a series of investigative actions intended to better understand hydrological and geochemical conditions downgradient of the Grum Dump, and to assess the level of environmental impact of Grum Dump loadings on Vangorda Creek.

Key components of the plan were:

- Collection of routine water quality samples;
- Review of existing water quality records;
- Seepage surveys;
- Detailed contaminant pathway survey;
- Installation of flow monitoring station on Grum Creek;
- Groundwater monitoring well installation; and
- Reporting.

The potential for increased contaminant loading from the Grum Dump was acknowledged prior to implementation of the AMP. Therefore, several of these activities were already underway. Where relevant, results from these studies are included in this report. In addition, an evaluation of seepage collection options for surface and shallow groundwater downgradient of Grum Dump was completed in June 2004 (SRK 2004c).

The Response Plan was initiated in the second half of 2004. 2004 Event #4 Response activities were summarized in the 2004 AMP Event #4: Status Report (SRK 2005), which also outlined the remaining items to be completed in 2005 as part of the Response Plan. A summary of full-year water quality monitoring results was presented in the AMP Annual Review for 2005 (GLL 2006).

This document is intended to record the current status of the various response activities, and to review monitoring results to the end of 2005. The document is organized as follows:

- Section 2 summarizes the 2005 field activities that were completed as part of AMP response and other programs relevant to Grum Dump seepage;
- Section 3 discusses the results of 2005 monitoring activities, and reviews historical water quality at selected stations;
- Section 4 presents a summary of final Response Plan implementation activities, and conclusions from the 2005 water quality; and
- Section 5 presents recommendations for further monitoring, and reporting and discussion of monitoring results.

2 Summary of 2005 Field Activities

2.1 Installation of Monitoring Wells

The Response Plan highlighted the need to replace monitoring well BH96-9b, located near the intersection of Tributary A and the Grum Dump toe access road. This well was initially installed in 1996, and was situated to monitor breakthrough of oxidation products from the upgradient waste rock (RGI 1996). In addition, installation of additional monitoring wells was recommended following the development of a water and load balance for Grum Dump (SRK 2005).

A total of six monitoring wells were installed between Grum Dump and Vangorda Creek in 2005, both as part of AMP Event #4 Response activities and as part of investigations into the feasibility of seepage collection. The locations of the new wells, along with existing groundwater monitoring wells and surface water monitoring stations, are shown in Figure 2.1. Detailed discussion of well installations can be found in 2005 Seepage Investigations at the Grum Dump Area (SRK 2006a). Mauro Prado of SRK logged the recovered core and supervised well installation. The following summarizes installation details for each of the wells installed in 2005.

2.1.1 Downgradient of Moose Pond: SRK05-06 (Moose Well) and SRK05-09 (Moose Well 2)

The data review and water and load balance carried out as part of Response activities indicated that there was potential for significant load to enter Vangorda Creek via a groundwater pathway downgradient of Moose Pond. Installation and monitoring of a shallow groundwater well between Moose Pond and Vangorda Creek was recommended to monitor this pathway, and this was carried out during August and September 2005.

Two wells were installed (SRK05-06 and SRK05-09), as the first well had insufficient inflow to permit collection of water samples. Well locations are shown in Figure 2.1.

Installation of these monitoring wells using a conventional drill would have required development of road access to the desired location. Instead, an alternative drilling method was used, whereby well installation was carried out using a hand-portable Pionjar hammer drill with 50 mm (2”) and 76 mm (3”) split spoon samplers. This drilling method advances without the benefit of casing to maintain an open borehole, which requires that the walls of the borehole are competent during the process of extracting drilling tools and inserting the monitoring well. Drilling and well installation was carried out by Rocky Mountain Soil Sampling, of Bowen Island, BC.

SRK05-06 (Moose Well)

Drilling and installation of monitoring well SRK05-06 was carried on August 4, 2005, using a 2” split spoon sampler. A nominal 32 mm (1¼”) PVC monitoring well was installed, with a screened interval from 1.7 to 2.7 m below ground surface (bgs) in a zone of silty sand. An attempt was made to backfill the screened zone with #10 silica sand, with a bentonite seal placed above the monitoring zone. The narrow clearance between the casing and the wall of the borehole resulted in the sand filter not being installed to the satisfaction of the inspector. Appendix A contains the core log and monitoring well installation details for SRK05-06.

Subsequent attempts to collect water samples from SRK05-06 were unsuccessful. The static water level was approximately 1.8 m bgs on August 4, 2005, but well recharge was insufficient to allow adequate well development and sample collection. Water within the well casing had high levels of suspended solids, indicating that the placement of the sand filter was incomplete. On review of these results, it was decided to install another well in an attempt to establish a functional monitoring point.

SRK05-09 (Moose Well 2)

Drilling and installation of monitoring well SRK05-09 was carried on September 17, 2005, using Rocky Mountain’s Pionjar hammer drill equipped with a 3” split spoon sampler. A nominal 32 mm (1¼ “) PVC monitoring well was installed, with a screened interval from 0.5 to 3.5 m below ground surface (bgs) in a zone of silty sand. Drill performance and recovered sample indicated that the drillhole terminated in weathered foliated bedrock. The screened zone was backfilled with #10 silica sand, and a bentonite seal was placed above the monitoring zone. The wider clearance between the casing and the wall of the borehole permitted the placement of a satisfactory filter pack over the screened interval. Appendix A contains the core log and monitoring well installation details for SRK05-09.

Water samples were successfully collected from SRK05-09 using an inertial pump (Waterra tubing + foot valve). Static water level was approximately 1.7 m bgs on September 17, 2005. Water quality is discussed in Section 3.1.4.

2.1.2 SRK05-05C

Two wells were installed adjacent to Grum Creek on the upslope side of the Grum Dump Toe Access Road during 2004. Both wells were found to be artesian, indicating that both were screened within a confined aquifer and that neither was capable of monitoring groundwater quality in the near-surface unconfined aquifer. To acquire this monitoring capability, Rocky Mountain Soil Sampling was contracted to install a shallow monitoring well adjacent to SRK04-05a and -05b.

Drilling and installation of monitoring well SRK05-05c was carried on August 4, 2005, using a 2” split spoon sampler. A nominal 32 mm (1¼”) PVC monitoring well was installed, with a screened interval from 1.5 to 3.0 m below ground surface (bgs) in a zone of silty sand with gravel. The screened zone with #10 silica sand, with a bentonite seal placed above the monitoring zone. Appendix A contains the core log and monitoring well installation details for SRK05-05c.

The static water level was approximately 1.2 m bgs on August 4, 2005, indicating that the new well was successfully screened in the unconfined aquifer. Water quality is discussed in Section 3.1.4.

2.1.3 BH05-9b

BH96-9a and -9b were installed in 1996 along what was considered to be the pathway most likely to show early arrival of oxidation products generated from weathering of Grum waste rock. These wells provided useful surveillance of shallow (96-9a) and deep (96-9b) groundwater quality. In 2001, BH96-9 ceased to be functional, apparently due to break or separation in the well casing near the ground surface and subsequent blockage of the well by soil. Attempts to rehabilitate BH96-9b were unsuccessful, and it was decided that this well should be replaced to provide the capacity to continue monitoring deep groundwater at this location going forward.

Drilling and installation of monitoring well BH05-9b was carried on August 11, 2005, using a Nodwell-mounted sonic drill rig owned and operated by Sonic Drilling Services (a division of Boart Longyear), of Calgary, AB. The sonic rig was equipped with a 4 x 6 system (4"/10 cm core barrel and 6"/15 cm casing) that allowed for continuous sampling in 3 meter runs (1 core barrel = 10 ft; approximately 3 metres) by advancing the core barrel using ultra-sonic vibrations. Casing was advanced over the core barrel to below the bit to keep the hole open during barrel retrieval. Water was only used during casing advancement to prevent heave between barrel and casing. Water use was kept to the minimum required to advance casing.

Core was recovered in the drill rod and extruded into flexible plastic sample tubes. Disturbance of in-situ stratigraphy is minimal using the sonic drilling method. The sample tubes were laid out adjacent to the drill and core was logged as it was recovered.

A nominal 51 mm (2") PVC monitoring well was installed in the borehole, with a screened interval from 15.5 to 18.6 m below ground surface (bgs) in a zone of sandy gravelly silt. The screened zone was backfilled with #10 silica sand, with a bentonite seal placed above the monitoring zone. Appendix A contains the core log and monitoring well installation details for BH05-96b. No samples were collected from BH05-9b in 2005; monitoring of this well will be carried out during both Spring and Fall 2006 sampling rounds.

2.1.4 SRK05-07 and SRK05-08

Two wells were installed west of BH96-9 to provide monitoring points for groundwater downgradient of the south-western portion of Grum Dump. These wells were installed as part of the assessment of options for collection of Grum Dump seepage, in the event that seepage collection is required. Both wells were installed on August 24, 2005 using SDS Drilling's sonic rig, according to the methods summarized in Section 2.1.3 for BH05-9b. Both wells terminated bedrock; the sonic drill is poorly suited for drilling in bedrock, and advancing the boreholes to greater depths was impractical.

SRK05-07 was installed on the south side of the Grum Dump Toe Access Road, downgradient of the dump toe seep location SRK-GD16 and upgradient of the Sweet Creek sample station (Figure 2.1). This seep has been intermittently observed as a surface flow. In 2003, a test pit excavated on the upgradient (north) side of the road showed water inflow to the pit at a depth of approximately 3 m (SRK 2004c). Appendix A contains the core log and monitoring well installation details for SRK05-07.

SRK05-08 was installed on the south side of the Grum Dump Toe Access Road, at the intersection of the Grum Dump Toe Access Road and a ridge that runs perpendicular from the dump toe to Vangorda Creek (Figure 2.1). This ridge forms a surface water divide, and the location was selected to assess whether groundwater flow mimicked surface patterns. Appendix A contains the core log and monitoring well installation details for SRK05-08.

No water samples were collected from SRK05-07 or SRK05-08 in 2005. Following well installation, water levels were near the bottom in both wells, and there was insufficient water to sample. Monitoring in 2006 will show whether these wells are deep enough to provide water quality monitoring capability along the southwest margin of Grum Dump.

2.2 Water Quality

2.2.1 Reference Water Quality Stations

Monitoring of the six Reference Water Quality Stations (RWQSs) (Figure 2.1) identified in the AMP was carried out by site environmental staff during 2005. These stations were:

- V2 - located on the main stem of Grum Creek, below Tributary B.
- V2A - located on the ditch that presently diverts Grum Creek into Moose Pond.
- V14 - located at the Grum Dump Toe Access Road upgradient of Sheep Creek. This station appears to have changed locations over the course of monitoring and may also have been monitored on the road downgradient of SRK-GD05, and upstream of V15 at the dump toe.
- V16 - located in the ditch adjacent to the Grum Toe Access Road between V15 and Grum Creek.
- V15 - located at the outlet of the Tributary A sedimentation pond.
- P96-9A- located adjacent to Tributary A, downgradient from V15.
- Moose Seep- located between Moose Pond and Vangorda Creek. This station was made an RWQS in 2005.

Monitoring frequency at V15, V2, and V2a was increased from monthly to twice-monthly following the data review carried out as part of the AMP Event #4 Response in early 2005. Historical monitoring results are discussed in Section 3.1.1 along with monitoring results from 2005.

2.2.2 Grum Dump Toe Seepage Survey

Seeps at the toe of the Grum Dump have been sampled as part of the spring (May/June) and fall (September) seepage surveys completed since 2002. Results of the seep surveys are reported in SRK (2006b) and a summary of the relevant data is provided in Section 3.1.2. The purpose of the surveys was to determine the water quality associated with discrete seepage pathways exiting the toe of the dump, prior to any dilution or attenuation that could have occurred downgradient of the dump. The toe seeps are typically free of suspended sediments, and are analyzed for routine parameters and dissolved metals. Total metals are not included due to the potential for entrainment of sediments during sampling. The locations of the toe monitoring stations are shown in Figure 2.1.

2.2.3 Downgradient Pathways Survey

Selected downgradient seepage monitoring stations (GD05 d/s, Sweet Creek, Sheep Creek, Moose Seep) have been monitored on a spring/ fall basis since 2003, and monitoring of these stations was continued in 2005. Selected additional stations have been intermittently monitored, and two additional stations were sampled in 2005 (WGD01- fall only and Sheep Creek US- spring only). These downgradient stations monitor water quality along potential Grum Dump drainage pathways not captured in the routine monitoring program. Station locations are shown in Figure 2.1, and monitoring results are discussed in Section 3.1.3.

One station (Moose Seep) initially monitored as part of the downgradient surveys was added to the routine monitoring program carried out by site environmental staff in 2005. The data review and analysis carried out as part of the AMP Event #4 Response identified Moose Seep as a potential location to monitor water quality downgradient of Moose Pond. Moose Seep was added to the routine monitoring program in 2005, with sampling to occur on a twice-monthly basis.

2.3 Grum Creek Weir Instrumentation

A 90° V-notch weir was installed on Grum Creek at the upstream end of the Grum Creek Diversion in September 2004, and preparations were made to install a data logger during October 2004 to provide a continuous record of flow volume in Grum Creek during the 2005 open water season (SRK, 2005). None of the instrumentation options for monitoring water levels in shallow pools are suitable for exposure to sub-zero temperatures, and for this reason the instrument itself was not installed until April 2005.

A Thalimedes water level monitoring instrument, with a built-in data logger, was installed in a stilling well in the pool upstream of the v-notch weir in April 2005 by Access Consulting of Whitehorse (see Appendix A in SRK (2005) for installation details). The instrument was removed in September 2005 by SRK staff and delivered to Access Consulting for data recovery and over-winter storage. The resulting Grum Creek flow record is discussed in Section 3.2.

2.4 Options for Emergency Collection of Grum Creek Flow and Transfer to Grum Creek

The data review and analysis carried out as part of the AMP Event #4 Response identified degraded water quality in Grum Creek as a potentially risk to the receiving environment water quality in Vangorda Creek. One recommendation of the AMP Event #4 Response Status Report (SRK 2005) was that site management needed to assess realistic lead times required for sourcing the pumps, piping, and related hardware, as well as the time required for installation of same.

Discussion between SRK staff and site management indicate that the necessary pumps, piping, and related hardware for collection and transfer of the entire flow of Grum Creek are available on site. Deployment of this system could be achieved within a one week timeframe, should collection and transfer be required.

3 Results of 2005 Monitoring, Field Activities, and Data Review

3.1 Water Quality Monitoring

3.1.1 Reference Water Quality Stations

Station V2

Zinc and sulphate concentrations at Station V2 are shown in Figure 3.1 for the entire period of record (1988 through 2005). As indicated in the figure, total and dissolved zinc concentrations were highly variable during mining operations, and runoff and erosion from the Grum Dump led to continued variable and elevated zinc concentrations at V2 during the period from the cessation of mining through 2002. Improved runoff management since 2002 has resulted in total and dissolved zinc concentrations within a much narrower range at V2.

In 2005, the range of zinc concentrations at V2 was similar to that observed in 2004 (2005 range from below detection (0.005 mg/L) to 0.05 mg/L). However, there is a year-over-year trend of increasing zinc concentrations (particularly dissolved zinc), indicating the continued increase in arrival of oxidation products from Grum Dump at V2.

Sulphate concentrations at V2 showed a consistent increase from the initial pre-mining period through operations, and this trend continued through mid-2004. This increasing trend in sulphate concentrations at V2 triggered Event #4 of the Adaptive Management Plan on the date of implementation (July 1, 2004). Since mid-2004, sulphate concentrations at V2 appear to have stabilized within a seasonally-variable range of 700 to 1200 mg/L, with the highest observed sulphate concentration to date occurring in October 2004. Future monitoring is required to confirm that sulphate concentrations at V2 have stabilized.

Water at V2 continues to show slightly alkaline pH conditions. Other than the previously-reported sulphate trigger, were no specific thresholds exceeded in 2005 at V2.

Station V2A

Zinc and sulphate concentrations at Station V2A are shown in Figure 3.2 for the entire period of record (1997 through 2005). Sulphate concentrations at V2A show a similar pattern to those at Station V2, with concentrations increasing from the earliest monitoring through 2004, and appearing to have stabilized in 2005. In 2005, sulphate concentrations at V2A remained with the range observed in 2004 (2005 range 325 to 900 mg/L) with the highest concentrations occurring in July and August.

Zinc concentrations have shown strong season patterns in 2004 and 2005, with the highest concentrations occurring in June. Zinc concentration were generally within a range of 0.05 to

2 mg/L over the period of mid-2001 through 2005, within isolated excursions outside this range, and there is no trend of increasing zinc concentrations over this period. The seasonal variability in zinc concentration at V2A has been emphasized by the increase in monitoring frequency since mid 2004.

Water at Station V2A continues to show lightly alkaline pH conditions.

Station V14 and V16

Stations V14 and V16 have been monitored on a sporadic basis, from 1989 in the case of V14 and from 1995 in the case of V16. V14 was originally established to sample seepage present on the Grum Dump Toe Access Road upgradient of Sheep Creek (Figure 2.1). However, station location maps also occasionally show V14 to be located on the road downgradient of dump toe seep SRK-GD05, as well as upstream of V15 at the dump toe. Given the uncertainty in the station location, the pre-2004 data for V14 has questionable value for informing management decisions.

Station V16 is located in the ditch adjacent to the Grum Toe Access Road between V15 and Grum Creek (Figure 2.1), and was initially established in 1995 when water management activities included selective diversion of Grum Creek water to either Moose Pond or to V15, depending on water quality. During September 2004, this station was observed to receive seepage from the adjacent disturbed ground, particular in the area of SRK04-5. No September 2004 sample was collected during routine monitoring. This station also variably receives runoff from the adjacent road.

Zinc and sulphate data for the period of record are shown in Figure 3.3 for Stations V14 and V16. Values for both parameters remain within previously observed ranges. Given the sporadic and uncertain nature of the monitoring, trends in concentration cannot be reliably evaluated. Although sampling of these stations is required by the water licence, the resulting data has questionable value for informing management decisions.

Station V15

Station V15 is located at the outlet of the Tributary A sedimentation pond (upstream of Station V2-Figure 2.1), and has been a reliable sampling point since pond construction in 1995. This location is thought to be directly downgradient from the Grum sulphide cell, and water chemistry at this location is expected to be a good indicator of the arrival and loading of oxidation products from the sulphide cell. A summary of sulphate and total and dissolved zinc concentrations at V15 is shown in Figure 3.4.

Sulphate concentrations at V15 steadily increased over the 1995 through 2001 period. From 2001 through early 2004, sulphate concentrations at V15 were within a stable range (700 to 1050 mg/L). This stable period was followed by a period of increasing concentrations from around 1000 mg/L to around 200 mg/L by June 2005, with a single high result of 2990 mg/L recorded in February 2005. Samples collected during the June through November 2005 period returned sulphate concentrations in the range of 1750 to 2060 mg/L, and may indicate that sulphate concentrations are stabilizing. Future monitoring will be necessary to confirm this stable trend.

Dissolved and total zinc concentrations at V15 were high variably from 1995 to 2002, typically ranging from 0.01 to 0.1 mg/L, with occasional values as high as 1 mg/L. This variability is the result of operational and post-operational water management, as discussed above for Station V2. Following the implementation of dump runoff control in 2002, zinc concentrations have been lower and more uniform, ranging between 0.006 and 0.05 mg/L. Zinc concentrations at V15 in 2005 were generally within the previously observed range. There appears to be a year-over-year increase in average zinc concentrations, although this may be an artifact of the increased frequency of monitoring over this period. Slightly alkaline waters have been observed over the period of record, with pH values consistently between 7 and 8 since 2000.

Moose Seep

Moose Seep is located below Moose Pond approximately 25 m upslope from Vangorda Creek just upstream of Grum Creek (Figure 2.1), and has been monitored since Fall 2003. Monitoring frequency increased from twice-yearly to twice-monthly in 2005 as part of the AMP Event #4 Response.

Discontinuous surface flow was observed between natural depressions in the original moss ground cover for approximately 25 m upslope of the sample station and downslope to the edge of Vangorda Creek. No mineral soil was exposed in this vicinity. Minor lime-green algae were present in the sampled pond at the time of sampling. Surface flow into the sampled depression has been visually estimated to be about 1 L/minute and was the largest seep identified below Moose Pond.

Zinc and sulphate concentrations at Moose Seep over the period of monitoring are shown in Figure 3.5. Sulphate concentrations have ranged from 427 to 814 mg/L, and observed zinc concentrations have ranged from less than detection (0.005 mg/L) to 0.012 mg/L. Zinc concentrations appear to have increased somewhat in 2005, although 4 of 8 samples collected in 2005 returned zinc concentrations below the detection limit of 0.005 mg/L. Moose Seep had a neutral to slightly alkaline pH during all monitoring rounds.

Station P96-9a and -9b

A single hole was drilled and one shallow (P96-9A) and one deeper piezometer (P96-9B) were installed in 1996 to allow monitoring of groundwater quality adjacent to Tributary A, immediately downstream of the Grum Dump toe access road (Figure 2.1). These wells were intended to monitor the early arrival of oxidation products from the Grum sulphide cell in groundwater, in the same way that V15 was intended to monitor surface seepage.

Sulphate concentrations in the shallow unconfined aquifer at P96-9A show an increasing trend over the 1996-2001 period (Figure 3.6), and then show a period of stable concentrations with seasonal variations (950 to 1600 mg/L) from 2001 through 2005. Field pHs have varied between 5.9 and 7.7 since installation, and there appears to be an evolving trend of declining pH. Dissolved zinc and iron concentrations have been somewhat variable, but zinc concentrations remain low (up to 0.03 mg/L since 1999), and iron concentrations have remained below 0.08 mg/L since 2001.

Sulphate concentrations in the deeper confined aquifer (P96-9B) , which experienced flowing artesian conditions, were between 100 and 320 mg/L from 1996 through 2001 (Figure 3.7). P96-9B became non-functional in 2001 and no samples have been collected from the deeper well since that time. From 1996 through 2001, dissolved iron concentrations varied from 0.01 mg/L to 0.31 mg/L, with the highest concentration measured on the most recent (2001) sample. Dissolved zinc concentrations ranged from below the detection limit of 0.01 mg/L to 0.04 mg/L; samples since 1999 have had dissolved zinc concentrations at or near the detection limit. Field pH reported for the 1996 to 2001 period ranged from 7.6 to 8.3 standard pH units, and showed no discernable trend.

In 2005, BH05-9b was installed to replace the damaged P96-9b. Monitoring of BH05-9b in 2006 will allow assessment of the evolution of water quality in the deep aquifer at this location since 2001.

3.1.2 Grum Dump Toe Seeps

SRK-GD01

SRK-GD01 is located where the main stem of Grum Creek emerges from the toe of Grum Dump (Figure 2.1). During initial surveys, two seeps were identified and separately sampled as SRK-GD01 and SRK-GD02. Review of analytical results showed that both had similar chemistry and were likely from the same source, and monitoring of SRK-GD02 was terminated.

SRK-GD01 represents the largest surface flow identified at the toe of Grum Dump by a wide margin, and is thus considered to be the most important single source of surface flows originating from the dump. Sulphate concentrations have remained between 1080 and 1390 mg/L over the monitoring period (2002 through 2005). Dissolved zinc has varied between 2.5 and 17 mg/L over the same period, with peaks during the 2004 and 2005 freshets. Fall zinc concentrations have remained relatively constant (range of 2.5 to 3.7 mg/L) over the monitoring period.

Neutral pH conditions were observed during all sampling rounds. Figure 3.8 shows dissolved zinc and total sulphate at SRK-GD01 over the four year period from 2002 to 2005. Complete results, including data from previous years, are provided in Appendix B1.

SRK-GD05

Stations SRK-GD05 and SRK–GD06 are located at the dump toe directly upgradient of the linear topographic depression shown on Figure 1.1 as No Fork Creek. During initial surveys, two seeps were identified and separately sampled as SRK-GD05 and SRK-GD06. Review of analytical results showed that both had similar chemistry and were likely from the same source. Therefore, monitoring of SRK-GD06 was terminated.

Sulphate and dissolved zinc data for SRK-GD05 are summarized in Figure 3.9. Slightly alkaline pH was observed at SRK-GD05 during all sampling rounds. Sulphate concentrations ranged from 1080 to 1760 mg/L over the monitoring period, and a general trend of increasing sulphate concentrations is apparent, although the rate of increase appears to have decreased since 2004. Zinc concentrations range from 1.7 to 5.2 mg/L, with the highest concentrations measured in September 2005. Zinc concentrations appear to be increasing, although the 2005 results were at or near the limits of the historically observed range. Complete results, including data from previous years, are provided in Appendix B1.

Flows volumes at SRK-GD05 and SRK-GD06 are low compared to Grum Creek flows, but these seeps appear to flow continuously and were sampled during all sampling rounds. Although seepage infiltrates into the ground within a few metres of the dump toe, emergent seepage is observed topographically downgradient in No Fork Creek at station GD05 d/s, with seepage volumes that exceed those observed at the toe on the basis of visual observation and crude field measurements. It is inferred that subsurface flow is more significant than surface flow at SRK-GD05, and that the No Fork Creek drainage is a preferred groundwater flowpath and a potential route for transport of contaminants from Grum Dump to Vangorda Creek. Sampling results from No Fork Creek are discussed in Section 3.1.3 under station GD05 d/s.

SRK-GD16

SRK-GD16 is located at the toe of Grum Dump topographically upgradient from the linear alignment shown on Figure 2.1 as Sweet Creek. Flows were observed during only two of eight sampling rounds. Seepage had field pHs ranging from 7.3 to 7.5, sulphate concentrations of 1680 to 2090 mg/L, and dissolved zinc concentrations of 10.8 to 60 mg/L. The high zinc sample was collected in May 2005, and represents the highest zinc concentration observed from any external toe seep from Grum Dump. Complete results, including data from previous years, are provided in Appendix B1.

During geotechnical investigations in 2003, a 4 m test pit was excavated adjacent to the Grum Dump toe access road (SRK, 2004c) at a location immediately downgradient of SRK-GD16. The pit was sited in a gentle topographic swale that is the upstream extension of the linear depression occupied by Sweet Creek. Although no surface flow was observed at SRK-GD16 at the time, heavy seepage into the test pit was observed at a depth of 3 m. The observed seepage flow rate was sufficient to cause destabilization and collapse of the test pit walls, and indicated that subsurface flow was likely occurring upgradient of Sweet Creek.

A monitoring well was installed adjacent to the Grum Dump Toe Access Road in August 2005, near the test pit location described above. This well had insufficient water for sampling at the time of well installation.

SRK-GD04 and SRK-GD21

SRK-GD04 and SRK-GD21 are located immediately upgradient of V15 and Tributary A (Figure 2.1) at a minor topographic low along the dump toe. Surface flow in this area was observed during only 4 of 8 sampling rounds. Sulphate concentrations ranged from 1350 to 2170 mg/L, zinc concentrations ranged from 1.8 to 3.7 mg/L, and pH ranged from 7.1 to 7.7 standard pH units. A sample was collected in May 2005, and returned intermediate sulphate and zinc concentrations compared to previously values. Complete results, including data from previous years, are provided in Appendix B1.

3.1.3 Downgradient Pathways Survey

GD05 d/s

Station GD 05 d/s is located in the linear depression topographically downgradient from the toe seep station SRK-GD05 (Figure 2.1), which was discussed in Section 3.1.2. This station, which is the downstream limit of surface flow, was previously sampled by SRK in 2003 and 2004. The bed of the flow was original ground (moss and vegetation), with minor hard tan precipitate observed on the moss.

Seepage at GD05 d/s had field pHs ranging from of 6.9 to 7.9, sulphate concentrations of 972 to 1360 mg/L. Dissolved zinc concentrations were <0.005 mg/L during all five monitoring rounds from 2003 through 2005. Figure 3.10 shows dissolved zinc and total sulphate concentrations over the monitoring period at GD05 d/s; there appears to be a trend of increasing sulphate concentrations, similar to the trend observed in the upgradient dump toe seep at SRK-GD05. Complete results are provided in Appendix B2.

Sweet Creek

Sweet Creek was sampled in September 2004, and in both May and September 2005, at a sampling station 20 metres above the confluence with Vangorda Creek (Figure 2.1). This station is downgradient of dump toe seepage station SRK-GD16, as discussed in Section 3.1.2. At this location a small inactive fan has formed at the mouth of the steep Sweet Creek drainage within the incised Vangorda Creek valley. This fan may provide a subsurface flow path to Vangorda Creek. Surface flow volumes have been estimated by the bucket-and-stopwatch method to be approximately 60 to 90 L/min. The stream bed at this location was covered with moss or vegetation, which had been coated with a hard tan to orangey tan precipitate crust.

Field pH at Sweet Creek ranged from 8.0 to 8.1, with sulphate concentrations ranging from 847 to 1190 mg/L. Dissolved zinc concentrations were less than the detection limit (0.005 mg/L) during all three monitoring rounds. Figure 3.11 shows dissolved zinc and total sulphate concentrations over the monitoring period at Sweet Creek; complete results are provided in Appendix B2.

Sheep Creek

Sheep Seep is located at the break in slope where Sheep Creek enters the incised Vangorda Creek valley (Figure 2.1). Upstream of this point, flow in the Sheep Creek drainage occurs largely as diffuse flow in the shallow subsurface across the width of the gentle topographic depression shown in the figure. Continuous surface flow originates at the increase in slope where the Sheep Creek depression intersects the incised Vangorda Creek valley, and remains on surface to immediately above the confluence with Vangorda Creek. At this point, the entire flow infiltrates into a fan deposit adjacent to Vangorda Creek. This station was previously sampled by SRK in 2003 and 2004.

Field pH at Sheep Seep has ranged from 7.3 to 8.3 over the 2003 to 2005 period. Sulphate concentrations have ranged from 44 to 68 mg/L, and dissolved zinc concentrations have ranged from <0.005 to 0.006 mg/L over the same period. Sulphate, calcium and magnesium concentrations were all higher, by up to 15%, in both Spring and Fall 2005 than had been previously observed. Figure 3.12 shows dissolved zinc and total sulphate concentrations over the monitoring period at Sheep Creek; complete results are provided in Appendix B2.

WTA02

Station WTA02 represented seepage ponded on the roadway of the Grum Dump toe access road near the upper end of Sheep Creek (Figure 2.1) which was sampled in September 2004 and in May 2005. Seepage originates as diffuse flow from a 10 metre section of the upslope road cut and is sufficiently concentrated to sample only in the roadway. Dark grey phyllitic bedrock is exposed in the road cut. Upslope topography suggests that the seepage face is the intersection of the road cut with a minor topographic swale, and the surface topography indicates that this station should not be influenced by Grum Dump drainage. Surface flow volume was visually estimated 1 L/minute. Clasts in the roadway within and adjacent to flow had encrustations of white hard precipitate.

Seepage at WTA02 had field pHs of 7.55 and 8.0, sulphate concentrations of 18 and 286 mg/L, and dissolved zinc concentrations below the detection limit of 0.005 mg/L during monitoring in both September 2004 and May 2005. Complete results are provided in Appendix B2.

WGD01

Station WGD01 is located above Sheep Creek west of Grum Dump (Figure 2.1) and was sampled in September of both 2004 and 2005. At WGD01, seepage over a diffuse area approximately 40 m by 50 m, beginning 15 m laterally out from the dump toe. This area does not appear to be topographically downgradient of the dump. However, clasts within the exposed mineral soil were coated with hard white to tan encrustations of precipitate, which suggests high dissolved solids concentrations in water from either natural mineralization or influence from the dump. The surrounding area appears boggy, with stunted trees growing on small dispersed hummocks. Filamentous green algae were observed in isolated locations within the larger seepage area. Total flow was visually estimated to be approximately 2 L/minute.

Seepage at WGD01 in September 2004 had a field pH of 7.7 and a sulphate concentration of 384 mg/L. In September 2005, field pH was 7.9, and the seepage had a sulphate concentration of 380 mg/L. Dissolved zinc concentrations of below the detection limit of 0.005 mg/L were observed during monitoring in both September 2004 and 2005. Complete results are provided in Appendix B2.

3.1.4 Groundwater Monitoring

Most groundwater monitoring wells downgradient of Grum Dump are Reference Water Quality Stations, and results for these stations were discussed in Section 3.1.1. The following discussion is limited to groundwater monitoring results from wells installed in 2004 and 2005.

Moose Well 2 (SRK05-09)

Installation of Moose Well 2 was completed in September 2005, as described in Section 2.1.1. Sampling of Moose Well 2 was first carried out on October 3, 2005, and analytical values of 763 mg/L sulphate and 0.0094 mg/L dissolved zinc were reported. Two subsequent sampling events in early and mid-November returned similar results, with sulphate concentrations of 827 and 764 mg/L, and dissolved zinc concentrations of 0.008 and 0.006 mg/L, respectively. Field pH was between 7 and 8 during all monitoring rounds.

The elevated sulphate concentrations around 800 mg/L are very similar to those observed upgradient at V2A (the point of Grum Creek discharge into Moose Pond). These similar sulphate concentrations in shallow groundwater and in Grum Creek at V2A support the assumption that infiltration into Moose Pond reports to Vangorda Creek via a diffuse shallow groundwater pathway.

The low zinc concentrations observed at Moose Well 2 (~0.008 mg/L vs. ~0.5 mg/L at V2A) support the interpretation that zinc loadings from Moose Pond to Vangorda Creek are low, and that significant attenuation is occurring along the seepage pathway between Moose Pond and Moose Well 2. The available information suggests that this attenuation will continue to provide Vangorda Creek with a measure of protection against elevated zinc loadings from Moose Pond. Ongoing monitoring of Moose Well 2 is required to confirm that concentration of dissolved zinc in shallow groundwater downgradient of Moose Pond remains low.

SRK05-05c

Installation of SRK05-5c was completed in August, 2005, as described in Section 2.1.2. Water quality at SRK05-5c was monitored in November 2005. Sulphate concentration was 173 mg/L, and dissolved zinc concentration was below the detection limit of 0.005 mg/L.

Although Grum Creek is within 10 m of SRK05-5c and is slightly topographically upgradient, the much higher sulphate concentrations in the creek (~900 mg/L at V2A) suggest that the shallow groundwater at SRK05-5c has a significant component of the flow that originates from some other source. Sulphate concentrations at V15 (which is located in a topographic low which receives seepage directly from Grum Dump) are much higher than at SRK05-5c, suggesting a local runoff source for most of the shallow groundwater at SRK05-5c. As the adjacent wells SRK04-5a and –b are screened in a confined, artesian aquifer, it is possible that the shallow groundwater at SRK05-5c is sourced from the underlying hydrostratigraphic unit. The following section discusses the water quality in these deeper artesian wells.

SRK04-05a and -05b

SRK04-5a and –b are nested wells that were installed adjacent to Grum Creek and the Grum Dump Toe Access Road in 2004, as described in Section 2.1.2. Flowing artesian conditions were encountered at a depth of 12.5 m. The deep monitoring well was completed in weathered bedrock and the shallow piezometer was completed immediately below the inferred aquitard (SRK 2005). It is therefore likely that the two wells are hydraulically connected.

Artesian conditions have persisted since installation. As such, it has not been possible to determine static water levels for either monitoring well, but the piezometric surface in the confined aquifer was determined to be greater than 2.7 m above the adjacent ground surface.

Samples from each well were collected in September 2004 and September 2005. Samples collected from the deep well (SRK04-5A) had lab pH of 8.0 to 8.3, sulphate concentrations of 90 to 108 mg/L, and dissolved zinc concentrations of 0.008 to 0.01 mg/L. Samples collected from the shallow well (SRK04-5B) had lab pH of 8.0 to 8.3, sulphate concentrations of 85 to 100 mg/L, and dissolved zinc concentrations of <0.005 to 0.015 mg/L.

Sulphate concentrations in SRK04-5a and -5b are similar to sulphate concentrations observed in well P96-9a, and somewhat similar to P96-9b. Sulphate concentrations in the confined aquifer are lower than observed in the shallow unconfined aquifer. However, the strong upward gradient observed at these wells indicates that contaminants from the shallow unconfined aquifer cannot migrate advectively to the deeper (confined) aquifer, and therefore will not degrade the deeper aquifer in the vicinity of SRK05-5c.

3.2 Grum Creek Discharge Monitoring

Flow in Grum Creek at the Grum Creek weir peaked on May 19, 2005, at just over 26 L/s. Summer base flow in Grum Creek, for the period of August through September, appears to be 3 to 4 L/s. Raw data and corrected flow volumes are shown in Figure 3.13.

These measurements of Grum Creek discharge appear to agree with estimates of runoff from the upgradient catchment that were incorporated into the water and load balance (SRK 2005). The discharge data will be used to calibrate the runoff model at a later date, when a more extensive discharge record is available. The water and load balance will be reviewed at that time.

4 Summary and Conclusions

4.1 Final Implementation of AMP Event #4 Response Plan

The outstanding components of the AMP Response Plan were implemented in 2005. The following summary addresses the points raised in "*Section 6: Recommendation and Commitments for Further Action"*, in the 2004 AMP Event #4 Status Report, and the actions taken in 2005 to address these commitments.

Recommendation #1: Increase monitoring of surface and groundwater

Response actions in 2005:

- Increased monitoring frequency at stations V15, V2, and V2a to twice-monthly from monthly.
- Installed a groundwater monitoring well (Moose Well 2) between Moose Pond and Moose Seep, and initiated twice-monthly monitoring.
- Reviewed monitoring data and included monitoring results as part of the regular monthly report to the Water Board.

Recommendation #2: Discuss capacity and requirements for implementing collection and transfer of Grum Creek with site management

Response actions in 2005:

- Discussed availability of pumps and related piping, and the capacity of site staff to implement collection and transfer of Grum Creek if dictated by degraded water quality. Site management is confident that the necessary hardware is currently available on site, and that implementation could be carried out within the span of one week.

Recommendation #3: Implement collection and transfer of water to Vangorda Pit if zinc concentrations exceed acceptable levels

Response actions in 2005:

- None. Zinc concentrations in Grum Creek did not exceed acceptable levels in 2005.

Recommendation #4: Monitor potential contaminant pathways downgradient of Grum Dump at stations that are not part of the routine monitoring network

Response actions in 2005:

- Carried out May and September monitoring of both Grum Dump toe seeps and previously-identified downgradient stations between Grum Dump and Vangorda Creek.

Recommendation #5: Continue existing monitoring and planned investigations in the area between Grum Dump and Vangorda Creek

Response actions in 2005:

- Installed and monitored Grum Creek discharge monitoring instrumentation.
- Installed three additional groundwater wells, over and above those specifically outlined in the Response Plan, as part of seepage collection feasibility studies.
- Monitored routine Reference Water Quality surface and groundwater stations as required by the Water Licence.

Recommendation #4: Report results of 2005 AMP Event #4 monitoring activities

Response actions in 2005/06:

- Summarized results of 2005 monitoring activities in the 2005 AMP Annual Report.
- Prepared the current document to document Response activities in detail.

4.2 Summary of Water Quality Monitoring Results

Water quality at Station V2 continues to show a statistically significant increasing trend in sulphate concentration. 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 2005 dump toe seepage surveys indicate that zinc concentrations in dump seepage are increasing, with the highest observed zinc concentration to date recorded at SRK-GD16 in May 2005 (60 mg/L). Zinc concentrations in Grum Creek (the largest discharge from Grum Dump) in 2005 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 all surface and shallow subsurface flowpaths.

5 Recommendations

The following points summarize recommendations for continued monitoring of water quality downgradient of Grum Dump, and for implementation of additional water management if zinc concentrations exceed acceptable levels.

1. Continue monitoring Reference Water Quality Stations, as required under the AMP, by site environmental staff on a twice-monthly basis. Moose Well 2, the new monitoring well downgradient of Moose Pond, should be added to the list of Reference Water Quality Stations, and monitored on a twice-monthly basis as well.

2. Implement collection and transfer of water to Vangorda Pit if zinc concentrations exceed acceptable levels at station V2, at Moose Seep, or in the proposed groundwater monitoring well between Moose Pond and Moose Seep.

    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.

3. Continue Spring/ Fall downgradient pathway and dump toe seepage surveys.

4. Re-install flow monitoring instrumentation at the Grum Creek weir for the open-water period of 2006.

5. Review monitoring data on an ongoing basis. Results of the Reference Water Quality Station monitoring data should be included as part of the regular monthly report to the Water Board.

6. Summarize the 2006 monitoring results in the AMP annual report prepared by GLL. There will be no stand-alone Event #4 Status Report prepared for 2006 unless water quality thresholds are exceeded that necessitate additional management response.

This report, **"2005 AMP Event #4 Response: Status Report"**, has been prepared by SRK Consulting (Canada) Inc.

Dylan MacGregor, GIT (BC)

Reviewed by:

Peter Healey, P.Eng.

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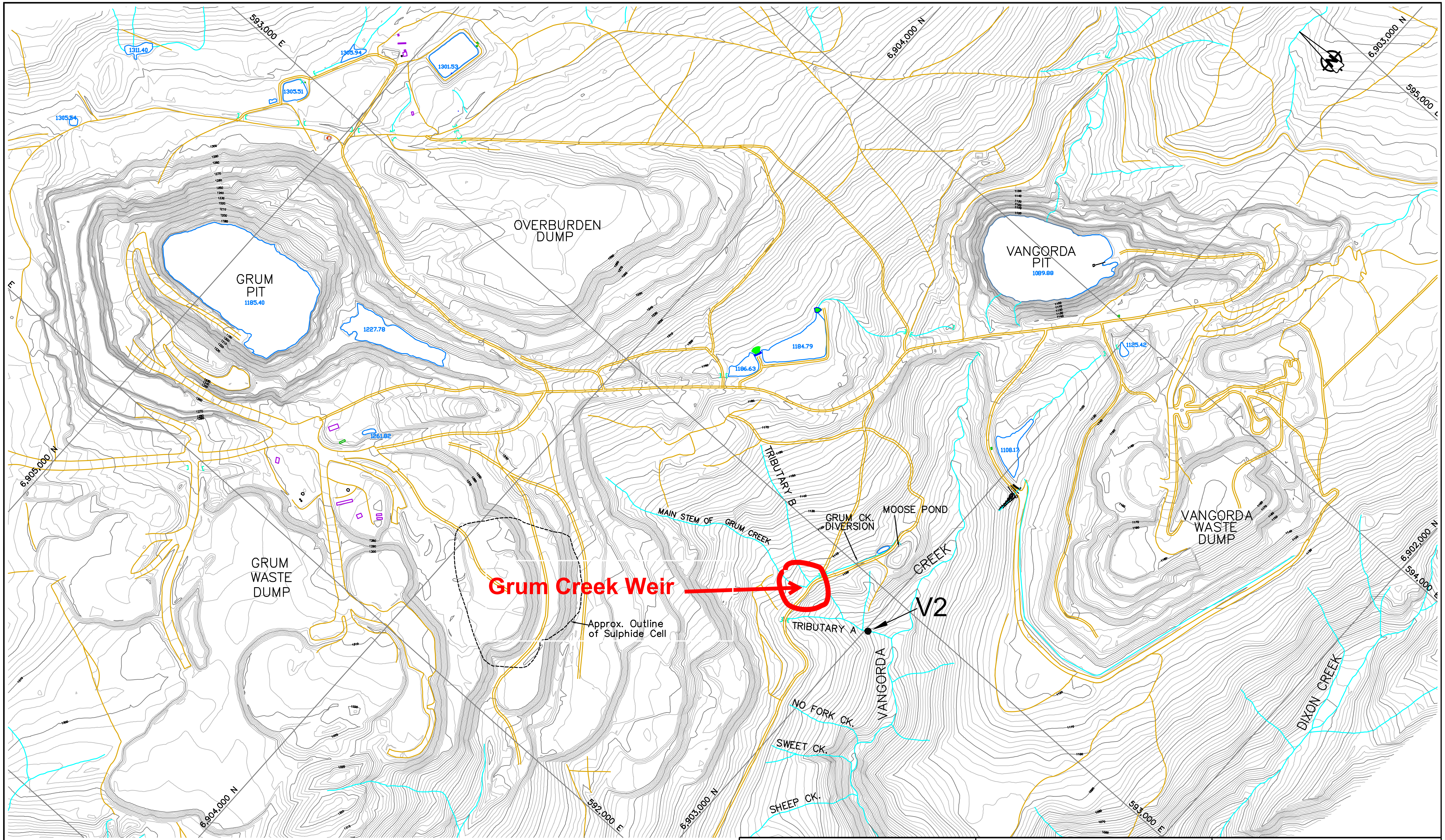
Figures



Date of Photography: 2003/07/25
Scale of Photography: 1:20000
Survey control derived from existing 1:20000 photography
Survey control based on: UTM Projection, NAD27
Compiled by The ORTHOSHOP, Calgary, September 2003
WO 8856

Note 1:
Sulphide cell outline from as-built drawing, Feb. 1996, as reported in Figure 1, Anvil Range Mining Corporation, May 1996.

0 100 200 300 400 500 Metres
1:10,000

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SRK JOB NO.: 1CD003.063.0100
Acad–Vangorda–Grum\Acad–2006\ site_plan_2006.dwg

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Anvil Range Mining Complex

2005 AMP Event #4 Response: Status Report

Site Plan

DATE:	APPROVED:	FIGURE:
Apr. 2006	D.B.M.	1.1

Legend

- ● Reference Water Quality Stations
- ● Dump Toe Seeps
- ● Downgradient Monitoring Stations
- ⊙ Groundwater Monitoring Well

Note 1:
Sulphide cell outline from as-built drawing, Feb. 1996, as reported in Figure 1, Anvil Range Mining Corporation, May 1996.

0 50 100 150 200 250 300 Metres
Scale 1:5000

Date of Photography: 03/07/25
Scale of Photography: 1:20000
Survey control derived from existing 1:20000 photography
Survey control based on: UTM Projection, NAD27
Compiled by The ORTHOSHOP, Calgary, September 2003
WO 8856

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SRK JOB NO.: 1CD003.063.0100
Acad-Vangorda-Grum\Acad-2006\ site_plan_2006-Photo.dwg

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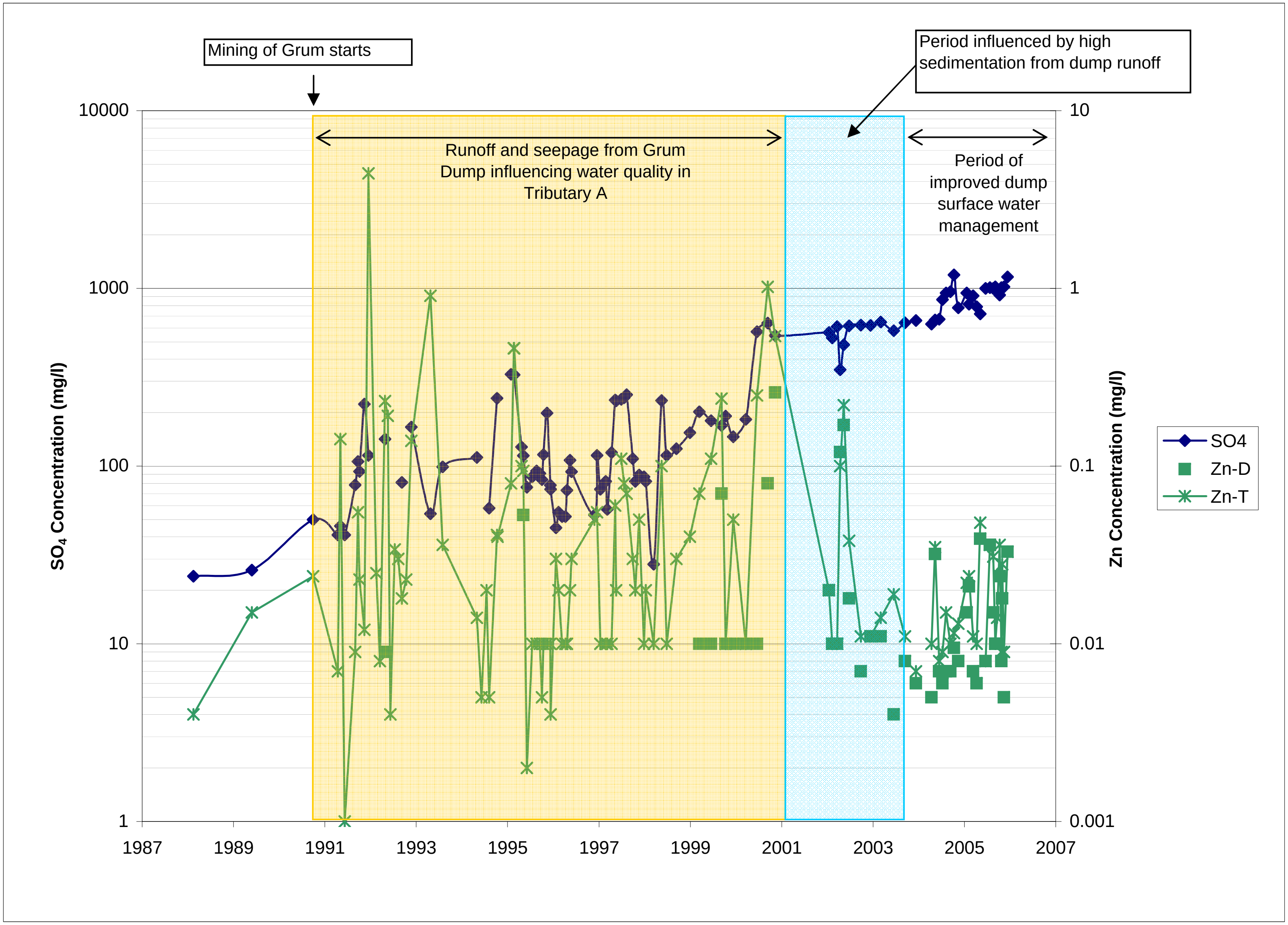
Anvil Range Mining Complex

2005 AMP Event #4 Response: Status Report

2005 Borehole and
Water Sampling Stations

DATE: Apr. 2006
APPROVED: D.B.M.
FIGURE: 2.1



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

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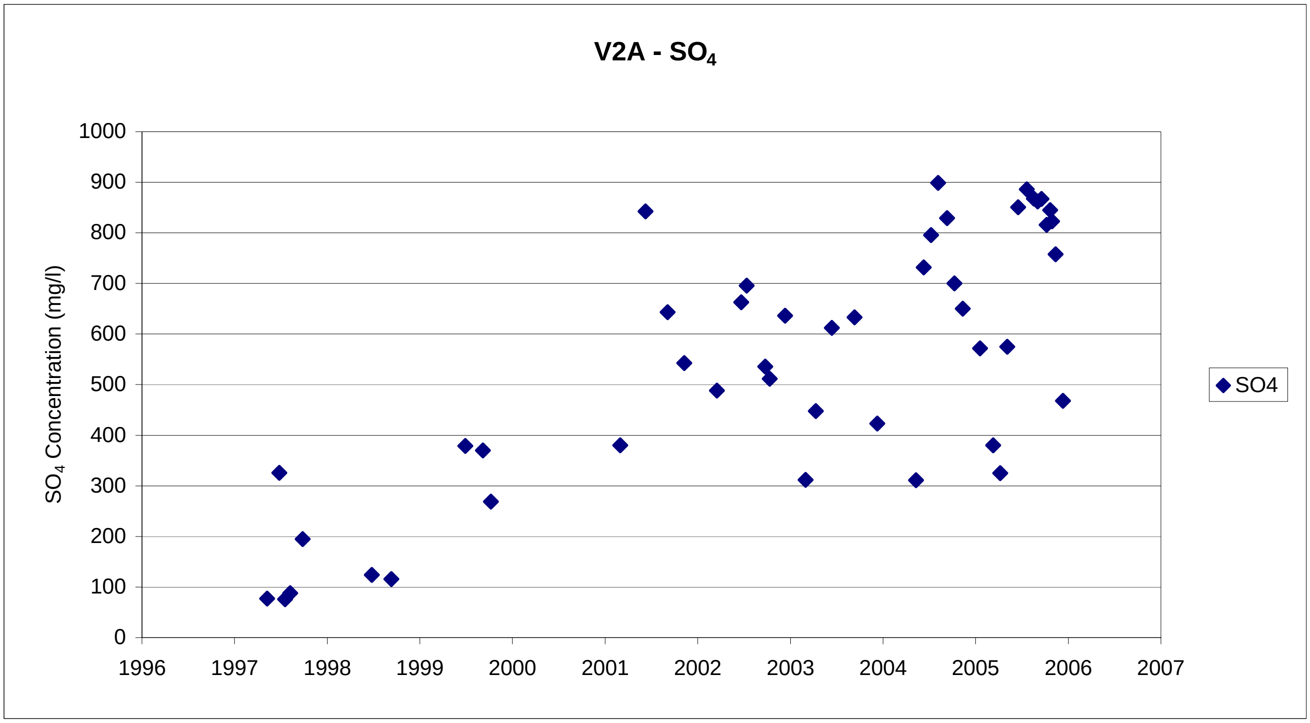
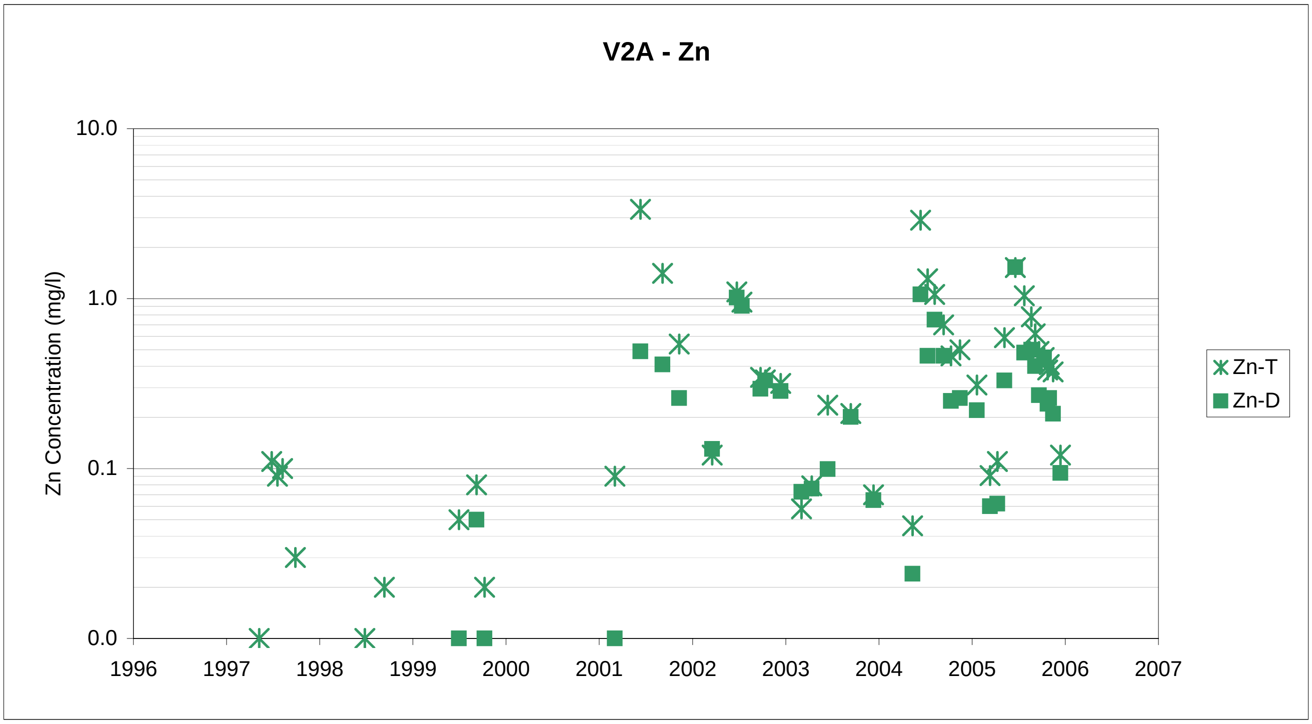
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at V2

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.1**





Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

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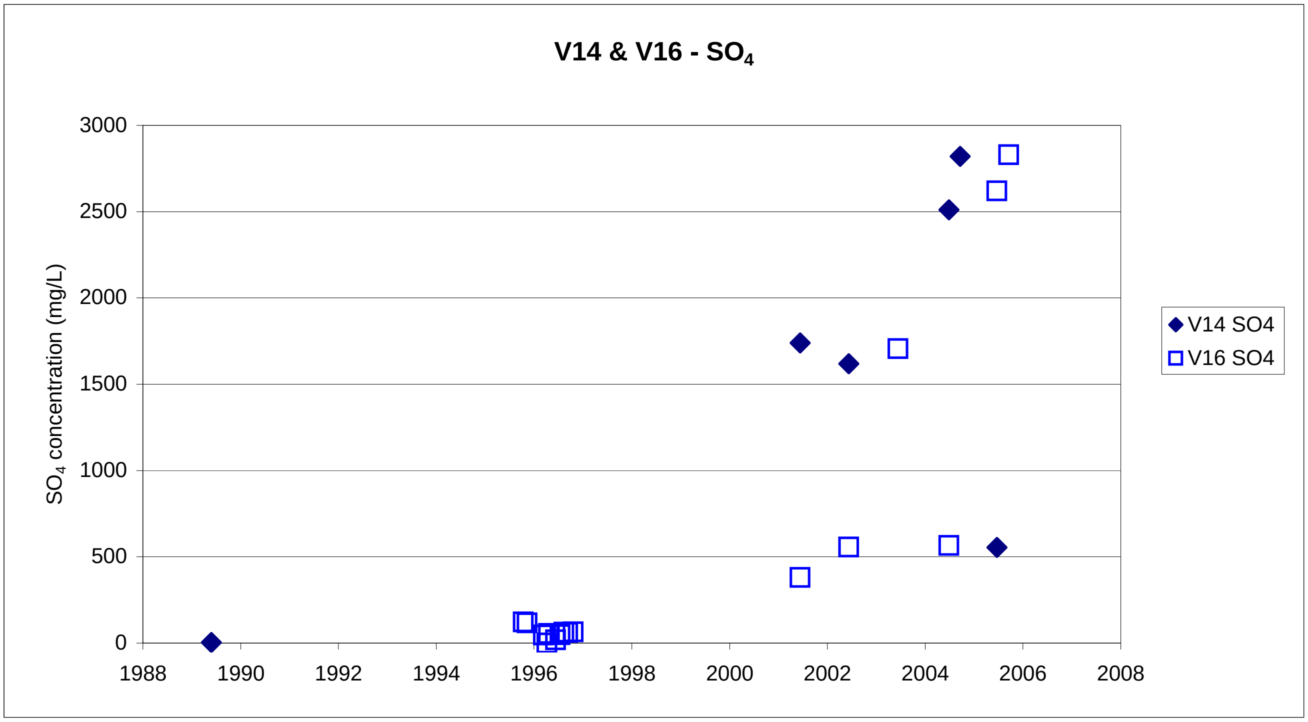
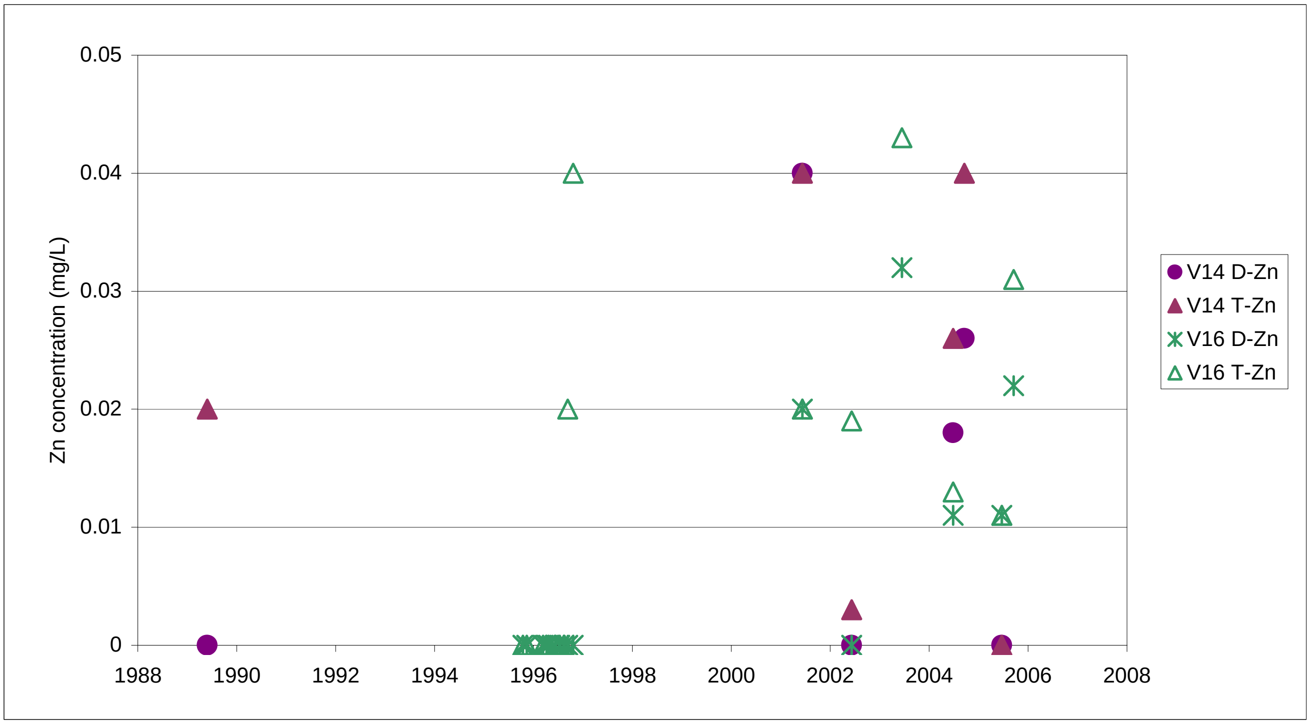
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at V2A

Project	Date	Approved	Figure
1CD003.063.0100	May-06		**3.2**





Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

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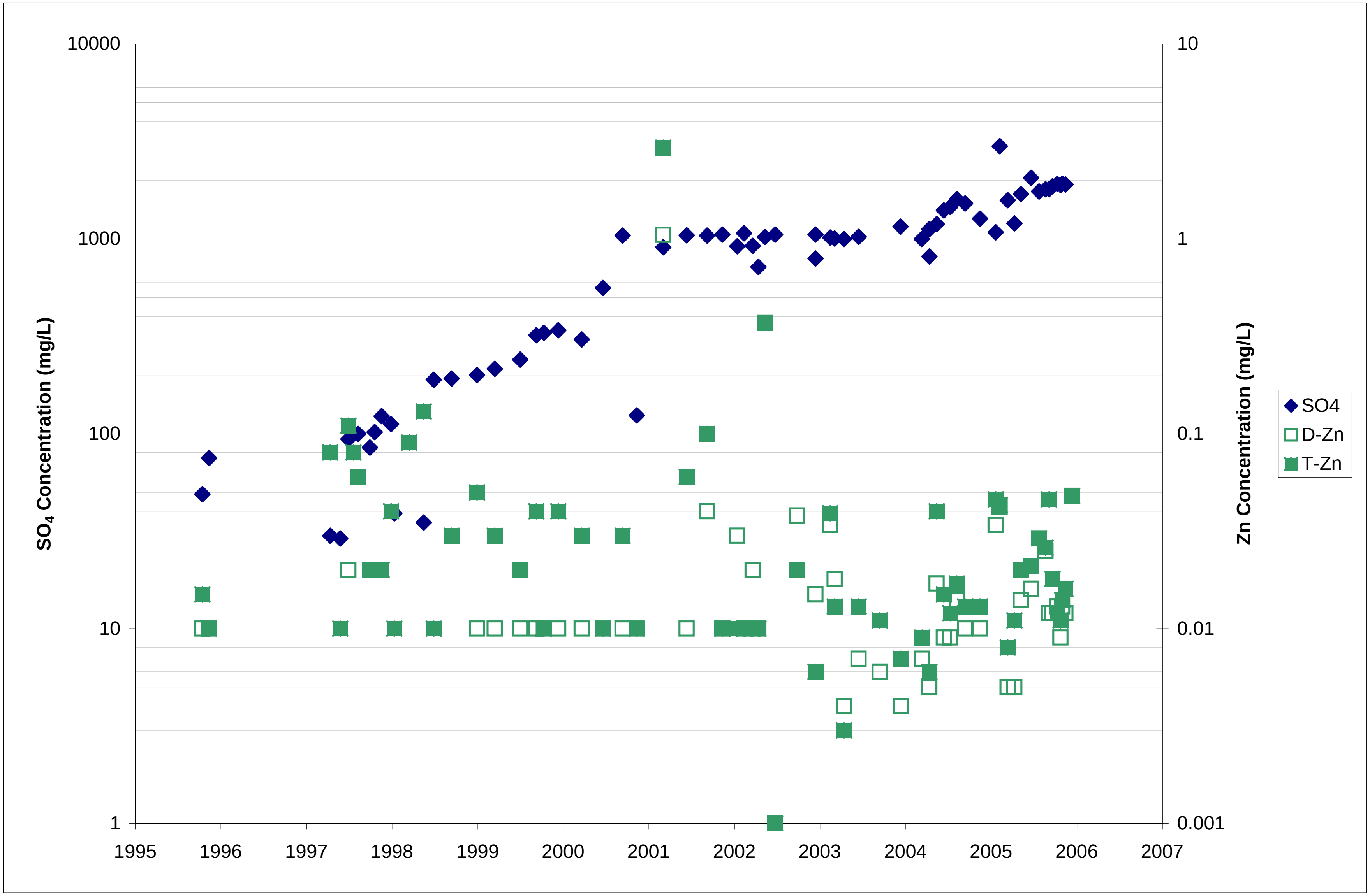
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at V14 and V16

Project	Date	Approved	Figure
1CD003.063.0100	May-06		**3.3**



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

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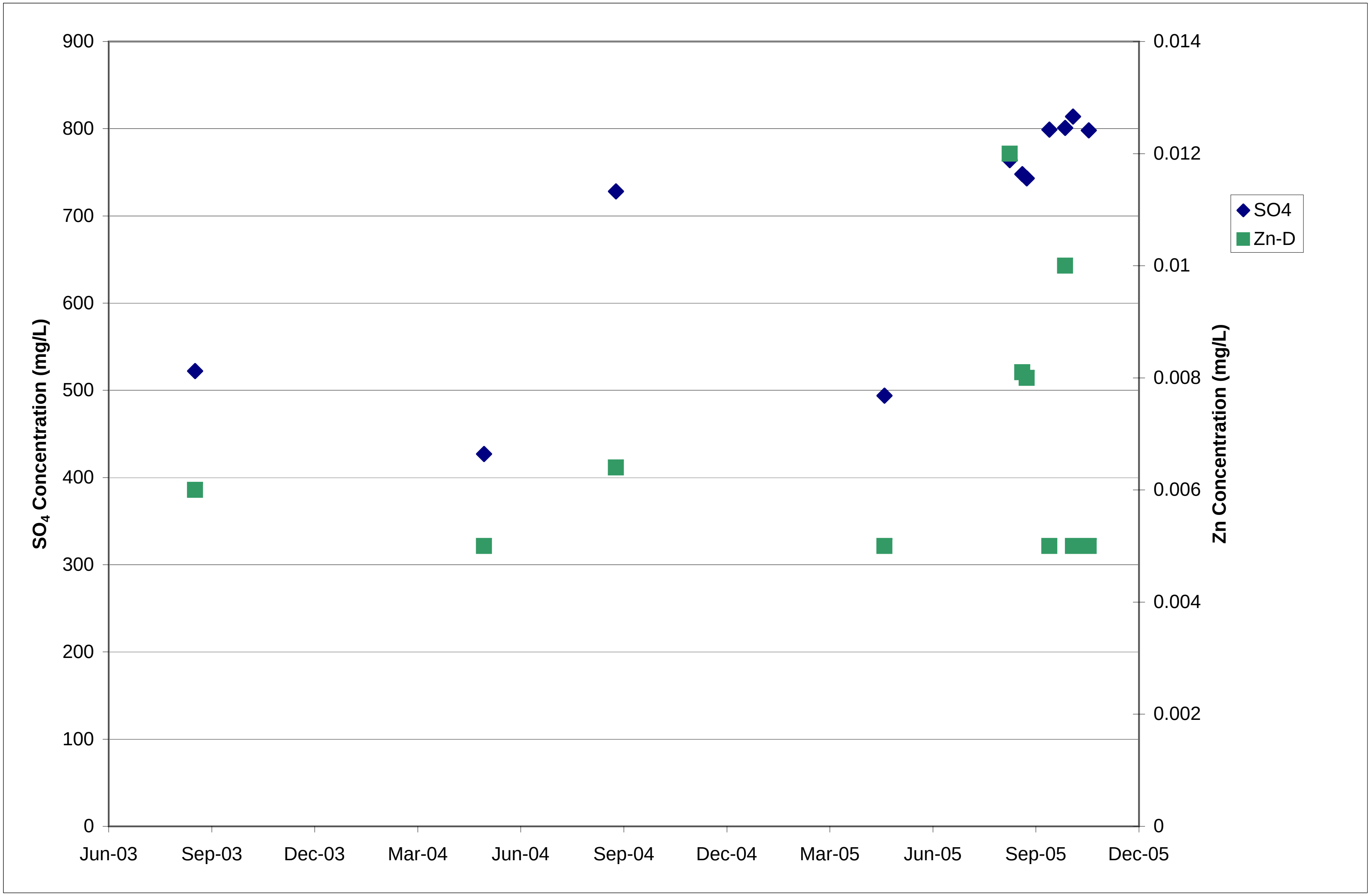
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at V15

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.4**



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

Detection Limit = 0.005 mg/L Zn

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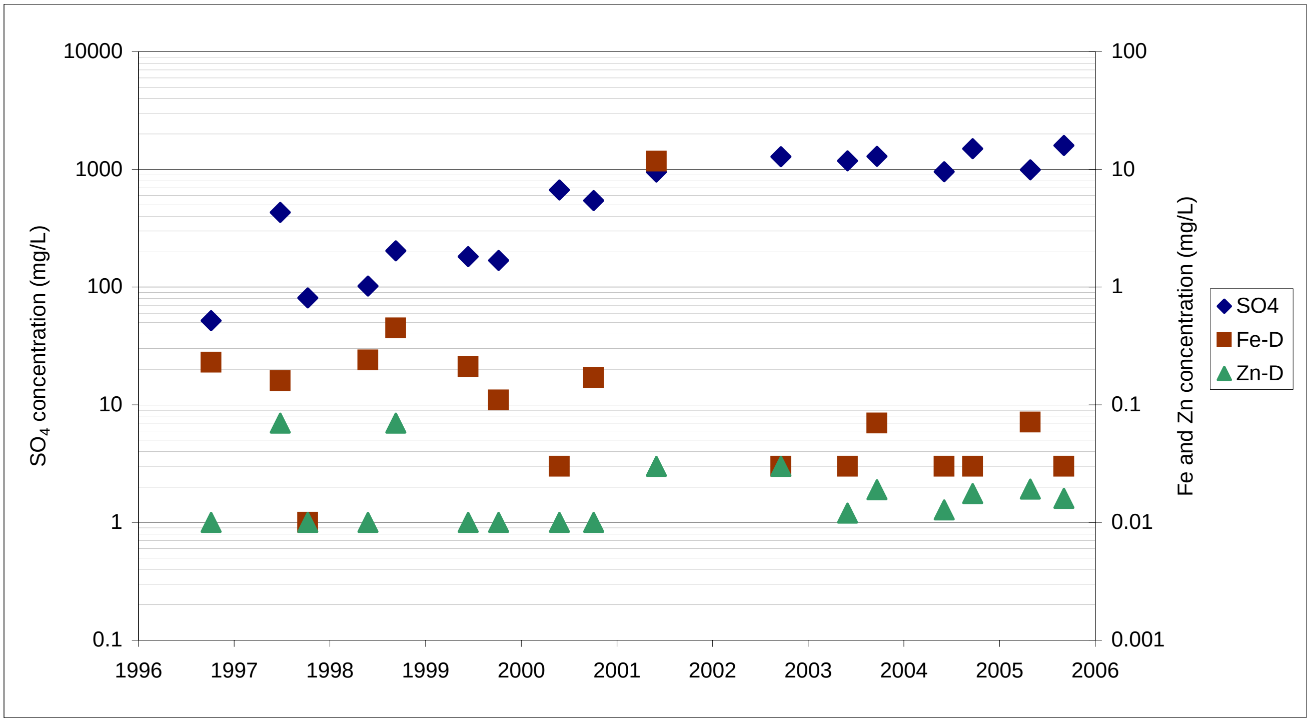
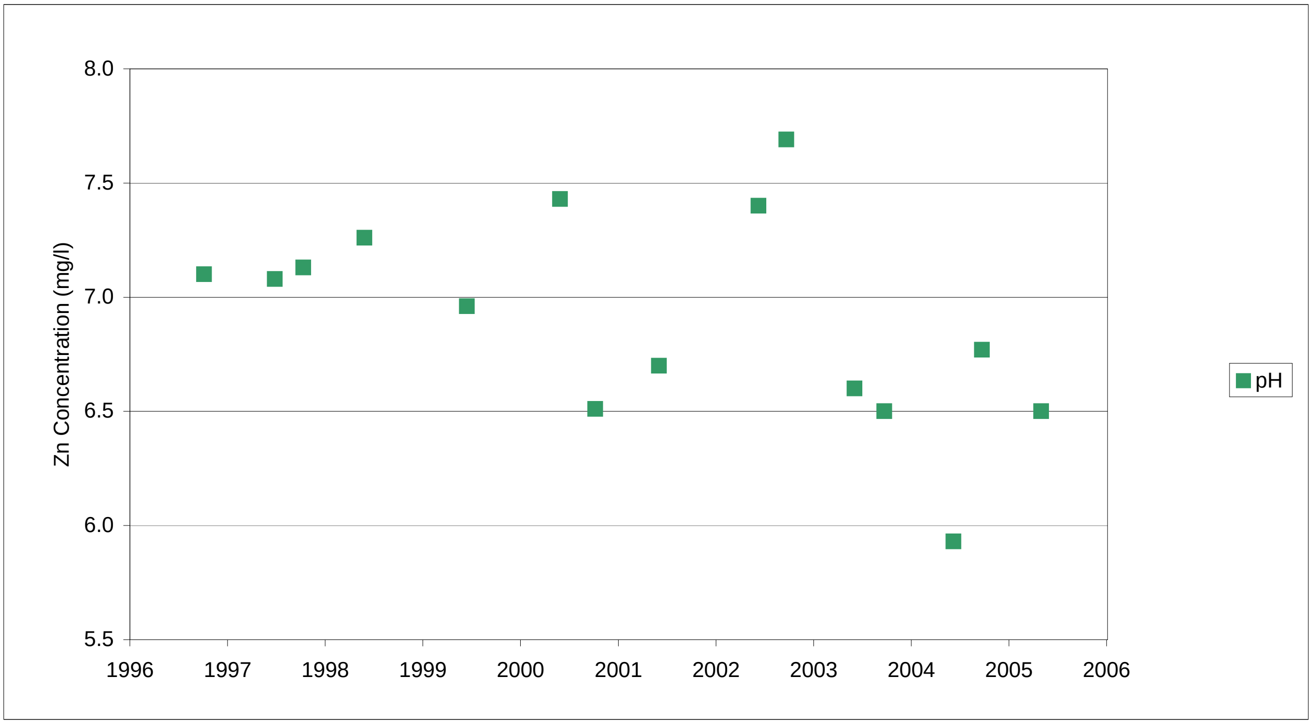
Status Report

Zinc and Sulphate Concentrations at Moose Seep

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.5**





Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

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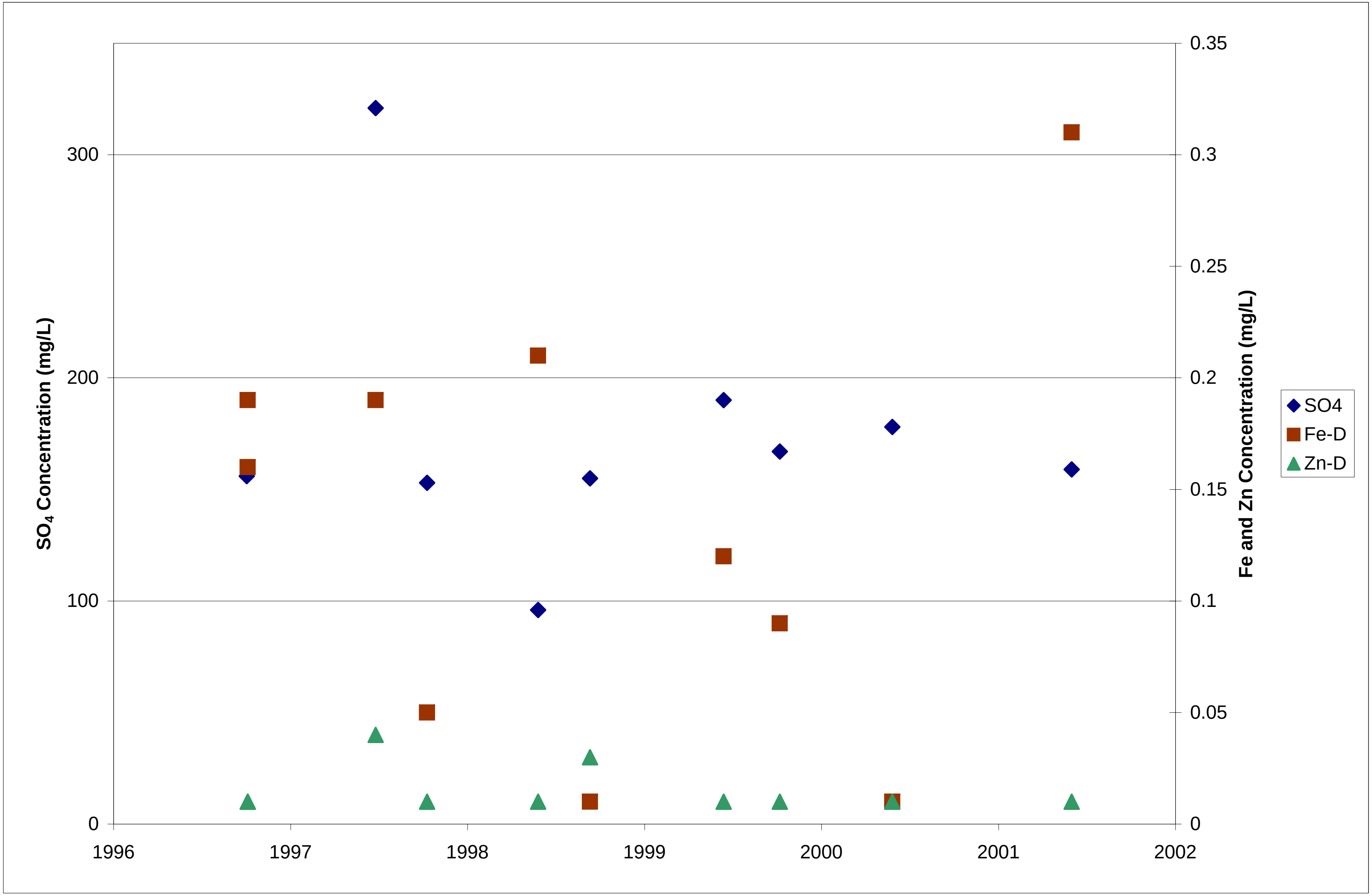
2005 AMP Event #4 Response:
Status Report

Zinc, Iron, and Sulphate Concentrations, and Field pH at P96-9a

Project	Date	Approved	Figure
1CD003.063.0100	May-06		**3.6**



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

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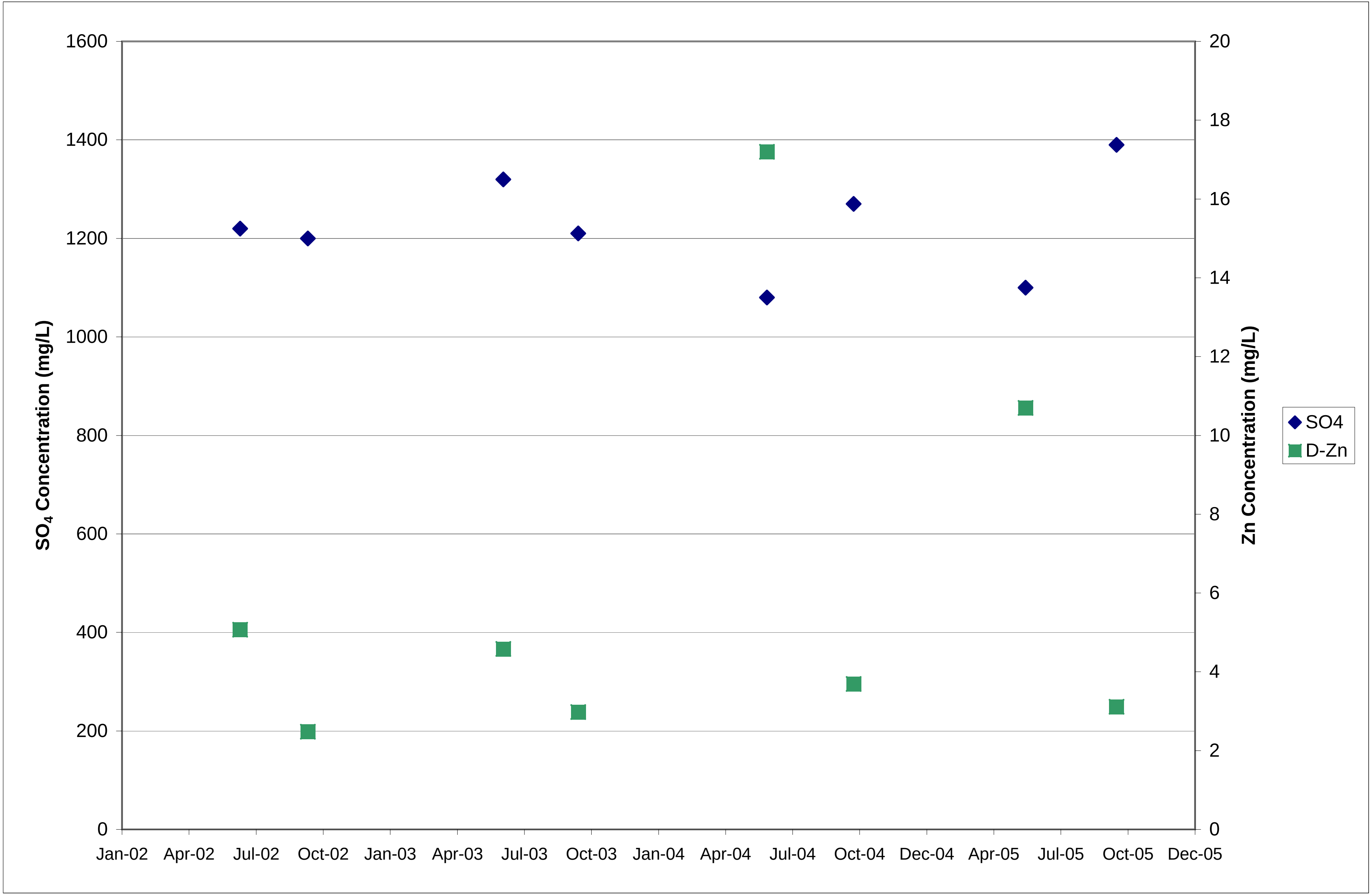
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at P96-9B

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.7**



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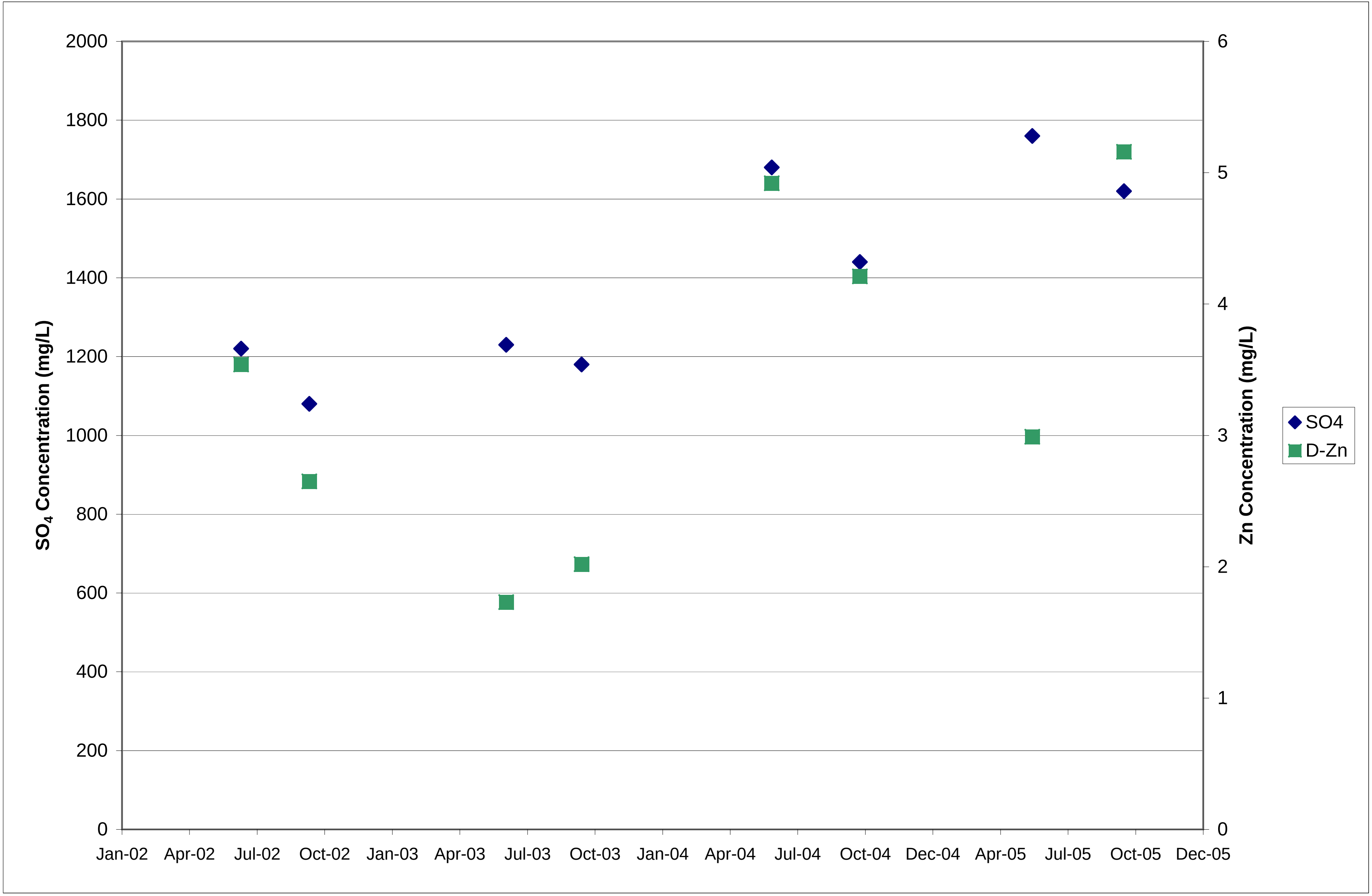
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at SRK-GD01

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.8**



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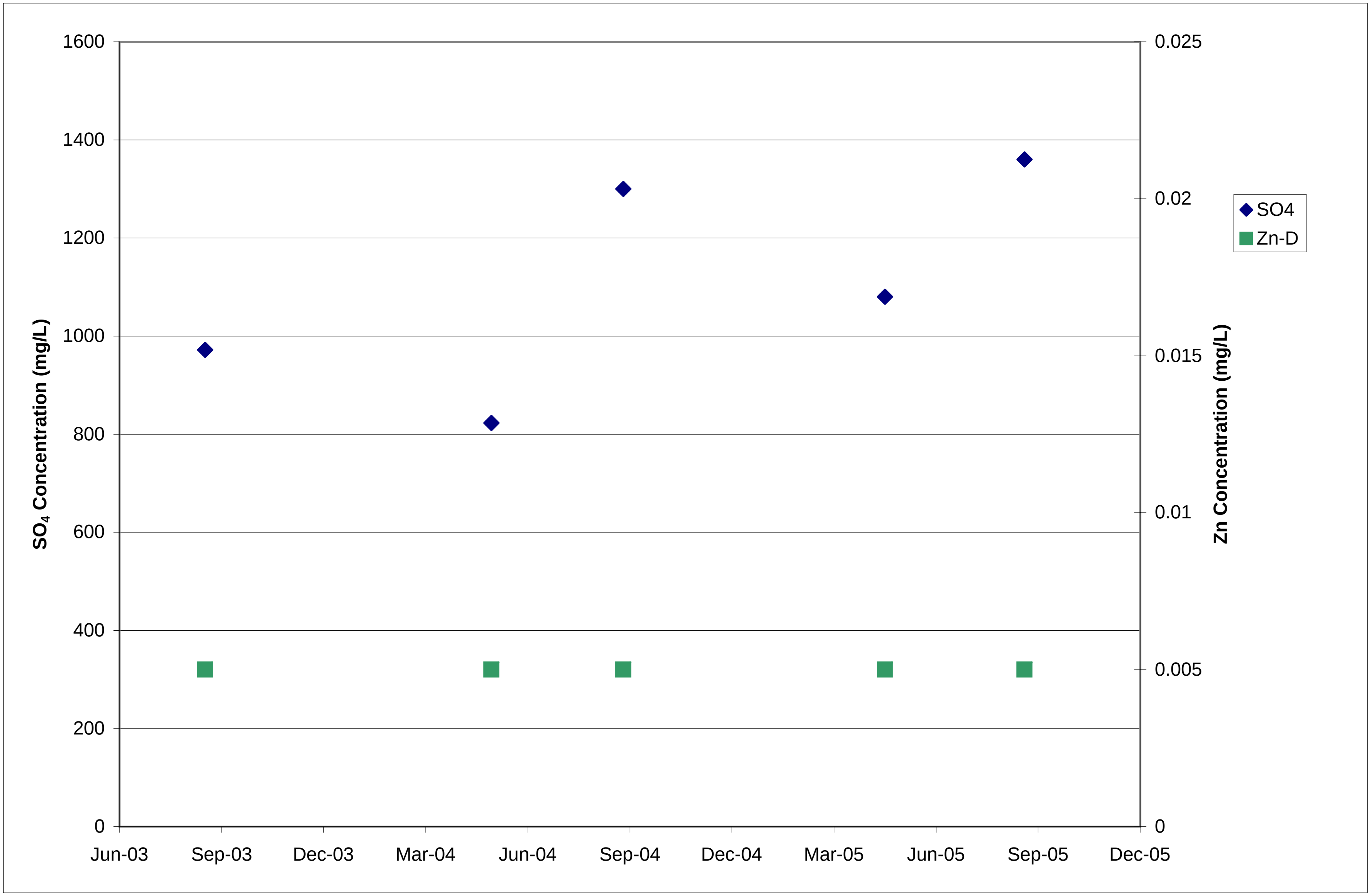
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at SRK-GD05

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.9**



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

Detection Limit = 0.005 mg/L Zn

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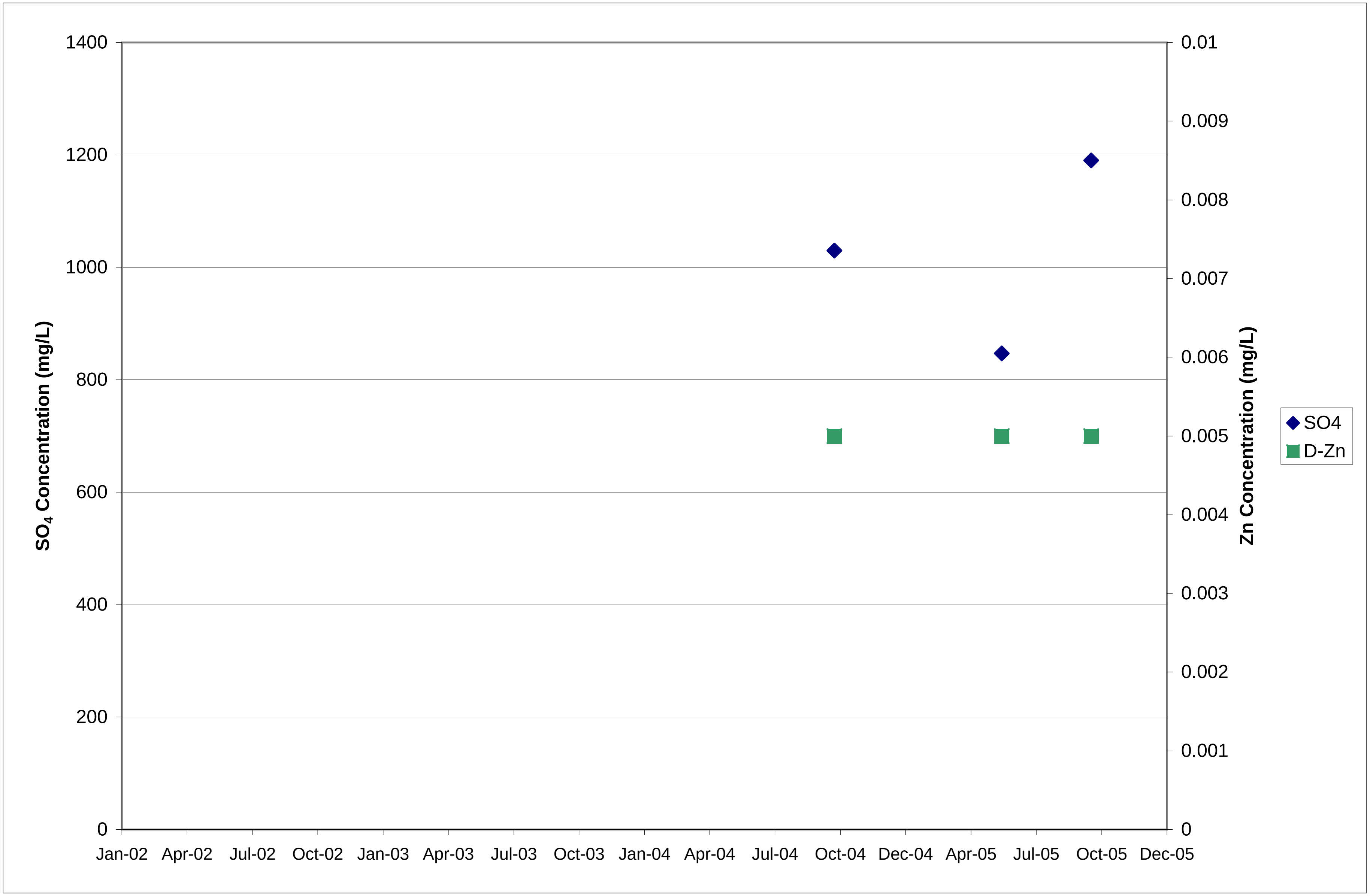
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations
at GD05 d/s

PROJECT 1CD003.063.0100	DATE May 2006	APPROVED	FIGURE **3.10**



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

Detection Limit = 0.005 mg/L Zn

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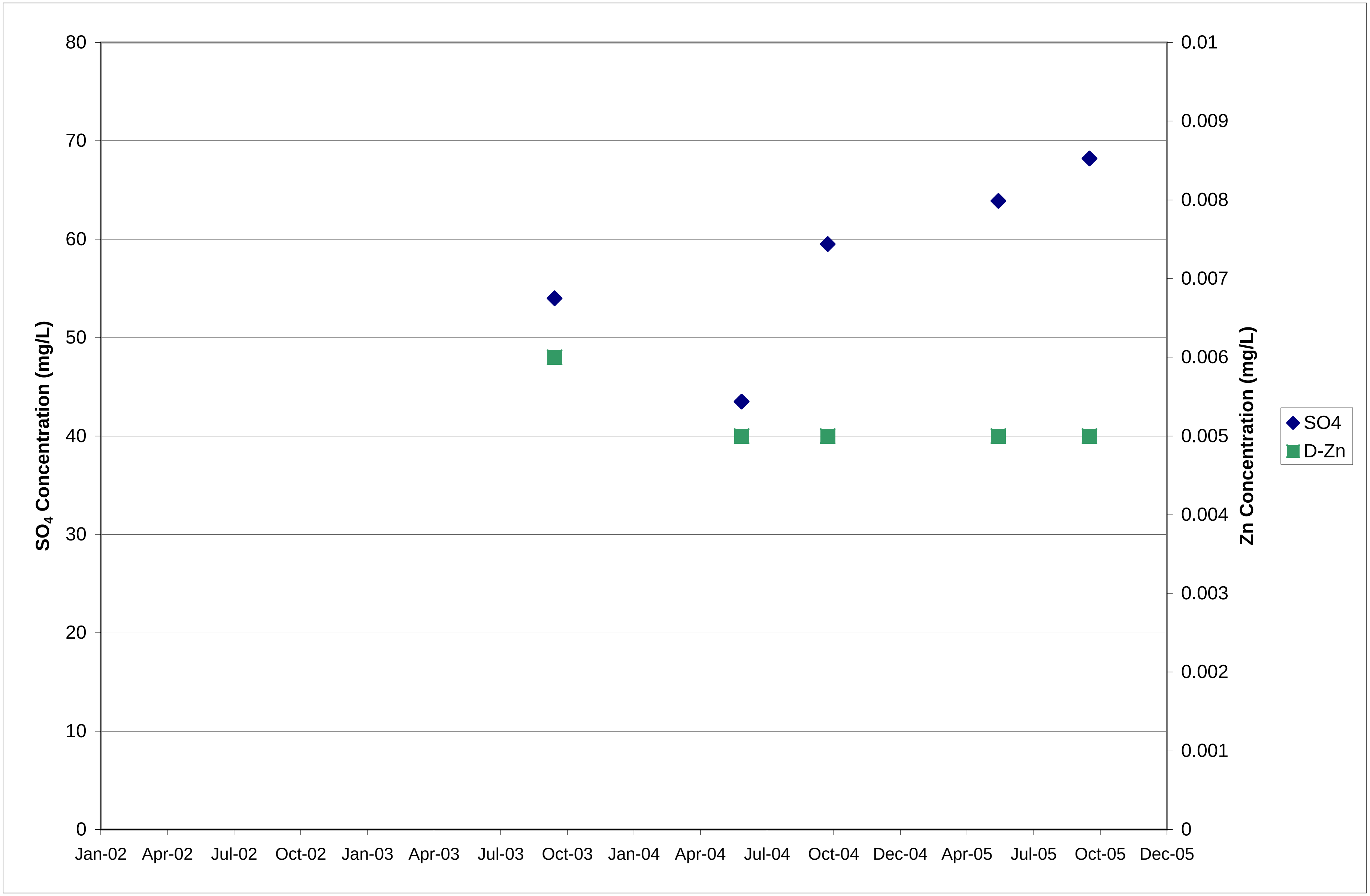
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at Sweet Creek

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.11**



Note: Dissolved zinc concentrations are plotted at the detection limit where values were reported as less than detection.

Detection Limit = 0.005 mg/L Zn

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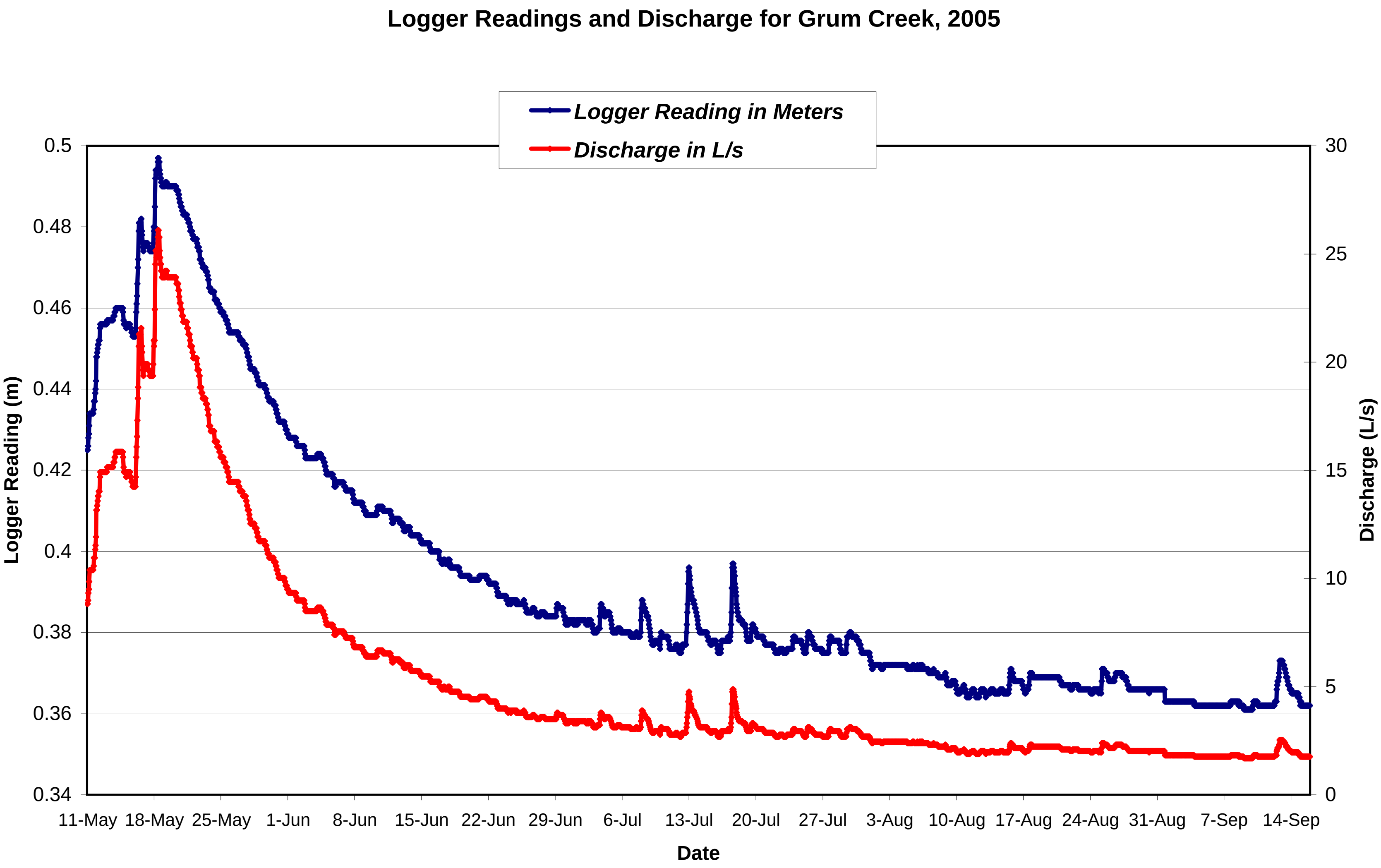
2005 AMP Event #4 Response:
Status Report

Zinc and Sulphate Concentrations at Sheep Creek

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.12**



*Data provided by Access Consulting.

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2005 AMP Event #4 Response:
Status Report

Grum Creek Discharge,
May- September 2005

PROJECT	DATE	APPROVED	FIGURE
1CD003.063.0100	May 2006		**3.13**

Appendix A

2005 Borehole Logs

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM-Moose Pond
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-04 **TO** 2005-08-04
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6902982.00 N 593043.00 E **DATUM:**

BOREHOLE: SRK05-06
PAGE: 1 **OF** 1
DRILL TYPE: Portable Hammer
DRILL: Pionjar
CASING:

SAMPLE CONDITION

☒	Remoulded
▨	Undisturbed
■	Lost
◧	Rock core

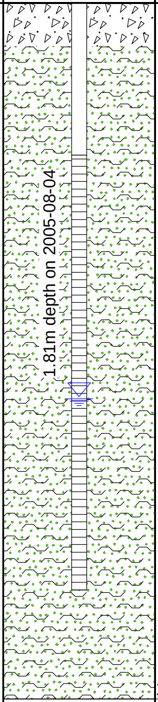
WELL PLUG MATERIALS

▵	Bentonite / Grout
●	Cuttings
🟩	Sand

TYPE OF SAMPLER

DC	Diamond core barrel	SS	Split spoon
GS	Grab sample	AS	Auger Sample

GENERAL COMMENTS: Stickup height=0.76m; 3 samples/bags: 1.32m, 2.18m, 3.2m



DEPTH - ft	DEPTH - m	ELEVATION - m DEPTH - m	DESCRIPTION	SYMBOL	TYPE AND NUMBER	CONDITION	RECOVERY %	RQD %	SAMPLE DESCRIPTION	DEPTH - m	LABORATORY and IN SITU TESTS
		1073.83	Natural ground surface								
		0.00	Sand, clayey, gravelly		SS-1	▨			0.00 Top organic soil, black.		
					SS-2	▨			0.10 Sand and gravel, poorly graded, brown, loose, damp.		
									0.30 Fine to medium sand, brown, with trace silt, loose, damp, well graded.		
	1				SS-3	▨				1	
5											
									1.60 Fine to medium sand, with clay, with fine to coarse gravel, brown, wet. Some more clayey levels presenting low plasticity.		
	2									2	
					SS-4	▨					
									2.70 Sandy clay (fine to medium sand), with fine to coarse gravel, dark grey, wet, with low plasticity.		
	3				SS-5	▨				3	
10		1070.63 3.20	END OF BOREHOLE								

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM-Moose Pond
FILE No: FARO (1CD003.063)
BORING DATE: 2005-09-17 **TO** 2005-09-17
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6902985.94 N 593058.50 E **DATUM:**

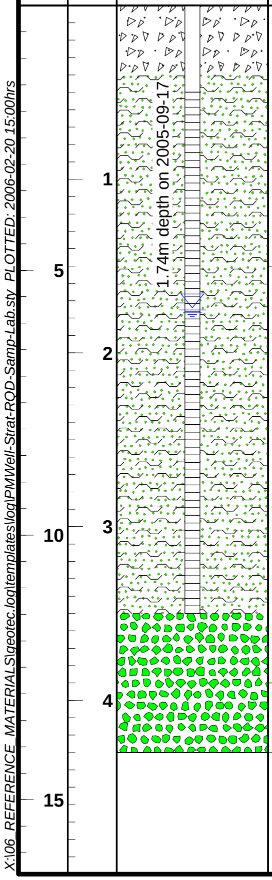
BOREHOLE: SRK05-09
PAGE: 1 **OF** 1
DRILL TYPE: Portable Hammer
DRILL: Pionjar
CASING:

SAMPLE CONDITION
- ☒ Remoulded
- ▨ Undisturbed
- ■ Lost
- ◧ Rock core

WELL PLUG MATERIALS
- ▵ Bentonite / Grout
- ▲ Cuttings
- ⁘ Sand

TYPE OF SAMPLER
- DC Diamond core barrel
- SS Split spoon
- GS Grab sample
- AS Auger Sample

GENERAL COMMENTS: Stickup height=1m (approx.)



STRATIGRAPHY			SAMPLES						
ELEVATION - m	DEPTH - m	DESCRIPTION	SYMBOL	TYPE AND NUMBER	CONDITION	RECOVERY %	RQD %	SAMPLE DESCRIPTION	LABORATORY and IN SITU TESTS
0.00		Natural ground surface							
	0.00	Top soil layer, no recovery		SS-1	■			0.00 Top soil layer, very soft, no recovery.	
-1.50	1.50	Silty sand with gravel	⁘	SS-2	▨			1.50 Silty fine to coarse sand, with some fine to coarse, angular to subangular gravel, greyish brown, soft, wet. Intercalated organic silt-clay (peat, black) layers, 5-8cm thick, and thin ash (white) layers (max 2cm thick).	
				SS-3	▨			2.60 As above, less fines, sub-angular to sub-rounded fine to coarse, gravel, wet. Contains minor silt.	
-3.90	3.90	Weathered bedrock, schist	▤	SS-4	▨			3.90 Weathered bedrock, schist, orangish-brown, wet.	
-4.30	4.30	END OF BOREHOLE							

DEPTH - m: 1, 2, 3, 4

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: Grum Creek
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-04 **TO** 2005-08-04
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6903208.00 N 592873.00 E **DATUM:**

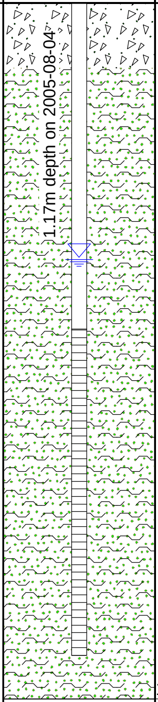
BOREHOLE: SRK05-05C
PAGE: 1 **OF** 1
DRILL TYPE: Portable Hammer
DRILL: Pionjar
CASING:

SAMPLE CONDITION
- ☒ Remoulded
- ▨ Undisturbed
- ■ Lost
- ◧ Rock core

WELL PLUG MATERIALS
- ▷ Bentonite / Grout
- ● Cuttings
- ⁘ Sand

TYPE OF SAMPLER
- DC Diamond core barrel
- GS Grab sample
- SS Split spoon
- AS Auger Sample

GENERAL COMMENTS: Stickup height = 0.84m



DEPTH - ft	DEPTH - m	ELEVATION - m / DEPTH - m	DESCRIPTION	TYPE AND NUMBER	CONDITION	RECOVERY %	RQD %	SAMPLE DESCRIPTION	DEPTH - m	LABORATORY and IN SITU TESTS
		1104.08	Natural ground surface							
		0.00	Sand, gravelly, with silt and clay		▨			0.00 Top soil: fine to coarse sand, with clay and gravel (fine to coarse), dark grey, damp, loose, with organic matter (roots).		
	1			SS-1					1	
5										
					▨			1.75 Silt or clay, brown, with fine to medium sand and fine to coarse gravel, damp, with some plasticity.		
	2			SS-2					2	
					▨			2.10 Fine to coarse sand, brown, with trace clay or silt, with fine to coarse subangular to subrounded gravel, wet, loose (poorly graded sand)		
				SS-3						
	3								3	
10										
		1100.88		SS-4	▨			3.10 Sandy clay (fine to coarse sand), with fine gravel, brown to greenish grey, with low plasticity, damp (wet). Drilling refusal at 3.2m.		
		3.20	END OF BOREHOLE							

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM - Tributary A
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-11 **TO** 2005-08-11
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6903172.14 N 592747.06 E **DATUM:**

BOREHOLE: BH05-9B-R
PAGE: 1 **OF** 3
DRILL TYPE: Sonic
DRILL: 4x6
CASING:

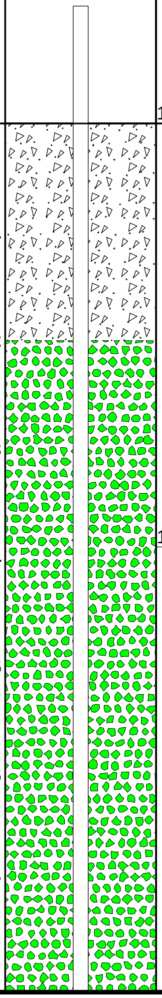
SAMPLE CONDITION
- ☒ Remoulded
- ▨ Undisturbed
- ■ Lost
- Rock core

WELL PLUG MATERIALS
- Bentonite / Grout
- Cuttings
- Sand

TYPE OF SAMPLER
- DC Diamond core barrel
- GS Grab sample
- SS Split spoon
- AS Auger Sample

GENERAL COMMENTS Replacement monitoring well for P96-9B; Stickup height: 1.08m; Water level = 1100.35 masl on Sept. 8, 2005; Samples:1-1.22m, 2-3.05m, 3-4.57m, 4-7.62m, 5-9.14m, 6-10.66m, 7-12.18, 8-13.71, 9-14.93, 10-15.85.

WELL DETAILS & WATER LEVEL - m



STRATIGRAPHY

ELEVATION - m DEPTH - m	DESCRIPTION
1099.98	Natural ground surface
0.00	Sandy silts.
1096.08 3.90	Well-graded sands.

SAMPLES

TYPE AND NUMBER	CONDITION	RECOVERY %	RQD %
1	▨		
2	▨		
3	▨		
4	▨		
5	▨		
6	▨		

SAMPLE DESCRIPTION

0.00
Sandy silt (fine to coarse sand), with fine to coarse, subangular to subrounded gravel and rare cobles (dia. ~10cm), dark brown, with organic matter (roots), loose, damp.

1.20
Clayey silt, trace to minor fine sand, dark brown to black, with organic matter (roots), loose, damp.

1.90
Fine to coarse sandy silt, trace clay, with fine to coarse, subangular to subrounded gravel, dark brown, with organic matter, loose, damp.

3.30
Silty medium to coarse sand with fine sand, trace to minor clay and fine to coarse subangular to subrounded gravel, dark brown, with organic matter, loose, damp.

3.90
Gravelly medium to coarse sand with fine sand, and fine to coarse, subangular to subrounded gravel, trace to minor silt, with sparse cobbles, brown, wet.

6.00
Medium to coarse sand with fine sand, fine to coarse subangular to subrounded gravel and trace silt, brown, loose, wet.

7.40
Clayey silt, with fine to coarse sand, fine to coarse, subangular to

DEPTH - m 1, 2, 3, 4, 5, 6, 7

LABORATORY and IN SITU TESTS

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM - Tributary A
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-11 **TO** 2005-08-11
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6903172.14 N 592747.06 E **DATUM:**

BOREHOLE: BH05-9B-R
PAGE: 2 **OF** 3
DRILL TYPE: Sonic
DRILL: 4x6
CASING:

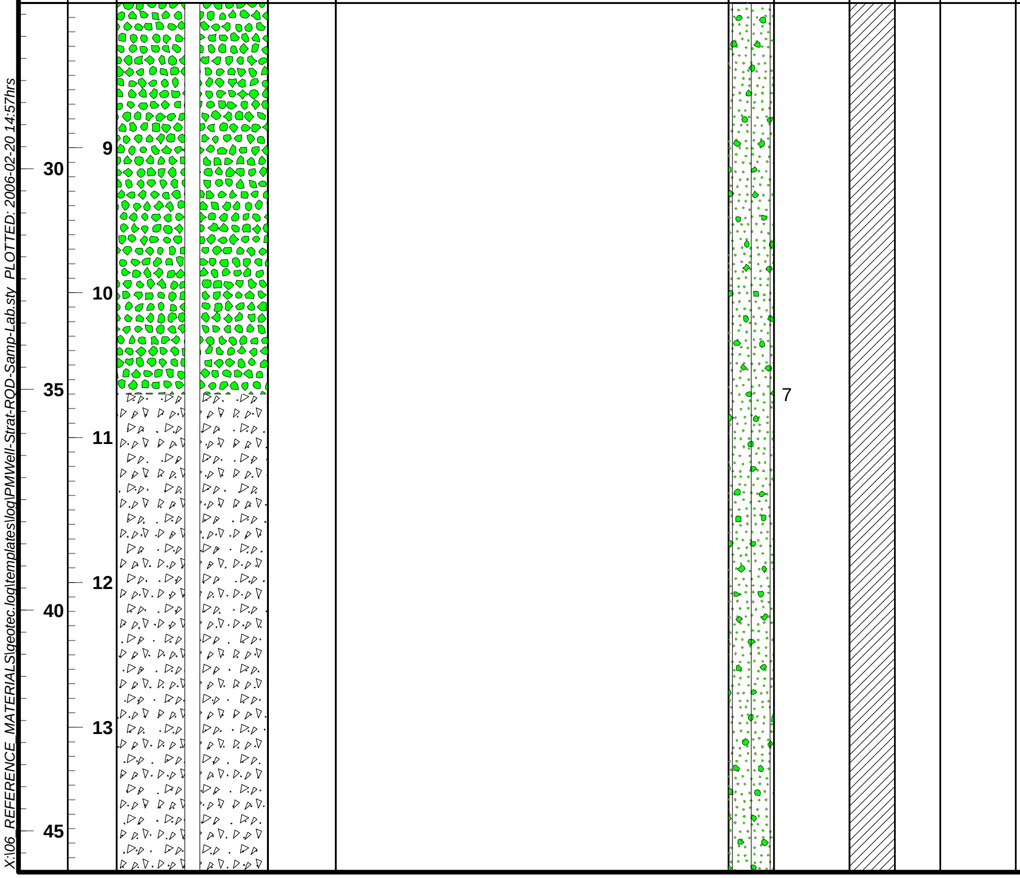
SAMPLE CONDITION
☒ Remoulded
▨ Undisturbed
■ Lost
◧ Rock core

WELL PLUG MATERIALS
▷ Bentonite / Grout
● Cuttings
⁘ Sand

TYPE OF SAMPLER
DC Diamond core barrel
GS Grab sample
SS Split spoon
AS Auger Sample

GENERAL COMMENTS Replacement monitoring well for P96-9B; Stickup height: 1.08m; Water level = 1100.35 masl on Sept. 8, 2005; Samples:1-1.22m, 2-3.05m, 3-4.57m, 4-7.62m, 5-9.14m, 6-10.66m, 7-12.18, 8-13.71, 9-14.93, 10-15.85.

DEPTH - ft	DEPTH - m	WELL DETAILS & WATER LEVEL - m	STRATIGRAPHY			SAMPLES				SAMPLE DESCRIPTION	DEPTH - m	LABORATORY and IN SITU TESTS
			ELEVATION - m DEPTH - m	DESCRIPTION	SYMBOL	TYPE AND NUMBER	CONDITION	RECOVERY %	RQD %			



with low plasticity. Till.

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM - Tributary A
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-11 **TO** 2005-08-11
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6903172.14 N 592747.06 E **DATUM:**

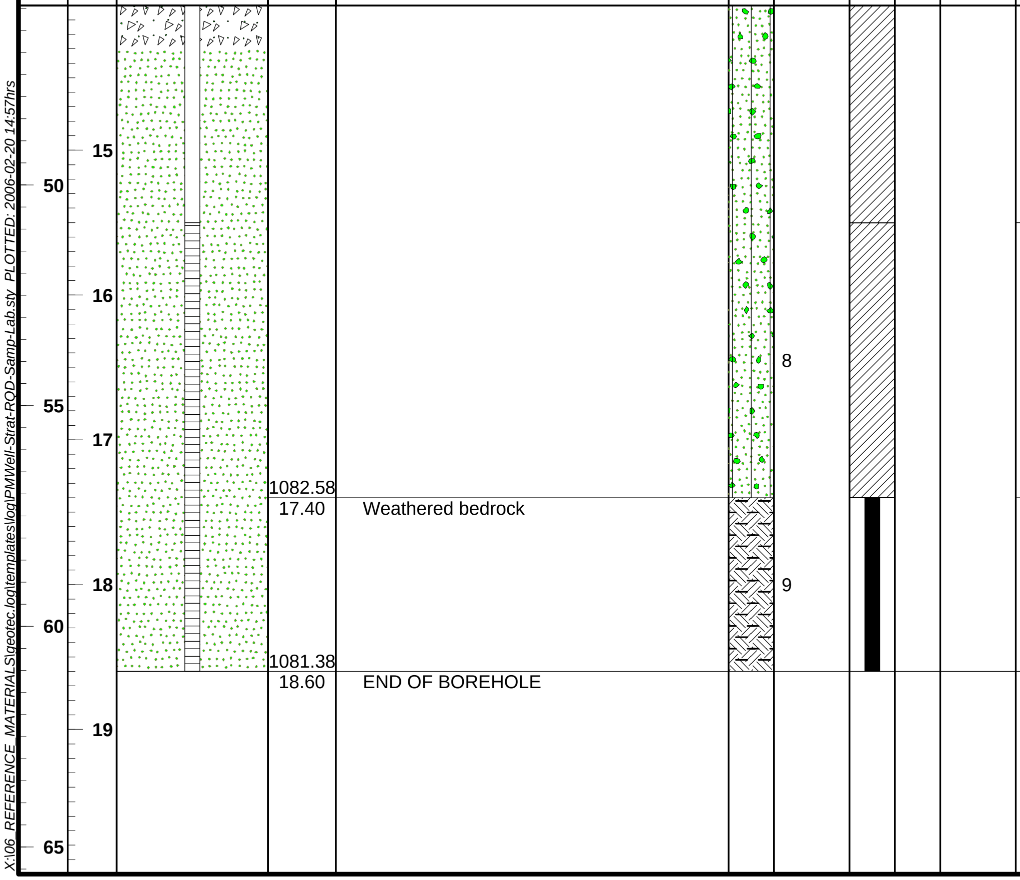
BOREHOLE: BH05-9B-R
PAGE: 3 **OF** 3
DRILL TYPE: Sonic
DRILL: 4x6
CASING:

SAMPLE CONDITION
- ☒ Remoulded
- ▨ Undisturbed
- ■ Lost
- ◧ Rock core

WELL PLUG MATERIALS
- Bentonite / Grout
- Cuttings
- Sand

TYPE OF SAMPLER
- DC Diamond core barrel
- GS Grab sample
- SS Split spoon
- AS Auger Sample

GENERAL COMMENTS Replacement monitoring well for P96-9B; Stickup height: 1.08m; Water level = 1100.35 masl on Sept. 8, 2005; Samples:1-1.22m, 2-3.05m, 3-4.57m, 4-7.62m, 5-9.14m, 6-10.66m, 7-12.18, 8-13.71, 9-14.93, 10-15.85.



DEPTH - ft	DEPTH - m	WELL DETAILS & WATER LEVEL - m	STRATIGRAPHY ELEVATION - m DEPTH - m	STRATIGRAPHY DESCRIPTION	STRATIGRAPHY SYMBOL	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	SAMPLES RECOVERY %	SAMPLES RQD %	SAMPLE DESCRIPTION	DEPTH - m	LABORATORY and IN SITU TESTS
						8				15.50 Gravelly-sandy silt with fine to coarse subangular to subrounded gravel, with sparse cobbles, gray, friable, very damp. Till.		
			1082.58 17.40	Weathered bedrock		9				17.40 Weathered bedrock: Greenish-gray phyllite, slightly damp.		
			1081.38 18.60	END OF BOREHOLE								

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-24 **TO** 2005-08-24
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6903011.00 N 592477.00 E **DATUM:**

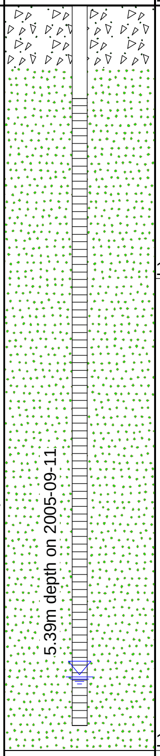
BOREHOLE: SRK05-07
PAGE: 1 **OF** 1
DRILL TYPE: Sonic
DRILL: 4x6
CASING:

SAMPLE CONDITION	
☒	Remoulded
▨	Undisturbed
■	Lost
◧	Rock core

WELL PLUG MATERIALS	
▷	Bentonite / Grout
☐	Cuttings
⁘	Sand

TYPE OF SAMPLER
DC Diamond core barrel
GS Grab sample
SS Split spoon
AS Auger Sample

GENERAL COMMENTS: well dry at time of installation; stickup height 0.72m.



DEPTH - ft	DEPTH - m	ELEVATION - m DEPTH - m	DESCRIPTION	SYMBOL	TYPE AND NUMBER	CONDITION	RECOVERY %	RQD %	SAMPLE DESCRIPTION	DEPTH - m	LABORATORY and IN SITU TESTS
		1107.29	Natural ground surface								
		0.00	Sandy silt with gravel		1	▨			0.00 Sandy silt (fine to coarse sand), with fine to coarse angular to sub-angular gravel, brown, with abundant organic matter (roots, wood fragments), dry, loose. From 1.3-1.6m: cobbles and gravel.		
					2	▨			2.00 Till: As above, consolidated, greyish brown, with coarser gravel (diam.~5-7cm) at the interface with weathered bedrock. Friable, dry.		
		1105.09 2.20	Weathered bedrock, phyllite		3	◧			2.20 Weathered bedrock (phyllite: Silver grey, dry. Fresh fragments recovered. Some oxidised (orange nodes) levels present. Dry. At 5.3m hit harder/fresher bedrock.		
		1101.29 6.00	END OF BOREHOLE								

Depth scale: DEPTH - ft 5, 10, 15, 20; DEPTH - m 1, 2, 3, 4, 5, 6.

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BOREHOLE LOG

PROJECT: AMP Event #4 Response
LOCATION: GRUM
FILE No: FARO (1CD003.063)
BORING DATE: 2005-08-24 **TO** 2005-08-24
DIP: 90.00 **AZIMUTH:**
COORDINATES: 6903063.00 N 592690.00 E **DATUM:**

BOREHOLE: SRK05-08
PAGE: 1 **OF** 1
DRILL TYPE: Sonic
DRILL: 4x6
CASING:

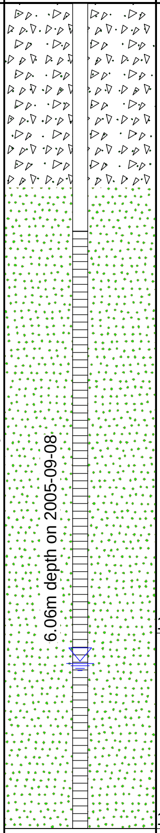
SAMPLE CONDITION	
☒	Remoulded
▨	Undisturbed
■	Lost
◧	Rock core

WELL PLUG MATERIALS	
▷	Bentonite / Grout
🟩	Cuttings
░	Sand

TYPE OF SAMPLER
DC Diamond core barrel
GS Grab sample
SS Split spoon
AS Auger Sample

GENERAL COMMENTS: Stickup height = 0.78m

WELL DETAILS & WATER LEVEL - m



ELEVATION - m DEPTH - m	STRATIGRAPHY DESCRIPTION	SAMPLES TYPE AND NUMBER	SAMPLE DESCRIPTION
1105.25	Natural ground surface		
0.00	Sandy silt, gravel	1	0.00 Sandy silt (fine to coarse sand(, with angular to subrounded fine to coarse gravel, brown, slightly moist, with abundant roots, loose. (white ash layers present ~1-2cm thick)
		2	0.70 Fine sand, well sorted (minor medium-coarse fractions), trace silt, with minor fine-coarse subang.-subrounded gravel at top and base of the layer, yellowish-brown, loose,dry.
		3	1.30 Gravelly fine to coarse sand (predominant fine fraction), (fine to coarse angular to sub-angular gravel), trace silt, dark brown, loose, dry.
		4	1.50 Till: Sandy silt (fine to coarse sand), trace clay, with fine to coarse angular to sub-angular gravel and sparse cobbles (diam.~10cm), greenish-grey, compact, damp, gray. From 3.6m: gets very hard (slow drilling).
1099.45 5.80	Weathered to fresh bedrock, phyllite	5	5.80 Slightly weathered to fresh bedrock (phyllite). Fresh rock fragments plus ground rock (powder/dust) recovered. No water detected. Granite cobbles in the contact between till and bedrock.
1097.65 7.60	END OF BOREHOLE		

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Appendix B

Water Quality Monitoring Results

Appendix B1

2002-2005 Waste Rock Seepage Survey Results

Appendix B.1 2002-2005 Waste Rock Seepage Survey Results- Southern Toe of Grum Dump

		Field Parameters					Dissolved Anions				Dissolved Metals																														
Sample ID	**Date Sampled**	pH (WTW)	Cond (uS/cm)	Temp (C)	ORP (mV)	Flow (L/min)	Acidity (to pH 8.3) CaCO3	Alkalinity-Total CaCO3	Chloride Cl	Sulphate SO4	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	Tl	Sn	Ti	V	Zn
Min. detection level							1.0	1.0	0.50	0.50	0.20	0.20	0.20	0.010	0.0050	0.20	0.10	0.010	0.050	0.010	0.010	0.010	0.030	0.050	0.010	0.10	0.0050	0.030	0.050	0.30	2.0	0.20	0.050	0.010	2.0	0.0050	0.20	0.030	0.010	0.030	0.0050
Units		s.u.	uS/cm	0C	mV	L/min	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
SRK-GD01	6/11/2002	6.69	2170	1.8	272	100	38	337	1.7	1220	<0.2	<0.2	<0.2	0.03	<0.005	<0.2	<0.1	<0.01	283	<0.01	<0.01	<0.01	<0.03	<0.05	0.02	141	0.059	<0.03	0.26	<0.3	5	<0.2	3.98	<0.01	7	0.914	<0.2	<0.03	<0.01	<0.03	5.07
SRK-GD01	9/11/2002	6.91	2490	2.5	272	340	69	497	1.5	1200	<0.2	<0.2	<0.2	0.06	<0.005	<0.4	<0.1	<0.01	351	<0.01	<0.01	<0.01	<0.03	<0.05	0.02	216	0.062	<0.03	0.29	<0.3	8	<0.2	4.09	<0.01	9	1.31	<0.2	<0.03	<0.01	<0.03	2.48
SRK-GD01	6/4/2003	6.93	2670	2.4	488	105	25	534	2.2	1320	<0.2	<0.2	<0.2	0.05	<0.005	<0.2	<0.1	<0.01	316	<0.01	<0.01	<0.01	<0.03	<0.05	0.03	223	0.044	<0.03	0.43	<0.3	8	<0.2	4.36	<0.01	10	1.3	<0.2	<0.03	<0.01	<0.03	4.58
SRK-GD01	09/14/2003	7.26	2610	2.5	459	150	16	559	2.4	1210	<0.2	<0.2	<0.2	0.05	<0.005	<0.2	<0.1	<0.01	367	<0.01	<0.01	<0.01	<0.03	<0.05	0.02	233	0.053	<0.03	0.34	<0.3	8	<0.2	4.46	<0.01	10	1.48	<0.2	<0.03	<0.01	<0.03	2.98
SRK-GD01	5/28/2004	7.71	2110	2.1	414	400	44.2	255	1.17	1080	<0.2	<0.2	<0.2	0.037	<0.005	<0.2	<0.1	<0.01	259	<0.01	0.05	<0.01	<0.03	<0.05	0.018	146	0.998	<0.03	0.43	<0.3	5.4	<0.2	2.83	<0.01	5	0.912	<0.2	<0.03	<0.01	<0.03	17.2
SRK-GD01	9/23/2004	7.06	2780	3.6	285	180	23	583	<5	1270	<0.2	<0.2	<0.2	0.043	<0.005	<0.2	<0.1	<0.01	348	<0.01	<0.01	<0.01	<0.03	<0.05	0.027	239	0.056	<0.03	0.351	<0.3	8.3	<0.2	4.08	<0.01	10.1	1.36	<0.2	<0.03	<0.01	<0.03	3.69
SRK-GD01	5/15/2005	7.06	2220	1.6	460		21.8	290	<5.0	1100	<0.2	<0.2	<0.2	0.051	<0.005	<0.2	<0.1	<0.01	291	<0.01	0.016	<0.01	<0.030	<0.05	0.022	173	0.353	<0.03	0.295	<0.3	4.2	<0.2	2.93	<0.01	5.3	0.897	<0.2	<0.03	<0.01	0.037	10.7
SRK-GD01	9/16/2005	7.63	2540	2.9	402	100	19.1	566	<5.0	1390	<0.2	<0.2	<0.2	0.035	<0.005	<0.2	<0.1	<0.01	332	<0.01	<0.01	<0.01	<0.030	<0.05	0.022	248	0.0502	<0.03	0.355	<0.3	5.7	<0.2	3.90	<0.01	9.1	1.14	<0.2	<0.03	<0.01	<0.050	3.11
SRK-GD04	6/11/2002	7.6	3260	2.5	248	1.5	18	477	1.9	1350	<0.2	<0.2	<0.2	0.02	<0.005	<0.2	<0.1	<0.01	352	<0.01	0.03	<0.01	<0.03	<0.05	0.04	347	0.207	<0.03	0.42	<0.3	10	<0.2	3.65	<0.01	16	1.59	<0.2	<0.03	<0.01	<0.03	3.68
SRK-GD05	6/11/2002	7.74	2670	3.1	273	7.5	13	527	2.2	1220	<0.2	<0.2	<0.2	0.03	<0.005	<0.2	<0.1	<0.01	358	<0.01	<0.01	<0.01	<0.03	<0.05	0.04	211	0.189	<0.03	0.59	<0.3	8	<0.2	5.66	<0.01	14	1.52	<0.2	<0.03	<0.01	<0.03	3.54
SRK-GD05	9/11/2002	7.45	2550	3.7	292	30	28	600	1.9	1080	<0.2	<0.2	<0.2	0.02	<0.005	<0.3	<0.1	<0.01	349	<0.01	<0.01	<0.01	<0.03	<0.05	0.03	199	0.008	<0.03	0.51	<0.3	7	<0.2	6.06	<0.01	11	1.41	<0.2	<0.03	<0.01	<0.03	2.65
SRK-GD05	6/4/2003	7.8	2550	3.9	421	20	15	638	2.4	1230	<0.2	<0.2	<0.2	0.03	<0.005	<0.2	<0.1	<0.01	312	<0.01	<0.01	<0.01	<0.03	<0.05	0.03	199	0.007	<0.03	0.38	<0.3	7	<0.2	5.51	<0.01	12	1.36	<0.2	<0.03	<0.01	<0.03	1.73
SRK-GD05	09/14/2003	7.84	2610	1.7	402	21	14	627	2.8	1180	<0.2	<0.2	<0.2	0.03	<0.005	<0.2	<0.1	<0.01	337	<0.01	<0.01	<0.01	<0.03	<0.05	0.03	212	0.013	<0.03	0.44	<0.3	7	<0.2	5.66	<0.01	11	1.48	<0.2	<0.03	<0.01	<0.03	2.02
SRK-GD05	5/28/2004	7.83	3180	4.9	399	20	19.9	583	2.09	1680	<0.2	<0.2	<0.2	0.038	<0.005	<0.2	<0.1	<0.01	392	<0.01	<0.01	<0.01	<0.03	<0.05	0.043	269	0.0931	<0.03	0.644	<0.3	7.8	<0.2	5.48	<0.01	12.8	1.68	<0.2	0.033	<0.01	<0.03	4.92
SRK-GD05	9/24/2004	7.64	3010	4.7	577	10	4.8	609	<5	1440	<0.2	<0.2	<0.2	0.034	0.0056	<0.2	<0.1	<0.01	361	<0.01	<0.01	<0.01	<0.03	<0.05	0.052	263	0.009	<0.03	0.705	<0.3	8.3	<0.2	5.07	<0.01	13.5	1.6	<0.2	<0.03	<0.01	<0.03	4.21
SRK-GD05	5/15/2005	7.96	2520	3.7	413	8	10.3	541	<0.50	1760	<0.2	<0.2	<0.2	0.026	<0.005	<0.2	<0.1	<0.01	363	<0.010	<0.010	<0.01	<0.030	<0.050	0.044	298	0.0130	<0.03	0.540	<0.3	6.4	<0.2	3.90	<0.01	12.8	1.42	<0.2	<0.03	<0.01	0.059	2.99
SRK-GD05	9/16/2005	7.86	2550	6	386	3.6	9.6	610	<5.0	1620	<0.2	<0.2	<0.2	0.029	<0.005	<0.2	<0.1	<0.01	477	<0.010	<0.010	<0.01	<0.030	<0.050	0.056	341	0.0127	<0.03	0.917	<0.3	8.9	<0.2	6.25	0.011	17.9	1.81	<0.2	<0.03	<0.01	<0.07	5.16
SRK-GD06	6/11/2002	7.62	2640	3.5	269	15	17	557	2.5	947	<0.2	<0.2	<0.2	0.03	<0.005	<0.3	<0.1	<0.01	361	<0.01	<0.01	<0.01	<0.03	<0.05	0.04	209	0.23	<0.03	0.52	<0.3	9	<0.2	5.87	<0.01	14	1.56	<0.2	0.04	<0.01	<0.03	3.94
SRK-GD06	9/11/2002	7.35	2540	3.1	314	30	26	700	1.8	1040	<0.2	<0.2	<0.2	0.03	<0.005	<0.3	<0.1	<0.01	348	<0.01	<0.01	<0.01	<0.03	<0.05	0.02	196	0.008	<0.03	0.42	<0.3	7	<0.2	6.07	<0.01	11	1.39	<0.2	<0.03	<0.01	<0.03	2.73
SRK-GD06	6/4/2003	7.67	2510	3.1	473	-	18	643	2.6	1150	<0.2	<0.2	<0.2	0.03	<0.005	<0.2	<0.1	<0.01	337	<0.01	<0.01	<0.01	<0.03	<0.05	0.03	214	0.011	<0.03	0.38	<0.3	7	<0.2	6.15	<0.01	13	1.49	<0.2	<0.03	<0.01	<0.03	2.39
SRK-GD06	9/14/2003	7.74	2540	3.1	486	15	1	646	2.5	1120	<0.2	<0.2	<0.2	0.03	<0.005	<0.2	<0.1	<0.01	325	<0.01	<0.01	<0.01	<0.03	<0.05	0.03	199	0.008	<0.03	0.41	<0.3	7	<0.2	5.64	<0.01	11	1.41	<0.2	<0.03	<0.01	<0.03	2.34
SRK-GD16	5/28/2004	7.47	3280	3.4	504	30	43	619	2.14	1680	<0.2	<0.2	<0.2	0.041	<0.005	<0.2	<0.1	<0.01	382	<0.01	0.03	<0.01	<0.03	<0.05	0.048	253	1.75	<0.03	0.701	<0.3	7	<0.2	4.59	<0.01	12	1.67	<0.2	<0.03	<0.01	<0.03	10.4
SRK-GD16	5/18/2005	7.28			439	2.1	93.2	602	<5.0	2090	<0.2	<0.2	<0.2	0.032	<0.005	<0.2	<0.1	0.089	416	<0.01	0.096	0.026	<0.03	<0.05	0.045	338	4.93	<0.03	0.501	<0.30	6.1	<0.2	6.71	<0.010	15.4	1.69	<0.2	<0.030	<0.010	<0.03	59.9
SRK-GD21	5/28/2004	7.47	3390	3.4	394	7.5	27.6	393	1.26	1990	<0.2	<0.2	<0.2	0.036	<0.005	<0.2	<0.1	<0.01	315	<0.01	0.026	<0.01	<0.03	<0.05	0.066	403	0.271	<0.03	0.345	<0.3	12.3	<0.2	2.3	<0.01	14.9	1.53	<0.2	<0.03	<0.01	<0.03	2.52
SRK-GD21	9/24/2004	7.1	3860	4	536	Trace	6.3	628	<5	2170	<0.2	<0.2	<0.2	0.016	<0.005	<0.2	<0.1	<0.01	365	<0.01	<0.01	<0.01	<0.03	<0.05	0.041	438	0.0619	<0.03	0.409	<0.3	10	<0.2	3.89	<0.01	17.1	1.63	<0.2	<0.03	<0.01	<0.03	1.82
SRK-GD21	5/15/2005	7.74	2490	2.7	438	6	7.9	356	<5.0	1770	<0.20	<0.20	<0.20	0.025	<0.0050	<0.20	<0.10	<0.010	277	<0.010	0.012	<0.010	<0.030	<0.050	0.047	340	0.0983	<0.030	0.290	<0.30	8.2	<0.20	1.66	<0.010	11.4	1.16	<0.20	<0.030	<0.010	0.053	2.63

Appendix B2

2003-2005 Downgradient Seepage Pathways Monitoring Results

Sample ID	Moose Seep	Moose Seep	Moose Seep	Moose Seep	Moose Seep
Date Sampled	9/15/2003	5/28/2004	9/22/2004	5/18/2005	9/17/2005
Field Parameters					
pH	7.61	7.79	7.32	7.7	7.12
Conductivity (uS/cm)	1310	465	1573		1680
Temperature (C)	3.4	3.6	6.4		6.2
ORP (mV)	406	167	48	415	432
Flow (L/min)	1	Trace	1	Trace	Trace
Physical Tests					
Conductivity (uS/cm)	1280	1120	1540	1240	1590
pH	8.2	8.08	8.08	8.2	8.05
Dissolved Anions					
Acidity (to pH 8.3) CaCO3	5	5.2	5.4	3	6.8
Alkalinity-Total CaCO3	288	236	296	245	320
Chloride Cl	1.5	1.52	<5.0	0.79	<5.0
Sulphate SO4	522	427	728	494	748
Dissolved Metals					
Aluminum D-Al	<0.2	<0.2	<0.2	<0.2	<0.20
Antimony D-Sb	<0.2	<0.2	<0.2	<0.2	<0.20
Arsenic D-As	<0.2	<0.2	<0.2	<0.2	<0.20
Barium D-Ba	0.05	0.057	0.078	0.048	0.087
Beryllium D-Be	<0.005	<0.005	<0.006	<0.005	<0.0050
Bismuth D-Bi	<0.2	<0.2	<0.2	<0.2	<0.20
Boron D-B	<0.1	<0.1	<0.1	<0.1	<0.10
Cadmium D-Cd	<0.01	<0.01	<0.01	<0.01	<0.010
Calcium D-Ca	174	157	235	168	293
Chromium D-Cr	<0.01	<0.01	<0.01	<0.01	<0.010
Cobalt D-Co	<0.01	<0.01	<0.01	<0.01	<0.010
Copper D-Cu	<0.01	<0.01	<0.01	<0.01	<0.010
Iron D-Fe	<0.03	<0.03	<0.03	<0.03	<0.030
Lead D-Pb	<0.05	<0.05	<0.05	<0.05	<0.050
Lithium D-Li	<0.01	<0.01	<0.01	<0.01	<0.010
Magnesium D-Mg	72.9	62.6	97.6	69.2	117
Manganese D-Mn	<0.005	<0.005	<0.005	<0.005	0.0055
Molybdenum D-Mo	<0.03	<0.03	<0.03	<0.03	<0.030
Nickel D-Ni	<0.05	<0.05	<0.05	<0.05	<0.050
Phosphorus D-P	<0.3	<0.3	<0.3	<0.3	<0.30
Potassium D-K	2	2.1	2.1	<2	2.3
Selenium D-Se	<0.2	<0.2	<0.3	<0.2	<0.20
Silicon D-Si	4.84	4.38	5.45	3.81	6.1
Silver D-Ag	<0.01	<0.01	<0.02	<0.01	<0.010
Sodium D-Na	7	6.1	7.8	5	8.3
Strontium D-Sr	0.491	0.453	0.679	0.433	0.73
Thallium D-Tl	<0.2	<0.2	<0.2	<0.2	<0.20
Tin D-Sn	<0.03	<0.03	<0.03	<0.03	<0.030
Titanium D-Ti	<0.01	<0.01	<0.01	<0.01	<0.010
Vanadium D-V	<0.03	<0.03	<0.03	<0.03	<0.040
Zinc D-Zn	0.006	<0.005	0.0064	<0.005	0.0081

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Sample ID	GD5d/s	GD5 d/s	GD05 DS	GD05 D/S	GD05 D/S
Date Sampled	9/15/2003	5/28/2004	9/23/2004	5/15/2005	9/17/2005
Field Parameters					
pH	7.66	7.79	6.9	7.94	7.78
Conductivity (uS/cm)	2140	1884	2430	2170	2510
Temperature (C)	3.7	2.9	4.3	3.6	5.5
ORP (mV)	424	190	69	478	637
Flow (L/min)	60	30	2.25		9.6
Physical Tests					
Conductivity (uS/cm)	2070	1760	2390	2200	2480
pH	8.11	8.13	8.07	8.10	8.07
Dissolved Anions					
Acidity (to pH 8.3) CaCO3	15	6.6	8.0	7.5	8.8
Alkalinity-Total CaCO3	421	373	434	406	449
Chloride Cl	2.4	2.03	<5.0	-5	<5.0
Sulphate SO4	972	823	1300	1080	1360
Dissolved Metals					
Aluminum D-Al	<0.2	<0.2	<0.2	-0.2	<0.20
Antimony D-Sb	<0.2	<0.2	<0.2	-0.2	<0.20
Arsenic D-As	<0.2	<0.2	<0.2	-0.2	<0.20
Barium D-Ba	0.06	0.052	0.060	0.048	0.057
Beryllium D-Be	<0.005	<0.005	<0.006	-0.005	<0.0050
Bismuth D-Bi	<0.2	<0.2	<0.2	-0.2	<0.20
Boron D-B	<0.1	<0.1	<0.1	-0.1	<0.10
Cadmium D-Cd	<0.01	<0.01	<0.01	-0.01	<0.010
Calcium D-Ca	277	264	330	305	340
Chromium D-Cr	<0.01	<0.01	<0.01	-0.01	<0.010
Cobalt D-Co	<0.01	<0.01	<0.01	-0.01	<0.010
Copper D-Cu	<0.01	<0.01	<0.01	-0.01	<0.010
Iron D-Fe	<0.03	<0.03	<0.03	-0.03	<0.030
Lead D-Pb	<0.05	<0.05	<0.05	-0.05	<0.050
Lithium D-Li	0.01	<0.01	0.013	0.011	0.015
Magnesium D-Mg	166	129	192	171	217
Manganese D-Mn	<0.005	<0.005	<0.005	-0.005	<0.0050
Molybdenum D-Mo	<0.03	<0.03	<0.03	-0.03	<0.030
Nickel D-Ni	<0.05	<0.05	<0.05	-0.05	<0.050
Phosphorus D-P	<0.3	<0.3	<0.3	-0.3	<0.30
Potassium D-K	3	2.6	2.6	2.3	2.9
Selenium D-Se	<0.2	<0.2	<0.3	-0.2	<0.20
Silicon D-Si	5.84	5.4	6.06	5.00	5.94
Silver D-Ag	<0.01	<0.01	<0.02	-0.01	<0.010
Sodium D-Na	10	8.4	11.7	09.8	12.3
Strontium D-Sr	1.04	0.985	1.21	1.03	1.17
Thallium D-Tl	<0.2	<0.2	<0.2	-0.2	<0.20
Tin D-Sn	<0.03	<0.03	<0.03	-0.03	<0.030
Titanium D-Ti	<0.01	<0.01	<0.01	-0.01	<0.010
Vanadium D-V	<0.03	<0.03	<0.03	0.046	0.055
Zinc D-Zn	<0.005	<0.005	<0.005	-0.005	<0.0050

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Sample ID **Date Sampled**	SWEET CREEK 9/23/2004	SWEET CREEK 5/15/2005	SWEET CREEK 9/17/2005
Field Parameters			
pH	8.03	8.11	8.11
Conductivity (uS/cm)	2260	1935	2440
Temperature (C)	4.3	3	4.1
ORP (mV)	114	474	597
Flow (L/min)	90		60
Physical Tests			
Conductivity (uS/cm)	2180	1930	2300
pH	8.10	8.12	8.1
Dissolved Anions			
Acidity (to pH 8.3) CaCO3	7.4	6.5	8
Alkalinity-Total CaCO3	418	417	390
Chloride Cl	<5.0	-5	<5.0
Sulphate SO4	1030	847	1190
Dissolved Metals			
Aluminum D-Al	<0.20	-0.2	<0.20
Antimony D-Sb	<0.20	-0.2	<0.20
Arsenic D-As	<0.20	-0.2	<0.20
Barium D-Ba	0.071	0.055	0.065
Beryllium D-Be	<0.0050	-0.005	<0.0050
Bismuth D-Bi	<0.20	-0.2	<0.20
Boron D-B	<0.10	-0.1	<0.10
Cadmium D-Cd	<0.010	-0.01	<0.010
Calcium D-Ca	336	305	349
Chromium D-Cr	<0.010	-0.01	<0.010
Cobalt D-Co	<0.010	-0.01	<0.010
Copper D-Cu	<0.010	-0.01	<0.010
Iron D-Fe	<0.030	-0.03	<0.030
Lead D-Pb	<0.050	-0.05	<0.050
Lithium D-Li	<0.010	-0.01	<0.010
Magnesium D-Mg	152	138	180
Manganese D-Mn	<0.0050	-0.005	<0.0050
Molybdenum D-Mo	<0.030	-0.03	<0.030
Nickel D-Ni	<0.050	-0.05	<0.050
Phosphorus D-P	<0.30	-0.3	<0.30
Potassium D-K	<2.0	-2	<2.0
Selenium D-Se	<0.20	-0.2	<0.20
Silicon D-Si	6.03	5.18	5.85
Silver D-Ag	<0.010	-0.01	<0.010
Sodium D-Na	9.6	8.1	10.3
Strontium D-Sr	1.14	0.989	1.1
Thallium D-Tl	<0.20	-0.2	<0.20
Tin D-Sn	<0.030	-0.03	<0.030
Titanium D-Ti	<0.010	-0.01	<0.010
Vanadium D-V	<0.030	0.037	0.047
Zinc D-Zn	<0.0050	-0.005	<0.0050

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Sample ID	Sheep Seep	Sheep Seep	Sheep Seep	SHEEP CREEK	SHEEP CREEK
Date Sampled	09/15/2003	5/28/2004	9/23/2004	5/15/2005	9/17/2005
Field Parameters					
pH	7.3	7.51	8.02	8.34	8.22
Conductivity (uS/cm)	557	458	571	576	592
Temperature (C)	2.4	1.9	4.1	2.4	4.3
ORP (mV)	450	208	76	434	577
Flow (L/min)	45	270	4.5		6.8
Physical Tests					
Conductivity (uS/cm)	539	420	580	581	565
pH	8.36	8.24	8.36	8.34	8.28
Dissolved Anions					
Acidity (to pH 8.3) CaCO3	<1	1.6	<1.0	-1	<1.0
Alkalinity-Total CaCO3	262	205	268	269	294
Chloride Cl	0.7	0.72	<2.5	-0.5	<0.50
Sulphate SO4	54	43.5	59.5	63.9	68.2
Dissolved Metals					
Aluminum D-Al	<0.2	<0.2	<0.2	-0.2	<0.20
Antimony D-Sb	<0.2	<0.2	<0.2	-0.2	<0.20
Arsenic D-As	<0.2	<0.2	<0.2	-0.2	<0.20
Barium D-Ba	0.17	0.135	0.171	0.176	0.195
Beryllium D-Be	<0.005	<0.005	<0.005	-0.005	<0.0050
Bismuth D-Bi	<0.2	<0.2	<0.2	-0.2	<0.20
Boron D-B	<0.1	<0.1	<0.1	-0.1	<0.10
Cadmium D-Cd	<0.01	<0.01	<0.01	-0.01	<0.010
Calcium D-Ca	88.5	72	89.0	96.2	105
Chromium D-Cr	<0.01	<0.01	<0.01	-0.01	<0.010
Cobalt D-Co	<0.01	<0.01	<0.01	-0.01	<0.010
Copper D-Cu	<0.01	<0.01	<0.01	-0.01	<0.010
Iron D-Fe	<0.03	<0.03	<0.03	-0.03	<0.030
Lead D-Pb	<0.05	<0.05	<0.05	-0.05	<0.050
Lithium D-Li	<0.01	<0.01	<0.01	-0.01	<0.010
Magnesium D-Mg	21	15.9	19.7	23.3	23.6
Manganese D-Mn	<0.005	<0.005	<0.005	-0.005	<0.0050
Molybdenum D-Mo	<0.03	<0.03	<0.03	-0.03	<0.030
Nickel D-Ni	<0.05	<0.05	<0.05	-0.05	<0.050
Phosphorus D-P	<0.3	<0.3	<0.3	-0.3	<0.30
Potassium D-K	<2	<2	<3	-2	<2.0
Selenium D-Se	<0.2	<0.2	<0.3	-0.2	<0.20
Silicon D-Si	4.73	4.48	4.61	3.77	4.9
Silver D-Ag	<0.01	<0.01	<0.02	-0.01	<0.010
Sodium D-Na	2	<2	2.4	-2	2.2
Strontium D-Sr	0.369	0.297	0.364	0.394	0.414
Thallium D-Tl	<0.2	<0.2	<0.2	-0.2	<0.20
Tin D-Sn	<0.03	<0.03	<0.03	-0.03	<0.030
Titanium D-Ti	<0.01	<0.01	<0.01	-0.01	<0.010
Vanadium D-V	<0.03	<0.03	<0.03	-0.03	<0.030
Zinc D-Zn	0.006	<0.005	<0.005	-0.005	<0.0050

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Sample ID **Date Sampled**	WTA02 9/23/2004	WTA02 5/18/2005
Field Parameters		
pH	8.05	7.55
Conductivity (uS/cm)	450	
Temperature (C)	5.0	
ORP (mV)	69	389
Flow (L/min)	1	
Physical Tests		
Conductivity (uS/cm)	447	931
pH	8.39	8.2
Dissolved Anions		
Acidity (to pH 8.3) CaCO3	<1.0	3.3
Alkalinity-Total CaCO3	232	258
Chloride Cl	<2.5	0.55
Sulphate SO4	18.0	286
Dissolved Metals		
Aluminum D-Al	<0.20	-0.2
Antimony D-Sb	<0.20	-0.2
Arsenic D-As	<0.20	-0.2
Barium D-Ba	0.093	0.126
Beryllium D-Be	<0.0050	-0.005
Bismuth D-Bi	<0.20	-0.2
Boron D-B	<0.10	-0.1
Cadmium D-Cd	<0.010	-0.01
Calcium D-Ca	81.3	152
Chromium D-Cr	<0.010	-0.01
Cobalt D-Co	<0.010	-0.01
Copper D-Cu	<0.010	-0.01
Iron D-Fe	<0.030	-0.03
Lead D-Pb	<0.050	-0.05
Lithium D-Li	<0.010	-0.01
Magnesium D-Mg	9.52	37.9
Manganese D-Mn	<0.0050	-0.005
Molybdenum D-Mo	<0.030	-0.03
Nickel D-Ni	<0.050	-0.05
Phosphorus D-P	<0.30	-0.3
Potassium D-K	<2.0	-2
Selenium D-Se	<0.20	-0.2
Silicon D-Si	4.40	4.31
Silver D-Ag	<0.010	-0.01
Sodium D-Na	<2.0	3.1
Strontium D-Sr	0.291	0.677
Thallium D-Tl	<0.20	-0.2
Tin D-Sn	<0.030	-0.03
Titanium D-Ti	<0.010	-0.01
Vanadium D-V	<0.030	-0.03
Zinc D-Zn	<0.0050	-0.005

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.

Sample ID **Date Sampled**	WGD01 9/23/2004	WGD01 9/16/2005
Field Parameters		
pH	7.71	7.92
Conductivity (uS/cm)	1115	1149
Temperature (C)	6.8	8.8
ORP (mV)	64	380
Flow (L/min)	2	0.1
Physical Tests		
Conductivity (uS/cm)	1120	1100
pH	8.18	8.13
Dissolved Anions		
Acidity (to pH 8.3) CaCO3	2.6	3.8
Alkalinity-Total CaCO3	277	286
Chloride Cl	<5.0	0.82
Sulphate SO4	384	380
Dissolved Metals		
Aluminum D-Al	<0.20	<0.20
Antimony D-Sb	<0.20	<0.20
Arsenic D-As	<0.20	<0.20
Barium D-Ba	0.165	0.173
Beryllium D-Be	<0.0050	<0.0050
Bismuth D-Bi	<0.20	<0.20
Boron D-B	<0.10	<0.10
Cadmium D-Cd	<0.010	<0.010
Calcium D-Ca	172	186
Chromium D-Cr	<0.010	<0.010
Cobalt D-Co	<0.010	<0.010
Copper D-Cu	<0.010	<0.010
Iron D-Fe	<0.030	<0.030
Lead D-Pb	<0.050	<0.050
Lithium D-Li	0.012	<0.010
Magnesium D-Mg	54.1	56
Manganese D-Mn	<0.0050	<0.0050
Molybdenum D-Mo	<0.030	<0.030
Nickel D-Ni	<0.050	<0.050
Phosphorus D-P	<0.30	<0.30
Potassium D-K	<2.0	<2.0
Selenium D-Se	<0.20	<0.20
Silicon D-Si	5.09	5.03
Silver D-Ag	<0.010	<0.010
Sodium D-Na	3.8	3.4
Strontium D-Sr	0.957	0.89
Thallium D-Tl	<0.20	<0.20
Tin D-Sn	<0.030	<0.030
Titanium D-Ti	<0.010	<0.010
Vanadium D-V	<0.030	<0.030
Zinc D-Zn	<0.0050	<0.0050

Results are expressed as milligrams per litre except where noted.
< = Less than the detection limit indicated.