2010 ANNUAL ENVIRONMENTAL MONITORING AND ACTIVITY REPORT

FARO MINE COMPLEX – FARO, YT

PREPARED FOR:

Yukon Government
Department of Energy, Mines and Resources
Assessment and Abandoned Mines Branch
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March 1, 2011

Cover photo of monitoring station X3A.
Photo taken by Jay Cherian, DES Environmental Coordinator

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1. INTRODUCTION

1.1 Background

Mining and ore processing activities at the Faro Mine Complex stopped in February 1998, when the owner at the time, The Anvil Range Mining Corporation, went into receivership. The mine is considered to be permanently closed. From February 1998 until February 2009, the mine property was managed by Deloitte and Touche Inc. acting as the court appointed Interim Receiver (the "Interim Receiver"). As of March 1, 2009, the mine property has been managed through Indian and Northern Affairs Canada (INAC) and the Yukon Government, Energy Mines and Resources, Assessment and Abandoned Mines Branch (YG-AAM). Since this time, the Care and Maintenance component has been conducted by Denison Environmental Services (DES).

Prior to 2004, activities at the Faro and Vangorda Plateau mine sites were regulated under two separate Water Licences, QZ95-003 (Faro) and IN89-002 (Vangorda Plateau). After the review process when these two Water Licences expired (December 31, 2003), a single water licence (QZ03-059), which authorized the continuation of care and maintenance activities and the development of a Final Closure and Reclamation Plan ("FCRP") was issued. This water licence expired at the end of February 2009. As of March 1, 2009, the site has been regulated under the Waters Act. Terms and standards for Care and Maintenance activities are defined in the Care and Maintenance (C & M) contract.

Concurrent to C & M activities at the Faro Mine Complex, planning for mine closure has continued, also under the management of INAC and YG-AAM. DES has played a supporting role for some aspects of closure planning, as well as undertaking significant improvements to the site.

The C & M contract includes a requirement for annual reporting of site operations activities and environmental monitoring and reporting programs. This report has been prepared to meet these requirements.

1.2 Organization of Report

This 2010 Annual Environmental Monitoring and Activities Report has been prepared according to the provisions of the revised Appendix B of the C & M contract. This report, including all data presentations and interpretations, was prepared by DES based on information provided by DES site staff, and by consultants, including BGC Engineering Inc. (BGC), Kejeh Neyeh Golder Corporation (KNG), SRK Consulting

Engineers and Scientists (SRK), Yukon Engineering Services and Laberge Environmental Services.

This report is broadly organized into the following sections. Where applicable, the Rose Creek Drainage/Faro mine site and the Vangorda Creek Drainage/Vangorda Plateau mine site are reported separately within these sections:

- Introduction;
- Water Use;
- Water Quality Monitoring – Rose Creek Drainage;
- Water Quality Monitoring – Vangorda Creek Drainage;
- Water Treatment Plant Performance;;
- Faro Mine Complex Lab and Data Management;
- Meteorological Monitoring;
- Physical Stability and Facilities Monitoring;
- Maintenance Activities; and
- Special Projects.

The following documents are submitted as a component of this annual report, under separate cover:

- Kejeh Neyeh Golder Corporation (Golder Associates); *2010 Annual Geotechnical Dam Inspection, Faro Mine Complex, Faro, Yukon*; (separate cover); and
- SRK Consulting Engineers and Scientists; *2010 Annual Inspection – Waste and Water Management Facilities - Vangorda / Grum, Faro Mine Complex, Yukon* February 2011 (separate cover).

1.3 Routine Environmental Monitoring and Reporting Program

The environmental monitoring programs required under the C & M contract are largely a continuation, refinement and significant expansion of the programs that were being carried out under the previous water licences. These programs include:

- water quality monitoring;
- geotechnical and facilities monitoring;
- hydrological monitoring;

- meteorological monitoring;
- terrestrial monitoring;
- lab analysis of water quality samples and significant lab development;
- data management and database development;
- quality control and quality assurance;
- results assessment; and
- reporting.

Monitoring program objectives include monitoring of the water treatment process, support for closure planning, focussed investigations of specific issues, and monitoring related to site activities.

The 2010 routine environmental monitoring and reporting program is described in Appendix A, including required or recommended monitoring types, sites, frequencies and parameters, and actual monitoring dates.

Figures, included in the Figures section of this report, illustrate the general layout of the mine property and facilities, and illustrate water quality, geotechnical and meteorological monitoring locations.

Results of the routine monitoring program were reported on a daily, weekly and / or monthly basis as part of daily reports, weekly meetings, and monthly reports. In addition, water quality parameters and other select parameters (especially. groundwater related and flow rates) were imported into emLine, the site's database. Results stored as a component of emLine can be access through a web browser.

1.4 Non-Routine Environmental Monitoring and Reporting

This annual report includes the results of monitoring largely from the routine monitoring program. In addition to the routine monitoring program, several programs and follow-up monitoring events were undertaken as part of the 2010 overall activities as special projects. The results of special projects were generally summarised using a memo format. Initially in 2010, the memos were submitted as email attachments. As of April 2010, the memos were generally reported in the "Special Projects" section of monthly reports, in addition, on some occasions, to email distribution.

The following lists the reports submitted for projects under the non-routine environmental monitoring and reporting program in 2010. The list of memos summarising non-routine environmental programs, are shown as a sub-submission where program summaries were included in the monthly report:

DES; Memorandum: "*RCDC Staining Observation – Dec 24, 2009*", December 28, 2009.

DES; **"***Cross Valley Pond Report: Field Program: September to November 2009",* January 2010.

DES; Memorandum: "*Preliminary X3, X10 Review*", 8 January 2010.

DES; Memorandum: "*X13 Turbidity Review*", 8 January 2010.

DES; Memorandum: "*January 2010 Follow-Up to X3, X10 Review*", February 8, 2010.

DES; Memorandum: "*Snow Survey Results – February 12 and 13, 2010*", 20 February 2010.

DES; Memorandum: "*Grum Pit Water Elevation – AMP Event 6*", 21 April 2010.

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: April 2010'*, May 31, 2010; including:

DES; Memorandum*: "X13 Turbidity Review – to April 2010"*; May 11, 2010.
DES; Memorandum: "*Special Project – Grum Overburden – Run-off TSS – April 21, 2010*", May 20, 2010.
DES; Memorandum: "*Special Project – S-Wells Area Monitoring – April and May 2010*", May 20, 2010.
DES; Memorandum: "*Snow Survey Results – April 3 and 4, 2010*", 16 April 2010
DES; Memorandum: "*Sheep Pad Pond – Pre-Discharge and Discharge Water Quality Review*", 28 April 2010.

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: May 2010'*, June 30, 2010; including:

DES; Memorandum: "*Grum Sulphide Cell – Special Projects Water Quality Monitoring*", May 13, 2010.
DES; Memorandum: "*Intermediate Dam Observations and Phreatic Surface Monitoring*", 17 May 2010.
DES; Memorandum: "*Intermediate Dam Monitoring Results – to May 29, 2010*", 31 May 2010.

DES; Memorandum: "*Special Project – Vangorda Waste Rock Pile Seepage Monitoring*", 20 May 2010.

DES; Memorandum: "*North Fork Rose Creek – TSS Monitoring and Assessment*", 29 June 2010.

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: June 2010'*, July 30, 2010; including:

SRK Consulting; Memorandum: "*Vangorda Mine Geotechnical Inspection – Interim Report*", June 30, 2010.

DES; Memorandum: "*Intermediate Dam, Cross Valley Pond and Rose Creek Diversion Dike Monitoring Results – to June 20, 2010*", 20 June 2010.

DES; Memorandum: "*Grum Climate Relocation – Summary Brief",* 15 July 2010.

DES; Memorandum: "*2010 Spring Seep Monitoring*", June 25, 2010.

DES; Memorandum: "*Grum Dump Thermistors and Piezometers Monitoring - June 23 to 27, 2010*", 15 July 2010.

DES; Memorandum: "*Grum Climate Station – 2009 and May 2010 Wind Data*", 24 June 2010.

DES; Memorandum: "*Vangorda Till Berm Piezometer Monitoring – June 27, 2010*", 30 June 2010.

DES; Memorandum: "*AMP Event 4 – 2010 Spring Monitoring*", July 19, 2010.

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: July 2010'*, August 30, 2010; including:

DES; Memorandum: "*Special Project - CVP Experiment – June 2, 2010*", 30 August 2010.

DES; Memorandum: "*Discharge Water Quality – Cyanide Review*", 30 September 2010.

DES; Memorandum: "*Revised Faro Mill Optimisation Study*", 24 July 2010.

DES; Memorandum: "*Faro Mill Water Quality – Hydrocarbon Monitoring – July 2010*", 3 August 2010.

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: August 2010'*, October 1, 2010; including:

DES; Memorandum: "*Special Project – CVP Studies – Agitation – June 2, 2010 (Appendix A – CVP Lab Benchtop Studies, attached)*", 30 September 2010.

DES; Memorandum: "*Cyanide Testing – Multi-Lab Results Comparison – July 6, 2010*", 30 August 2010.

DES; Memorandum: "*Grum Sulphide Cover Project – V15 Water Quality to August 3, 2010*", 9 August 2010.

DES; Memorandum: "*Grum Sulphide Cover Project – V15 Water Quality to August 10, 2010*", 12 August 2010.

DES; Memorandum: "*Grum Sulphide Cover Project – V15 Water Quality to August 17, 2010*", 24 August 2010.

DES; Memorandum: "*Grum Sulphide Cover Project – V15 Water Quality to August 24, 2010*", 31 August 2010.

DES; Memorandum: "*Grum Sulphide Cover Project – V15 Water Quality to August 31, 2010*", 5 September 2010.

DES; Memorandum: "*Hydrocarbon Monitoring – August 5, September 3 and 4, 2010*", 7 September 2010.

DES; Memorandum: "*Grum Pit Slope Stability Monitoring – to September 9, 2010*", 30 September 2010.

Golder Associates (with Kejeh Neyeh Golder Corp.); Technical Memorandum: *"2010 Annual Geotechnical Dam Inspection Preliminary Geotechnical Assessment, Faro Mine Complex, Faro, Yukon"*; October 5, 2010.

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: September 2010'*, November 1, 2010; including:

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to September 7, 2010*", 14 September 2010

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to September 14, 2010*", 20 September 2010

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to September 21, 2010*", 29 September 2010

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to September 28, 2010*", 6 October 2010

DES; Memorandum: "*Hydrocarbon Monitoring – to September 21, 2010 with October 29, 2010 Observations (Photos)*", 31 October 2010

DES'; Memorandum: "*Grum Pit Slope Stability Monitoring – to October 7, 2010*", 31 October 2010

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: October 2010'*, November 30, 2010; including:

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to October 5, 2010*", 13 October 2010

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to October 19, 2010 (Observations to October 31)*", 31 October 2010

DES; Memorandum: "*Vangorda Waste Rock Dump – Groundwater Monitoring – October 18 & 19, and November 3, 2010*", November 16, 2010

DES; Memorandum: "*Hydrocarbon Monitoring – FCS-4 (downstream of ETA) October 21, 2010*", 15 November 2010

DES; Memorandum: "*North Fork of Rose Creek (NFRC) Low Flow Loading Studies: R7-R10*", November 22, 2010

DES; Memorandum: "*North Fork of Rose Creek (NFRC) Low Flow Loading Studies: NF2-X2"*, November 22, 2010

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: November 2010'*, December 30, 2010; including:

DES; Memorandum: "*Grum Sulphide Cover Project – Environmental Monitoring to November 8, 2010*", 10 November 2010

DES; Memorandum: "*Grum Pit Slope Stability Monitoring – to November 10, 2010*", 30 November 2010

DES; Memorandum: "*Nitrogen Monitoring – Downgradient of Cross Valley Dam – 4Nov2010*", 30 December 2010

DES; Memorandum: "*Review of Water Quality and Mixing at X3 and X3A – October 21, 2010*", December 30, 2010

DES; "*Monthly Environmental Monitoring Report: Special Projects Monitoring: December 2010'*, January 31, 2011; including:

DES; Memorandum: "*Hydrocarbon Monitoring – FCS-4 (downstream of ETA) and Guardhouse Creek (December 2, 2010)*", 2 December 2010.

DES; Memorandum: "*Dixon Creek Low Flow Study – November 2, 2010*", Jan 25, 2011.

DES; Memorandum: "*Grum Pit Slope Stability Monitoring – to December 7, 2010*", 31 December 2010.

DES; Memorandum: *"Low Flow Mixing Study at X14 – December 2, 2010",* January 27, 2011.

As the reports and memorandums listed above have documented the findings of special projects in 2010, including lab results, photo logs, field notes and figures, where applicable, the results are not further reported in this annual review, with one exception: where sites routinely monitored were a component of non-routine monitoring projects, the results are included in this report. In this case, the results are also reported, where applicable, in the Faro Mine Complex database, emLine.

1.5 Significant Development

Details of significant developments to improve existing programs and activities on-site undertaken by DES in 2010 are described in this report, and constitute another component of work done as part of the Care and Maintenance contract in 2010.

Health and safety protocols were in effect prior to 2010 as an integral component of the work at the Faro Mine Complex. In 2010, significant development to formalise the protocols was undertaken. From environmental monitoring and reporting staff, one representative was selected for the Joint Health and Safety Committee, and training for this role was provided through DES. Equipment related to health and safety aspects of monitoring and site operations activities was reviewed, upgraded and expanded in 2010.

2. WATER USE

This section documents water usage in the Rose Creek and Vangorda Creek drainages in 2010. Supporting documentation, including tables and figures, are included in Appendix B

2.1 Rose Creek Drainage

The C & M Contract requires that water use volumes remain within 10% of historic levels. 4.1 million m^3 per year was suggested by the former Water Licence application as a maximum water usage. Historic water use is documented in the tables in Appendix B.

The following lists water uses in the Rose Creek Drainage in 2010:

- Pumping from the Zone II pit to the Faro Pit;
- Pumping from the Faro Pit to the Faro Treatment Plant;
- Pumping from the S-Wells area to the Faro Pit; and
- Pumping from the ETA to the Faro Treatment Plant and the Intermediate Pond.

Water pumped from the ETA to the Intermediate Pond is included with the volume diverted through the Intermediate Pond.

Table B-1 summarizes the total water obtained from the Rose Creek drainage historically and in 2010. Volumes pumped in 2010 are based on measurements of pipe flow using a Dynasonics ultrasonic flowmeter, MagFlo magnetic flowmeter, as well as fixed area transit time, and volumetric fill rates. Table B-1 shows that the volume of water pumped from the Faro Mine area in 2010 (approximately 3.3 million m^3) was less than the volume that was pumped in 2009 (approximately 4.0 million m^3). As a result of moderate snowpack and below average precipitation (Table B-2), less water needed to be pumped in the Rose Creek Drainage to achieve the desired water levels. The total water use was 77% of the 2008 estimated total volume, and therefore within the historic water use, despite the lowering of both the Faro Pit and Intermediate Pond to water levels not observed in more than a decade.

Table B-2 presents measured monthly precipitation at the Faro airport over the available period of record, 1978 to 2010. The total precipitation recorded for 2010 was 83% of the 32 year average. Total precipitation at the Faro Climate station is shown in Table B-3.

2.1.1 Faro Pit Water Balance

The following summarises the inflows and outflows to and from the Faro Pit in 2010.

2.1.1.1 Zone II Pit

The Zone II Pit is backfilled with waste rock but still serves as a collection point for runoff water. A down-hole pump, operated only during the summer, is used to pump water from the backfilled pit on an as-required basis to maintain the water level safely below the overflow level of ~-39m. Water level measurements (Figure B-1) are obtained by static-line piezometer from an open riser pipe, which was installed in 1997 and a second well that was installed in 2010. In 2010, the Zone II pump was operated from May 4 until Oct 21 and pumped a total volume of approximately 70,000 m^3 of water (Table B-12). This pumping has resulted in a lower water level than that seen in (at least) the last 6 years (Figure B-1). However, an examination of the historic volumes pumped shows that this volume is within the range of typical pumping volumes for this well.

2.1.1.2 S-Wells

At the end of February 2009, the S-Wells area trench interception collection and pumping system was commissioned. Groundwater intercepted prior to recharging to the North Fork of Rose Creek in the shallow aquifer, was pumped to the Faro Pit. Totalizers installed at each of three pumping wells installed provide a record of flows (Table B-13).

In 2010, this pumping system was in operation continuously throughout the year (with minor interruptions) with variable pumping rate.

2.1.1.3 Faro (or Main) Pit

The recycle water system which provided water from the Faro Pit to the mill was installed during the summer of 1997 and was used to provide an estimated minimum 95% of the water required for processing while the mill was operating prior to February 1998. The system has been used since mine operations ceased to pump water from the Faro Pit to the mill for treatment in order to maintain the in-pit water level within the desired range.

The recommended maximum elevation for the Faro Pit is 3864.2 ft (mine datum) which is approximately 50 feet below the lowest point in the pit perimeter. This elevation is anticipated to provide a large enough safety margin to prevent the overflow of Faro Pit into Zone II in the event of a breach of the Faro Creek Diversion as well as preclude the possibility of seepage through the fractured rock between the two pits.

In 2010, the Faro Pit was pumped from April 19 until August 27. Flow measurements, using a Dynasonics ultrasonic flowmeter, were made during any changes to pumping rate and as a weekly routine during the pumping season and these data are presented in Table B-14. The measured Faro Pit water levels from 2005 to 2010 are illustrated in Figure B-2. The water levels of the Faro Pit at the end of the pumping season and the end of the year, were at the lowest levels since 1997 (3852.19 and 3854.67 ft asl mine datum, respectively) corresponding to a water level drop of approximately 2.0 m during the pumping period and 0.56 m over the year.

2.1.1.4 Water Balance

A simple water balance can be described for the Faro Pit that is based on the known values of pit water level measurements, the height-volume relationship and the dates of pumping. In this case, the water balance parameters are:

1. “Zone II water”;
2. “S-wells water”;
3. “Net uncontrolled inflows” (groundwater seepage in/out, runoff, precipitation, etc.) calculated from observed changes in the pit water elevation during strategic periods;
4. “Water pumped”; and
5. Overall “net inflow” calculated from the overall change in the water elevation for the year.

The simple water balance could be expressed as follows with application of the subsequent notes:

Zone II Water[1] + S-wells water[2] + Net Uncontrolled Inflow[3] - Water Pumped[4] = Net Inflow[5]

Therefore, the 2010 water balance for the Faro Pit can be expressed as:

$$0.07 + 0.07 + 1.59 - 2.01 = -0.28 \text{ (in millions } m^3\text{)}$$

Notes:

1. Zone II water is directed to the Faro Pit in the manner and for the reasons described above.

2. The volume of water pumped by the S-well sump to Faro Pit is determined from a permanently installed totalizer on the pipe to Faro Pit.

3. The estimated volume of net uncontrolled inflows entering Faro Pit from direct precipitation, evaporation, local run off, seepage inflow and seepage losses was 1.59 million m^3 for 2010. This estimate was derived by examining measurements of the pond water level and inflows where a net change of 1 mm corresponds to a net change of 510 m^3. During periods in 2010 where the only inflows/outflows were the uncontrolled water, the values were determined directly from the observed elevation changes. During periods of pumping, the net uncontrolled inflows were determined by subtracting the measured input/output from the net pit-volume change (determined from changes in elevation). In instances where elevations were not available at the beginning or end of each month, a weighted average was calculated and used.

4. The quantity of water pumped out during the pumping period is estimated using the sum of the total water pumped for each month as seen in Appendix B.

5. The net inflow of water entering the pit (for the year) is tracked via the change in water elevation from January 1 to December 31. This volume is inclusive of all uncontrolled inflows, inflows from the Zone II pit, inflows from the S-wells, and water pumped out. In 2010, there was a net decrease in the pond level of 0.56 m, representing a net volume decrease of 0.28 million m^3.

The estimated volumes of annual net inflows are plotted against annual precipitation on Figure B-3 and inflow factors are calculated in Table B-6. The plot suggests that there is a consistent linear relationship between net inflows and precipitation for the five years up to 2003 (R^2=0.87). However, the subsequent years have not shown such consistency. It has previously been proposed that a new relationship between inflow and precipitation was occurring due to maintenance work performed on the Faro Diversion (between 2003 and 2005), however, no strong correlations evident in the data from subsequent years up to and including 2010 suggests otherwise. The inflow factors in 2009 and 2010, calculated from data collected at the Faro Dump Weather station, were in close agreement with each other, though higher than earlier years.

2.1.2 Intermediate Pond Water Balance

The following summarises the inflows and outflows to and from the Intermediate Pond in 2010.

2.1.2.1 Emergency Tailings Area

The emergency tailings area (ETA) has been shown to contribute a significant contaminant load to the downgradient areas, through seep and groundwater migration. Studies have shown that a portion of this water was not being collected and there was therefore a possibility of contamination of the aquifer under the Rose Creek Tailings. As a result, a collection system consisting of a dual sump (with 15 hp and 30 hp pumps) with cut-off trench, and a gravity feed pipeline to the Intermediate Pond was installed during the winter of 2006/2007. The ETA collection system was historically operated through the summer with all of the collected water being discharged into the Intermediate Pond. In 2010, work was performed to enable this water to be pumped directly to the Faro Mill during the treatment season.

In 2010, the ETA pump system was used to deliver water to the Faro Mill from June 16 to August 30 and to the Intermediate Pond from August 30 to September 27. It is estimated to have pumped at an average flow rate of 5.4 L/s to the Faro Treatment Plant and 5.0 L/s to the Intermediate Pond based on end of pipe volumetric flow measurements taken during each pumping period (Tables B-15 and B-16). From the measured flows and pumping times, the total volume of water transported by the ETA collection system is estimated at 34,000 m^3 and 10,000 m^3 to the Faro Mill and the Intermediate Pond, respectively. Over the same period, the average flow measured from X23 was 0.30 L/s and therefore accounted for 6% of the total water captured by the ETA collection system. Weir measurements below the ETA collection system over the same period suggest that the total capture rate (for water in the ETA) was around 90% which is comparable to the rate (88%) seen in 2009.

2.1.2.2 Intermediate Pond

In previous years, the Intermediate Pond water level was managed by periodically siphoning, and treating the water through the Down Valley Treatment Plant (DVTP), to the Cross Valley Pond. In 2007, a diesel powered, barge-mounted, vertical turbine pump was installed in the Intermediate Pond in order to pump water to the Faro Mill. This unit was operated in 2007, without the DVTP, and then in conjunction with the DVTP in 2008 and 2009. In 2010, the Intermediate Pond pumping system was upgraded to an electrically-driven, dual pump system which allowed for better control over the water level in the pond and water treatment to be carried out wholly through the

Faro Mill Treatment Plant. (Details of the Intermediate Pond pumping and Faro Mill Water Treatment systems are discussed in Section 5.)

The pumping rates, volumes, and periods of operation are all presented in Tables B-17 and B-18 and a graph of the Intermediate Pond elevations is presented in Figure B-4. The 1.16 million m^3 of water removed from the Intermediate Pond in 2010 was substantially less than the 1.76 million m^3 that was pumped in the previous year, however, this pumping volume was sufficient to lower the pond almost 2 m lower than the lowest level (at least) since 1999. At the end of 2010, the water level (1045.179 m asl) remained well below historic levels for this time of year.

2.1.2.3 Water Balance

A simple water balance can be described for the Intermediate Pond that is based on the measured pond water levels, the stage-volume relationship and the dates of active pumping to the Mill Water Treatment System. In this case, the water balance parameters are the quantities of:

1. "Net uncontrolled inflows" (groundwater seepage in/out, runoff, precipitation, inflows from the ETA collection system, residual drainage from the ETA/Old Faro Creek area, residual drainage from pond catchment area, etc.) calculated from observed changes in the pond water elevation during strategic periods;
2. "Water Pumped to Mill Water Treatment System";
3. Overall "net inflow" calculated from the overall change in the water elevation for the year.

The simple water balance could be expressed as follows with application of the subsequent notes:

Net Uncontrolled Inflows[1] - Water Pumped to Mill Water Treatment System[2] = Net Inflow[3]

Therefore, the 2010 water balance for the Intermediate Pond can be expressed as:

0.94[1]- 1.16[2] = -0.21[3] (in millions m^3)

<u>Notes (also see Table B-7):</u>

1. The estimated volume of net uncontrolled inflows entering the Intermediate Pond from direct precipitation, evaporation, local run off, seepage inflow and seepage losses was 0.94 million m^3 for 2010. This estimate was derived by

examining measurements of the pond water level and inflows with the stage volume relationship calculated for each month (Table B-7). During periods in 2010 where the only inflows/outflows were the uncontrolled water and or ETA pumping, the values were determined directly from the observed elevation changes. During periods of pumping, the net uncontrolled inflows were determined by subtracting the measured input/output from the net pond-volume change (determined from changes in elevation).

2. The water pumped to the Faro Mill is calculated for each pumping period using measurements obtained from weekly flow measurements with a Dynasonics ultrasonic flowmeter until April 14, after which, flow measurements and totals were taken from a datalogger attached to a magnetic flowmeter.
3. The net change in volume was derived from the observed change in water level elevation, from January 1 to December 31, 2010 and was estimated to be a loss of 0.21 million m^3. This estimate was derived by examining measurements of the pond water level and inflows with the stage volume relationship calculated for each month (Table B-7).

2.1.3 Cross Valley Pond

The Cross Valley Pond (CVP) water level is maintained below the spillway by the operation of a siphon that discharges water into Rose Creek. The CVP is the body of water into which the water treated by the Faro Mill (and DVTP, in some previous years) is directed. It is the only water body from which controlled discharge to the environment takes place. Flow measurements of the discharge from the CVP using a Dynasonics ultrasonic flowmeter were taken, weekly, at the siphon control point (X5) and these measurements (Table B-19) were used to calculate the total amount of water released to the environment. In addition to the siphon, water also leaves the CVP through a number of seeps which are collected in a channel where a flat-bottomed weir is installed (X13).

A simple water balance can be described for the CVP that is based on the measured pond water levels, average flow rates for gravity discharge to the CVP from the Faro Mill, the stage-volume relationship, and the pumping periods. In this case, the water balance parameters are the quantities of:

1. “Faro Mill Treatment Plant Water” to Cross Valley Pond;
2. “Net uncontrolled inflows” (groundwater seepage, runoff, precipitation, residual drainage from pond catchment area, etc.) calculated from observed changes in the pond water elevation during strategic periods;
3. “Effluent” water siphoned to Rose Creek;

4. ”Seepage” from the toe of the CVP and;

5. Overall “net inflow” calculated from the overall change in the water elevation for the year.

The simple water balance could be expressed as follows with application of the subsequent notes:

Net Uncontrolled Inflows[1] + Faro Mill Treatment Plant water[2]- Seepage[3] – Effluent[4] = Net Inflow[5]

Therefore, the 2010 water balance for the Cross Valley Pond can be expressed as:

$$+1.88 + 3.21 - 0.68 - 4.40 = .01 \text{ (in millions } m^3\text{)}$$

<u>Notes (also see Table B-8):</u>

1. The estimated volume of net uncontrolled inflows entering the Cross Valley Pond from direct precipitation, evaporation, local run off, seepage inflow and unobserved seepage losses was 1.88 million m^3 for 2010. This estimate was derived by examining measurements of the pond water level and inflows where a net change of 1 mm corresponds to a net change of 213 m^3. During periods in 2010 where the only inflows/outflows were uncontrolled water, the values were determined directly from the observed elevation changes. During periods of pumping, the net uncontrolled inflows were determined by subtracting the measured input/output from the net pond-volume change (determined from changes in elevation).

2. Treated water discharged from the Faro Mill is calculated for each siphoning period using measurements obtained from flow measurements on all inputs that were being fed into the Faro Mill.

3. A continuous flow of seepage emerges to surface at the toe of the Cross Valley Dam. This is generally thought to consist primarily of seepage through the dam and the dam foundation from the Cross Valley Pond in addition to some portion of deeper groundwater. In this water balance calculation, all of the observed seepage at X13 was attributed to water lost from the CVP.

4. “Effluent” water siphoned to Rose Creek;

5. The net change in volume was determined from the net elevation change from January 1 to December 31 and was estimated to be 0.01 million m^3. This estimate was derived by examining measurements of the pond water level and inflows where a net change of 1 mm corresponds to a net change of 213 m^3.

Figure B illustrates the water level measurements in the Cross Valley Pond from 2005 to 2010. The pond level was 0.05 m higher at year end than at the beginning of the year.

2.1.4 Freshwater

Minimal freshwater was drawn from the North Fork of Rose Creek in 2010. Freshwater was not used for water treatment processes.

Some components of the fresh water supply system that were previously used (during mine operations) to supply water to the mill from Rose Creek remain in place. The system is, however, inoperable.

The fresh water supply system includes the following (unused) components which remain largely in place:

1. Pumphouse Pond located at the confluence of the North and South Forks of Rose Creek. The pond continues to pass all of the flow from the South Fork and most of the flow from the North Fork of Rose Creek (high flows in the North Fork partially spill into the North Fork Diversion). The North Fork channel into the Pumphouse Pond includes several settling/groundwater recharge ponds. The pond itself represents overwintering habitat for fish.

2. Pumphouse Building. The building is largely empty. Some pumps and motors have been previously removed for sale and/or alternate use.

3. Freshwater Pipeline. The steel pipeline is buried where it passes under the (former) copper sulphate and bulk explosives manufacturing yard and access road and is then overland to the Mill.

4. Portions of the former freshwater dam on the South Fork of Rose Creek. The dam was breached to original ground level in 2004.

5. Two groundwater wells, PW3 and PW 6, located near the pumphouse pond. These wells were capped and surface structures removed in 2005.

2.1.5 Flow Rate Monitoring – Continuous

Continuous flow rate monitoring at location R7 in the North Fork of Rose Creek up stream of the Faro Mine Complex, and location X14 in Rose Creek immediately downstream of the tailings facility was performed throughout 2010. The water levels have been monitored on a continuous basis using a pressure transducer and datalogger since 1996 (R7) and 1994 (X14) except during periods of malfunction or damage. The flow records for 2010 were subject to an annual technical review by a hydrologist who compared these measurements against the field measurements that were made at the same location. The processed data was used to construct graphs of water level and discharge over the monitoring period and this data was compared against flow/level measurements made by other means. These graphs are presented in Figures B-6 to B-9.

Flow was also logged continuously at FCD, at the extreme upstream end of the Faro Creek Diversion, and at X23, located where seepage from the Faro Waste Rock Dump drains to the ETA. Laberge Environmental Services (LES) installed and maintained the continuous loggers used for open channel flow measurements in 2010, and a memorandum from LES is included in Appendix B, including preliminary discharge from X23 and FCD.

An additional pressure transducer was installed at X2 in 2010. As it was installed late in the open water season, and was removed at ice up, the period of record was relatively short, and the results were not interpreted for this report.

2.1.6 Additional Flow Rate Monitoring

Flow rates were monitored at the 33 surface water and seepage sites, by in stream (depth / velocity profiles), volumetric, weir, staff gauge (with rating curve), or estimation methods. Most of the sites were monitored on monthly basis. Weekly measurements were taken at some sites during treated water discharge periods. Flow rate monitoring frequencies were reduced in the winter when flow was frozen up or was very low in the creeks. Flow rates and measurement methods are included in Appendix B (Table B-23). The results of in stream flow rate monitoring at R7 and X14 are included in Figures B-6 to B-9 along with the continuous flow records.

2.2 Vangorda Creek Drainage

2.2.1 Summary

Water use in the Vangorda Creek Drainage has historically consisted of pumping of:

- Little Creek Dam Pond;
- Vangorda pit; and
- Freshwater Supply Pond

Future plans for water use also include the possibility of pumping being required for Grum Pit. This possibility is further discussed in the Adaptive Management Plan 2010 review included in Appendix I.

2.2.2 Little Creek Dam Pond

Little Creek Dam Pond (LCDP) acts as a collection point for contaminated runoff and seepage from the Vangorda waste rock dump. This water is pumped to the Vangorda Pit on an as-required basis, typically on only one or two occasions each summer, to maintain the water level below the prescribed "safe" elevations. In 2010, the LCDP was pumped to Vangorda pit two times (in May and September) for an estimated total volume of 30,583 m^3 (Table B-20).

Figure B-10 illustrates the water level measurements in Little Creek Dam Pond from 2005 to 2010. During the summer, the LCDP was lowered to the lowest elevation in (at least) the last 6 years. At the end of the year, the pond level was approximately 0.8 m lower than at the beginning of the year.

2.2.3 Vangorda Pit

From mine shut down in 1998 to 2001, the water level in the Vangorda pit rose to its recommended "maximum" allowable elevation. This elevation provides approximately 30 m of safety freeboard below the estimated overflow elevation. Principle inflows into the pit include local area runoff, leakage and underflow from the Vangorda Creek Diversion, direct precipitation and water pumped from Little Creek Dam Pond.

In 2002, the Grum/Vangorda water treatment plant was reactivated and a new overland pumping system was installed from the Vangorda Pit. From 2002 to 2005, an annual seasonal pumping program was conducted to maintain the pit water level below the maximum recommended elevation. In 2005, a sufficiently large volume of water was pumped to eliminate the need for any pumping in 2006 and 2007. The total volumes pumped as well as the precipitation data from the Faro Airport for these years are presented in Table B-10.

Due to the low inflow and successful 2009 pumping program, Vangorda Pit pumping in 2010 was only necessary for one month (Appendix B, Table B-9) to achieve a water level more than 1 meter below the target elevation. At year's end the freeboard was over 6 metres and it is expected that this freeboard will be sufficient to handle the pit recharge until pumping resumes in 2011 based on the typical recharge rate observed since 2005 (Figure B-11). In 2010, Vangorda Pit was pumped to the Vangorda Treatment Plant (VTP) from June 9 until July 15 with a break from June 9-12 while treated water was checked for acute toxicity (in fish) before the VTP clarification pond could be discharged to the environment. The pumping rates, volumes, and periods of operation are all presented in Table B-21 and a graph of the Vangorda Pit elevations for the last six years is presented in Figure B-11.

Previous data suggested a strong correlation between the annual precipitation and the total influence to Vangorda Pit (Table B-10) with two exceptional years that did not fit the trend (2000 and 2003). Due to the incompleteness of the precipitation data from the Faro Airport, this type of evaluation was not possible for 2008 or 2009, however 2010 data fit the previously observed pattern (Figure B-12). Additional site-specific climate data is collected from the Grum climate station (Table B-11) which provided good agreement with the precipitation values recorded at the Faro Airport.

A simple water balance can be described for the Vangorda Pit that is based on the known values of pit water level measurements, the height-volume relationship and the dates of pumping. In this case, the water balance parameters are:

- "Little Creek Dam Pond (LCDP) water inflow";
- "Net uncontrolled inflows" (groundwater seepage in/out, runoff, precipitation, etc.) calculated from observed changes in the pit pond water elevation during strategic periods.
- "Water pumped"; and
- Overall "net inflow" calculated from the overall change in the water elevation for the year.

The simple water balance could be expressed as follows with application of the subsequent notes:

LCD Water[1] + Net Uncontrolled Inflows[2] - Water Pumped[3] = Net Inflow[4]

Therefore, the 2010 water balance for the Vangorda pit can be expressed as:

$$0.03 + 0.35 - 0.39 = -0.01 \text{ (in millions } m^3\text{)}$$

Notes (also see Table B-9):

1. The quantity of water pumped from Little Creek Dam into the Vangorda Pit in 2010 is estimated to be 30,583 m^3 as determined by timed volume measurements during periods of pumping.

2. The estimated volume of net uncontrolled inflows entering the Vangorda Pit from direct precipitation, evaporation, local run off, seepage inflow and seepage losses and water diverted from V25 BSP was 0.35 million m^3. This estimate was derived by examining measurements of the pond water level and inflows where a net change of 1 mm corresponds to a net change of 66 m^3. During periods in 2010, where the only inflows/outflows were the uncontrolled water, the values were determined directly from the observed elevation changes. During periods of pumping, the net uncontrolled inflows were determined by subtracting the measured input/output from the net pit-volume change (determined from changes in elevation).

3. The quantity of water pumped out of Vangorda Pit during the pumping period is determined from flow measurements and pumping time as listed in Appendix B.

4. The net volume change of water in Vangorda Pit was calculated from the change in elevation from January 1 to December 31, and was calculated as 8,000 m^3. The total volume was derived by calculating the volume change from the net change in elevation where 1 mm corresponded to a net change of 66 m^3.

2.2.4 Grum/Vangorda Freshwater Supply Pond

During years when the VTP is operated, a relatively small amount of freshwater is drawn from Vangorda Creek for mixing lime in the plant. This water is drawn from the Grum/Vangorda Freshwater Supply Pond which stores some surface runoff that flows into the Grum Interceptor Ditch just upgradient of the water treatment plant. Water is pumped from the pond to the plant on an on-demand basis to maintain an adequate supply of mix water in a storage tank located in the plant.

The quantity of water used for mixing of lime in 2010 is estimated to be 850 m^3 based on the typical lime density used at the VTP and the amount of lime consumed plus 25% for miscellaneous consumption.

2.2.5 Grum Pit

Since the cessation of mining activities in 1998, the Grum pit has been allowed to accumulate natural runoff water. The rate of filling has been slower than the Vangorda pit because of the relatively smaller inflows and relatively larger size. In 2003, a study was undertaken by Gartner Lee that developed a stage-capacity relationship and that recommended a maximum water elevation above which treatment or some other intervention should be considered if the water were non-compliant.

The pit filling curve (Figure B-13) illustrates the rise in Grum Pit water levels. Rough conservative projections of the rate of filling (using a linear projection based on data since 2007) indicated that the action level prescribed in the Adaptive Management Plan (AMP) may be reached near the end of 2011. This is projected to be a minimum 2 years prior to the water level reaching the elevation at which subsurface seepage might occur (1,216 m asl). In 2009, review of the maximum Grum Pit water level was initiated, including drilling of two piezometers in the Grum Slot Cut area, to investigate the subsurface hydraulic regime. An estimate of the inflow to the Grum Pit during an extremely wet year (100 year return period) was calculated, assuming failure of the Grum NE Interceptor Ditch, as a component of the reevaluation of the Grum Pit maximum elevation. Grum Pit elevations are further discussed in the Adaptive Management Plan 2010 review, included in Appendix I.

The estimated net quantity of water that accumulated in the Grum Pit in 2010, based on the measured elevations and the height-capacity curve, is 279,000 m^3 (8.8 L/s average) or approximately 63% of the influent of 2009.

2.2.6 Continuous Flow Monitoring

Continuous flow rate monitoring at location V1 in the Vangorda Creek up stream of the Vangorda Pit and former mine site activity areas, and location V8 in Vangorda Creek immediately downstream of the tailings facility was performed 2010. The water levels have been monitored on a continuous basis using a pressure transducer and datalogger since at least 2007 (V1) and 1996 (V8) except during periods of malfunction or damage. The flow records for 2010 were subject to an annual technical review by a hydrologist who compared these measurements against the field measurements that were made at the same location. The processed data was used to construct graphs of water level and discharge over the monitoring period and this data was compared against flow/level measurements made by other means. These graphs are presented in Figures B-14 to B-17.

Flow was also logged continuously at V27, located in Vangorda Creek, upstream of the confluence with Shrimp Creek. Preliminary discharge from V27 is included in the memorandum from LES in Appendix B.

2.2.7 Additional Flow Rate Monitoring

Flow rates were monitored at the 20 Vangorda Creek drainage surface water and seepage sites, by in stream (depth / velocity profiles), weir, or estimation methods. Most of the sites were monitored on monthly basis. Weekly measurements were taken at two sites (V25 and V25BSP) during treated water discharge periods, and twice a month at 4 sites in the Grum Waste Rock Dump east side drainage. Flow rate monitoring frequencies were reduced in the winter when flow was frozen or was very low under ice. Flow rates and measurement methods are included in Appendix B (Table B-24). The results of in stream flow rate monitoring at V1 and V8 are included in Figures B-14 to B-17 along with the continuous flow records.

3. WATER QUALITY MONITORING – ROSE CREEK DRAINAGE

3.1 Overview of Water Quality Monitoring Program

Water quality is monitored regularly throughout the mine property. The basis for the environmental water quality monitoring program is set out for the routine monitoring program largely by Appendix B of the C & M contract and water treatment process requirements. Details about the routine water quality monitoring program sites and frequency for 2010 are included in Appendix A.

The monitoring program is carried out by staff employed at the mine site by Denison Environmental Services (DES). Various professional laboratories have been used to provide the sample analyses over the life of the monitoring at the Faro site. Laboratories are selected on the basis of certification with the Canadian Association of Environmental Analytical Laboratories, service and other factors. In 2010, most of the water analyses were conducted by Maxxam, with supplementary analyses conducted through Caro Analytics and ALS. Analytical data for 2010, including bioassay results, are provided in Appendix C (surface water, seeps and groundwater). Graphs of water quality trends for Rose Creek Drainage sites are included in Appendix C.

The monitoring program also makes extensive use of the unique capability for on-site zinc analyses to provide immediate feedback to site managers regarding effluent quality. On-site analyses of effluent zinc concentrations are conducted on a daily, or more frequent basis, when treated effluent is being released. Results from on-site analytical testing in the Rose Creek drainage are also included in Appendix C, in both tables and figures.

The monitoring locations are illustrated in the Figures Section of this report.

The following provides a summary of water quality monitoring results in the Rose Creek Drainage in 2010.

3.2 Groundwater Monitoring Reporting and Assessment

While 2010 groundwater results have been reported as part of the 2010 annual reporting requirements under the Care and Maintenance contract, it is the understanding of DES site management that another consultant (Roberston GeoConsultants, or RGC) has been contracted to undertake the annual assessment and review of the groundwater monitoring program as a whole, as they have historically. Therefore, assessment of groundwater quality and gradients has been minimized in this 2010 Annual Report.

Groundwater quality monitoring results are included in Tables C-6 and C-7. Quality assurance and control comparison results are shown in Tables C-56 to C-63.

Supplementary groundwater monitoring data, including water levels, depth to bottom and stick-up measurements are included in Appendix E, Table E-1. Also included in Appendix E are tables showing comparisons of depth to bottom and stick-up measurements with 2009 and 2008 results, respectively.

3.3 Pit Lakes Monitoring Reporting and Assessment

Faro Pit water quality was monitored at depth intervals in 2010 as part of the Pit Lakes studies. The results of Faro Pit depth profiles monitoring are shown in Tables C-43 to C-45. Quality assurance and control comparison results are shown in Tables C-64 to C-69. It is understood by DES that water quality results are assessed as a component of closure planning and is therefore not repeated in this report.

3.4 Upstream of Former Mine Activities – Background / Reference

In 2010, water quality monitoring upstream of the former mine activities was carried out at the following locations:

- FAROCR, at the outlet of the Faro Creek Diversion;
- FCO, where water collects in the Faro Creek channel above the Faro Valley rock dump upstream of the Faro Valley Dump, and from where it flows along the base of the Faro Valley rock dump and into the Main Pit;
- R7, in the North Fork of Rose Creek, upstream of the confluence with the Faro Creek Diversion; and
- W10, in Upper Guardhouse Creek, upstream of the Faro Northwest Rock Dump; flows in this creek are diverted to Rose Creek downstream of the Faro Northwest rock Dump in the Northwest Interceptor Ditch.

Monitoring at each of these sites, with the exception of at FCO, provide background or reference water quality and flows data. In September 2010, in compliance with revisions to Appendix B of the Care and Maintenance contract, routine water quality monitoring was terminated at site W10, and the frequency of sampling was reduced from quarterly to three times a year at site FCO (though flow measurements were performed monthly, concurrent with sampling at seepage site A30); FAROCR and R7 maintained a monthly sampling/flow frequency. Results of water quality monitoring indicate, in all cases, that sulphate, zinc, copper, and cadmium concentrations are comparable to those observed in previous years, as can be seen in Figures C-1 to C-4 respectively.

3.5 Open Pits, Rock Dumps and Tailings

3.5.1 Main Pit

Water quality in the Faro Main Pit is monitored in the near surface zone at site X22b, located off the Faro barge near the easternmost pit wall. In 2010, sampling activities were performed for the purpose of monitoring and assessment of pit water quality conditions, and to support management of the annual Faro pit pumping program. Water quality at this location is generally demonstrative of buffered acid rock drainage with high levels of metals and sulphate at a neutral pH. This is as expected given the presence of mineralized rock dumps and pit walls in the drainage area and the inflow, up until February 1998, of lime treated tailings slurry. A generally progressive increase in zinc (Zn) concentrations observed from 1998 to 2003 is consistent with anticipated trends related to the discontinuation of high pH water inflow from the tailings slurry. While zinc concentrations remained relatively consistent from 2004 through 2007, they increased slightly in 2008 before levelling off again throughout 2009 and 2010 (Figure C-5). Although there was a slight spike in zinc concentrations in X22b in February 2010 and a deep plunge in May 2010 (consistent with spring freshet, and previously observed), throughout the year both total and dissolved zinc remained well within range of levels previously observed in the Faro Pit.

In 2010, sulphate levels were similar to those seen in recent years, though were slightly elevated from September to the end of the year. As with zinc, sulphate also dropped to a low concentration in May (Figure C-6). Lead concentrations remained low and relatively stable throughout 2010, as has been the case for the past several years (Figure C-7). Although total and dissolved cadmium have been increasing gradually since 2006, concentrations levelled off in 2010, with the exception of a spike in February and a dip in May (Figure C-8).

As previously noted, the water quality of the Faro Pit is monitored and assessed over depth intervals as part of the Pit Lakes studies.

In addition to the routine water quality monitoring in 2010, the Faro Pit influent to the Faro Mill Water Treatment System was sampled on July 18 for hydrocarbons testing. The hydrocarbons monitoring project was begun in response to qualitative changes observed in the appearance of the water running through the Mill Water Treatment

System during the 2010 treatment season. Results and discussion for this sampling event were submitted to the Yukon Government in the July monthly report.

3.5.1.1 Miscellaneous Surface Seepages

Locations A25 and A30 are seeps into the Main Pit from the Faro Pit walls. Location A25 is located on the northwest pit wall and station A30 is located immediately below the toe of the Faro Valley rock dump on the north pit wall. In September 2010, in compliance with revisions to Appendix B of the Care and Maintenance contract, routine water quality monitoring was terminated at site A25 and the frequency of sampling was reduced from twice a month to monthly at site A30.

Historically, trends at site A30 have demonstrated elevated metal and sulphate concentrations and low pH in the spring, suggesting water quality is most likely affected by acid rock drainage and metals leaching. The results of the 2010 sampling events at A30 correlate with this trend, showing high sulphate and dissolved zinc, cadmium, and lead concentrations in the spring (May) with a substantial decrease to minimum concentrations by November (Figures C-6, C-9, C-10 and C-11). Furthermore, in May 2010 dissolved zinc concentrations reached a new maximum dissolved and cadmium met the previous maximum at A30.

Sampling of the seepage water at site A25 showed that dissolved metal and sulphate concentrations in 2010 were lower than those observed at A30, a trend consistent with historical data, with dissolved zinc, cadmium, and lead demonstrating levels near the MDLs for the sampling event in 2010 (Figures C-6, C-9, C-10 and C-11). Sulphate and metal concentrations have remained relatively stable at low concentrations since monitoring of the site began in 2004.

Routine sampling at the site SP5-6, a surface ditch feeding into the Main Pit from the North East Dumps, is performed twice a year in the spring and fall; however, in 2010, five sampling events were carried out (monthly June through October) as part of a Yukon Government requested isotope study. The routine parameters for each of these events can be found in Appendix C, whereas the results specific to the isotope study have been included in the respective monthly reports and will be included as part of a formal submission from Robertson GeoConsultants. Evaluation of routine parameters at SP5-6 indicates that sulphate and dissolved metal concentrations from 2010 are comparable to those observed in recent years (Figures C-6, C-9, C-10 and C-11).

3.5.2 Zone II Pit

Water pumped from the Zone II Pit into the Main Pit is monitored at location X26 for water chemistry. Information at this location can identify changes in water chemistry that may be related to acceleration in the acid rock drainage process within the Zone II pit and also provides information on contaminant loading into the Main Pit.

Currently, water from the Zone II Pit is actively pumped during the spring, summer, and fall months, permitting that the water level remains above the Zone II pump (refer to Appendix B). In summer of 2010, a new well was drilled into the Zone II Pit that would allow pumping to be carried out continuously year-round and from a depth approximately 20 m below that of the old well, allowing for maintenance of the Zone II water level below that of the North Fork of Rose Creek (and thus preventing contaminated water from potentially seeping into the creek). Although plans for commissioning of the well are still under discussion, monitoring of the water level in the new well, concurrent with monitoring of the water level in the old well, began on October 12, 2010.

In 2010, water quality monitoring at X26 was carried out from May to October. During this period, sulphate concentrations at X26 were higher than those observed in previous years, and reached levels higher than any seen before at the site. In May, August, and September, sulphate concentrations reached 4800, 3700, and 4200 mg/L, respectively (Figure C-6). X26 maintains one of the highest sulphate concentrations of all the monitored inflows in the Main Pit (second only SRK08-SPW3, on which monitoring began in April of 2009).

Dissolved zinc levels at X26 in 2010 were, on average, higher than those observed in previous years, but remained below the peak zinc concentration observed in May, 2009 (Figure C-9). Dissolved lead was low at the beginning of the 2010 pumping season, but increased throughout the summer, reaching a maximum for the year in September; although the lead concentrations did not exceed the maximum reached in 2009, they were elevated relative to recent years (Figure C-10). Dissolved cadmium concentrations were also elevated in 2010 compared to previous years and, in May, reached the highest level observed since August 2000, 0.04 mg/L (Figure C-11).

3.5.3 Northeast Rock Dumps and the North Fork of Rose Creek

3.5.3.1 The North Fork of Rose Creek (upstream of Vangorda Haul Road)

From the confluence of the Faro Creek Diversion and the North Fork of Rose Creek, the North Fork of Rose Creek flows east of the Faro Rock Dumps. Seepage from the rock dumps is monitored biannually at NE1, NE2 NE3 and W5 (refer to Figures C-12 to C-15). However, in September 2010, in compliance with revisions to Appendix B of the Care and Maintenance contract, routine water quality monitoring by Denison Environmental Services was terminated at all four of these sites. For the 2010 spring monitoring event, samples were collected from NE1 and W5, however, both NE2 and NE3 were dry (NE3 having been dry since 1999), and thus no samples were collected at these sites.

The results of sampling at NE1, located at a small intermittent surface flow below the toe of the Northeast Rock Dumps, showed that while the sulphate concentration remained at a level typical of the site in May 2010, dissolved zinc, iron, and lead spiked to concentrations higher than those seen for several years and, in the case of iron, to a concentration higher than ever seen before at the site (0.31 mg/L). Sampling at W5, located at the toe of the Northeast Rock Dump, showed that sulphate and dissolved, zinc, iron, and lead concentrations were comparable to those observed in recent years.

Surface water is monitored in the North Fork of Rose Creek at R8, R9, R10 and NF1. Sulphate, zinc, iron and lead concentrations at R7 (background), and the above surface water sites are shown in Figures 3-16 to 3-19. As with the aforementioned seepage sites, routine monitoring at NF1 was terminated in September 2010 as a result of revisions to Appendix B of the Care and Maintenance contract.

In 2010, results of surface water sampling in the North Fork of Rose Creek demonstrated sulphate concentrations comparable to recent years, with the exception that location NF1 spiked to a new maximum sulphate concentration of 48 mg/L in August. Throughout the year, water flowing down the reach showed an increase in sulphate concentrations between R8 and R9 (a trend that has been generally apparent since 2004) with the greatest difference being observed in March and April, just before spring freshet.

Total zinc concentrations in the North Fork of Rose Creek in 2010 were also similar to those observed in recent years, again with the exception of location NF1, which showed a spike in August to 0.262 mg/L, a new maximum for the site. Although total zinc concentrations were quite similar at locations R7, R8, and R9 throughout the year, location R10 maintained concentrations equal to or higher than the upstream sites for every sampling event in 2010. In addition, the total zinc concentrations at NF1 were higher than those at R10 for all but one of the sampling events in 2010 (up to August, when it was sampled for the last time). The long term trend in total zinc concentration at the sites in the North Fork of Rose Creek has been quite erratic, with no clear increasing or decreasing trend along the reach.

No clear trend in total iron and lead concentrations along the reach could be discerned for 2010, except that concentrations at NF1 were greater than at the upstream sites for most of the sampling events. At all sites, total lead and iron levels were comparable to those seen in recent years, with the exception of location NF1, which showed spikes in both parameters in August (though levels did not exceed the maxima observed previously in either case). Long term lead and iron concentrations along the reach have also been erratic, and no trend could be discerned.

3.5.3.2 Groundwater: Zone II Rock Dumps

Wells BH1, BH2, and BH4, located at the southern base of the Zone II Rock Dumps, were removed from the 2010 Groundwater Program following revisions to Appendix B of the Care and Maintenance contract and were thus not sampled in 2010.

3.5.3.3 Groundwater: Northeast Rock Dumps

Wells BH12A/B, BH13A/B, and BH14A/B are located at various distances downgradient of the Northeast Rock Dumps. Following revisions to Appendix B of the Care and Maintenance contract, BH12A/B and BH13A were removed from the 2010 Groundwater Monitoring Program and thus were not sampled in 2010.

While BH13B was frozen for the spring sampling event, sulphate and dissolved zinc results from the fall sampling event were consistent with concentrations previously observed at this well. Sulphate concentrations at BH14A/B seem to be slowly decreasing following the spike in September 2008, though they are still elevated relative to the concentrations observed in earlier years. Dissolved zinc levels at BH14A are still high following the spike that occurred in September 2008; however, dissolved zinc at BH14B returned to levels that were typical of the well prior to the spike that occurred in September 2008.

Wells SRK08-P12A/B are located in the Zone II Washout Area and are monitored as part of closure planning. Wells SRK08-P13A/B, located in the same area, were formally monitored as part of closure planning but were removed from the 2010 Groundwater Monitoring Program following revisions to Appendix B of the Care and Maintenance contract, and thus were not sampled in 2010. Sulphate and dissolved zinc concentrations for SRK08-P12A/B in 2010 were comparable to the concentrations observed since monitoring began on the wells in 2008.

3.5.3.4 Rock Drain

The North Fork of Rose Creek flows under the Vangorda Haul Road (the Haul Road) through a rock drain. While it is possible that haul road drainage is leached from the rock drain, it is unknown whether there is any acid mine drainage from the haul road foundation in this area, due to the relatively high flows from the North Fork of Rose Creek it would be expected to dilute any leachate.

Sulphate and zinc concentrations are shown in Figures C-20 and C-21, respectively, at locations upstream (NF1) and downstream (NF2), of the Haul Road, in the North Fork of Rose Creek. As shown, sulphate concentrations at NF1 were fairly erratic throughout 2010, with levels reaching a new site maximum of 48 mg/L in August (the last time it was sampled as it was removed from the water quality monitoring program following revisions to Appendix B of the Care and Maintenance contract). Sulphate concentrations at NF2 were comparable to those observed in 2009.

Total zinc concentrations at NF1 remained at levels typical of the site throughout the year, until spiking in August to 0.262 mg/L, a new maximum for the site. Total zinc concentrations at NF2 were fairly stable throughout the year, but spiked to higher levels in May and November; despite this, however, zinc levels remained within range of concentrations previously observed at the site. A clearly defined increasing or decreasing trend in sulphate or total zinc concentrations down the reach is not discernable from the 2010 data.

3.5.3.5 Intermediate and Main Rock Dumps and the North Fork of Rose Creek (downstream of Vangorda Haul Road) – S-Wells Area

The Intermediate and Main Faro Rock Dumps are understood to drain to the North Fork of Rose Creek, downstream of the Haul Road, to the tailings area and to the Rose Aquifer. Water quality in and along the reach of the North Fork of Rose Creek, from monitoring location NF2 to X2 have been intensively monitored over the past few years, due to increasing zinc concentrations observed in the North Fork of Rose Creek and in groundwater which was understood to recharge to the creek, which resulted in the activation of a trigger under the Adaptive Management Implementation Protocol (Event 5).

A summary of the follow-up activities and monitoring results in the S-wells area is included in the 2010 Review of the Adaptive Management Plan, and is therefore only briefly summarised in this section.

In 2010, surface water in this area was monitored at NF2, SC-1, SC-2, SC-3, SC-4 and X2. However, in accordance with revisions to Appendix B of the Care and Maintenance contract, routine water quality monitoring at NFRC-SC1, -SC2, -SC3, and -SC4 was terminated as of September 1, 2010. Groundwater monitoring was carried out at locations:

- S1(A and B),
- S2(A and B),
- SRK05-SP1(A and B),
- SRK05-SP2,
- SRK05-SP3(A and B),
- SRK05-SP4(A and B),
- SRK05-SP5,
- SRK05-SP6,
- SRK05-SP7(A and B),
- SRK05-SP8(A and B),
- SRK08-SBR-1,
- SRK08-SBR-2,
- SRK08-SBR-3,
- SRK08-SBR-4,
- SRK08-SPW1,
- SRK08-SPW2, and
- SRK08-SPW3.

Additional wells installed in this area in 2009, were also monitored, namely:

- P09-SIS1,
- P09-SIS2,
- P09-SIS3,
- P09-SIS4, and
- P09-SIS5.

A groundwater collection and seepage interception system was installed in 2009, with collected water pumped to the Faro Pit. The winter of 2009 / 2010 was the first during which flows could be monitored since the installation. It was expected that a decrease in zinc concentrations would be observed in the North Fork of Rose Creek, especially in the winter, when groundwater provides the base flow in the creek.

Review of the water quality downstream of the S-Wells area reach shows that zinc concentrations in the North Fork of Rose Creek have decreased, as expected, with the installation of the groundwater interception system, and have remained at low levels throughout the year. Sulphate concentrations have also decreased and remained low. In addition, zinc and sulphate concentrations in the groundwater at S1A have shown a decrease in zinc and sulphate; in 2010, dissolved zinc reached lower levels than have ever been seen at the well.

The results of monitoring in the S-wells area are further discussed in the AMP section of this report (Appendix I).

3.5.3.6 Old Faro Creek Channel and Emergency Tailings Area (ETA)

Surface seepage from the toe of the Main and Intermediate rock dump area is sampled at X23 (also called Faro Creek Seep -1 or FCS-1) located in the old Faro Creek channel. Water quality at this location is characterized by buffered acid rock drainage with elevated metals and sulphate at neutral pH. This water then flows through the Emergency Tailings Area (ETA). Various studies carried out during the past few years concluded that surface and groundwater flows through the Emergency Tailings Area (ETA) contribute a significant contaminant load to the downstream area (but still within the larger tailings capture system) and that a portion of this contaminant loading was escaping collection, leading to possible contaminant loading to the aquifer below the Rose Creek Tailings. In response to this issue, a collection and pumping system for the ETA water was installed during the fall and winter of 2006/2007. Throughout the summers of 2007-2009, water collected in the sump was pumped directly to the Intermediate Pond, and for the remainder of the year was allowed to overflow the sump and drain into the tailings area. A pumping system was installed and commissioned at the ETA in June 2010 which allowed water to be pumped directly to the Mill Water Treatment System during the treatment season; however, prior to and following water treatment, the water was still pumped to the Intermediate Pond as in previous years (refer to Water Treatment Section).

In 2010, water was also sampled in the spring and fall at X7, also known as Faro Creek Seep 3, or FCS-3, in the old Faro Creek Channel downstream of the Main Access Road. In addition, following revisions to Appendix B of the Care and Maintenance

Contract, routine monthly monitoring began in September 2010 at FCS-4, located at the outfall from the ETA collection and pumping system at the Intermediate Tailings area, and ETA Combined, which refers to the water collected by the collection sump.

In addition to the routine water quality monitoring in 2010, several samples were also collected throughout the year for hydrocarbons testing. The hydrocarbons monitoring project was begun in response to qualitative changes observed in the appearance of the water running through the Mill Water Treatment System during the 2010 treatment season. In the ETA area, samples for hydrocarbons testing were collected from the ETA influent to the Mill (July 15), well ETA-05-4 (September 21), well P96-8A (a shallow well located at the upstream end of the ETA, near X23 (September 21), and FCS-4 (October 20, December 2). Results and discussion for each sampling event were submitted to the Yukon Government in monthly reports.

Water quality and flows from the Main and Intermediate rock dump seepage, through the ETA system to the discharge location on the Intermediate Tailings area, were the subject of intensive study in 2009, including isotope testing. The project was undertaken in an effort to determine loading to the Rose Aquifer from the flows, which are not currently transported to the tailings area, as part of closure activities planning. The project was undertaken by Robertson GeoConsultants (RGC) and supported by DES and Laberge Environmental Services for additional groundwater, surface water and flow monitoring and data compilation. A report summarising findings was submitted to the Yukon Government in early 2010 (by RGC) and showed that loading from the ETA to the Rose Aquifer was likely occurring along the north side of the tailing impoundment.

Sulphate at both X23 and X7 has generally increased since sampling at the sites first began, but in 2010 concentrations were similar to those observed in 2009 for both sites. Although there have only been a few sampling events at each FCS-4 and ETA Combined, sulphate at both site appears to be increasing, with the maxima for both sites recorded in December 2010 (7400 and 7500 mg/L, respectively) (Figure C-25).

Dissolved zinc at X23 has been rapidly increasing since February 2008, but throughout 2010 showed a general decrease in concentrations compared to those seen in 2009. Total zinc at location X7 has been gradually climbing since 2006, and continued to do so throughout 2010. Total zinc at both FCS-4 and ETA Combined reached a maximum in October 2010, but then decreased in the final two months of the year (Figure C-26).

3.5.3.7 Groundwater: Main Rock Dumps

Adjacent to surface monitoring location X23, well P96-7 is located at the central toe of the Main Waste Dump and wells P96-8A/B are located in the Old Faro Creek Channel. These wells were monitored as part of the Care and Maintenance Contract. SRK-04-3A, SRK05-ETA-BR1, SRK05-ETA-BR2, all wells located in the ETA, were also monitored in 2010, but under closure planning programs. In 2008, two new wells were installed to monitor groundwater understood to drain from the Main Rock Dumps and the ETA at SRK08-P10 (A and B). SRK08-P10A was monitored in 2010 as part of the Care and Maintenance Contract (spring and fall), though the well had insufficient water during the fall sampling event to collect a sample; SRK08-P10B was removed from the 2010 Groundwater Program as it was dry.

In 2010, P96-7 and P96-8B both exhibited sulphate concentrations similar to those that had been previously observed at the wells. P96-8A, however, demonstrated a decrease in sulphate concentrations to below what was observed in 2009, though still remained elevated relative the levels seen in previous years. Dissolved zinc at P96-7 in 2010 spiked to a level of 0.155 mg/L in the spring, a concentration much greater than has been observed at the site for many years, but returned to levels characteristic of the well by the fall. Concentrations of dissolved zinc at P96-8A and P96-8B were lower than the maximum values seen in 2009, but still elevated relative to concentrations seen in years previous.

While the 2010 sulphate concentrations for SRK08-P10A were comparable to those seen since monitoring of the well began in 2008, dissolved zinc concentrations spiked to 0.636 mg/L, a large increase when compared to the previous maximum of 0.0819 mg/L.

2010 sulphate and dissolved zinc concentrations for SRK04-3A, SRK05-ETA-BR1, and SRK05-BR2 were all comparable to historical values.

In 2009, two additional monitoring wells were installed at the base of the canyon that drains the portion of the Main Rock Dump and ETA flows that are not captured through the ETA collection system: P09-ETA1 and P09-ETA2. P09-ETA1 was sampled in the fall as specified in the final version of the 2010 Groundwater Monitoring Program; however, while the final version of the 2010 Program indicated that P09-ETA2 was to be monitored in the spring and fall, the draft of the program available during the spring sampling event indicated that it was to be sampled annually (in the fall) and, as a result, it was only sampled in September. Results of the sampling showed sulphate concentrations at both wells similar to those observed in 2009; however, while dissolved zinc concentrations at P09-ETA2 were similar in 2009 and 2010, the dissolved zinc concentrations at P09-ETA1 spiked to a much higher level in 2010 than was observed in 2009.

Figures of the water quality at these groundwater monitoring locations will be included in the 2010 Annual Groundwater Review (RGC) and are therefore not included in this report.

3.5.3.8 Northwest Rock Dump

Surface water sites W10 and W8 are located in Upper Guardhouse Creek upstream and downstream of where it passes under the corner of the Northwest Rock Dump, respectively. The water flowing through these sites is intercepted downstream by the North Valley Wall Interceptor Ditch. Starting in May 2009, a new monthly water sampling site, designated NWID, was established in the Interceptor Ditch approximately 350 m northeast of the Guardhouse, and downstream of locations W10 and W8. In September 2010, in compliance with revisions to Appendix B of the Care and Maintenance contract, routine water quality monitoring by DES was terminated at all three sites.

Only three samples from W10 and one sample from W8 were collected in 2010 because the sites were dry/frozen from January through April. However, the results obtained from the samples that were able to be collected show that sulphate concentrations at both sites were comparable to those seen in recent years, and only increased slightly between W10 and W8. Sulphate levels at NWID were also similar to those seen previously, remaining at an elevated level relative to that of W8.

Total zinc concentrations at location W10 were comparable to those observed in recent years, undergoing a slight increase as the water flowed to location W8. Total zinc concentrations downstream at NWID differed little from those observed at W8.

3.5.3.9 Miscellaneous Faro Dump and Area Drainage

In 2008, two wells were installed in the area east of the guardhouse: SRK08-P11(A and B). Sampling of these wells in 2010 revealed fairly low sulphate and dissolved zinc concentrations (similar to those observed in 2009), and circum neutral pH in both cases.

Another well, SRK08-P9, was also installed in 2008 to monitor groundwater flow downgradient of the Faro Main Dump. Although sampling was successfully carried out at this well in 2009, there was insufficient water at both sampling events in 2010 to successfully collect any samples. As a result, there is no 2010 data available for this well.

3.5.4 Rose Creek Tailings Facility

3.5.4.1 Intermediate Pond

From approximately 1986 to 1992, the Intermediate Impoundment was used for tailings deposition. Then from 1992 to 1997, a cessation of tailings deposition into the Down Valley Tailings Facility occurred and there was a general increase in the concentration of zinc in water flowing through the Intermediate Pond. This trend is attributed to:

- Removal of a large inflow of alkalinity that previously entered the pond via the tailings slurry;
- Continued inflow of contaminated water from the rock dumps (location X23) and the plant site (location Guardhouse Creek - GDHSECK); and
- Continued flushing of contaminants by run off over beached (exposed) tailings in the upstream portion of the Intermediate Impoundment.

In 1992, the Down Valley Water Treatment system was put into operation. This system included siphoning and treatment of water from the Intermediate Pond by addition of lime slurry in a mixing tank, followed by release of treated effluent into the Cross Valley Pond.

On a seasonal basis, the Intermediate Pond received inflow of treated water pumped from the Faro Main pit from 1998 to 2000. This periodic inflow of a relatively high volume of high pH water resulted in a general improvement in pond water quality. In 2001, the method for treatment of water pumped from the Faro Main pit was improved due to activation of a treatment system in the mill that utilized certain fixed equipment for lime treatment and settlement of sediments. From 2001 through 2005, bypassing the Intermediate Pond allowed for compliant effluent from the mill to be delivered into the Intermediate Pond spillway. This resulted in an apparent negative impact on water quality within the Intermediate Pond due to the removal of the periodic inflow of high pH (treated) water.

In 2006/2007, a water collection system (a sump) was installed at the Emergency Tailings Area (ETA) to reduce contaminant loading from the area into the underlying aquifer. Throughout the summers of 2007-2009, water collected in the sump was pumped directly to the Intermediate Pond, and for the remainder of the year was allowed to overflow the sump and drain into the tailings area. A pumping system was installed and commissioned at the ETA on June 16, 2010 which allowed water to be pumped directly to the Mill Water Treatment System during the treatment season;

however, following shut down of water treatment systems, the water was again pumped to the Intermediate Pond as in previous years.

A pumping barge was installed at the Intermediate Pond in 2006 to allow for redirection of water requiring treatment to the Mill Water Treatment System. Treated effluent was, and still is, released into the Cross Valley Pond. In 2010, the Intermediate Pond pumping system was upgraded from a diesel-driven pump system to an electrically-driven pump system which allowed for better control over the water level in the pond. Details of the Intermediate Pond pumping and Mill Water Treatment systems are discussed in Section 5. In 2007, the Down Valley Water Treatment System remained in place on a stand-by basis, but was not used. In 2008 and 2009, the Down Valley Treatment System was used during the water treatment season, allowing water to be pumped directly from the Intermediate Pond to the Cross Valley Pond, in addition to pumping from the Intermediate Pond to the Mill Water Treatment System. In 2010, all Intermediate Pond water treatment was carried out through the Mill Water Treatment System; the Down Valley Treatment System was decommissioned for use in routine water treatment, but was left in place for use in emergency situations.

The water quality in the Intermediate Pond is monitored at station X4 which, in 2010, was sampled from the Intermediate Pond Barge, located near the north eastern edge of the pond. Results of water quality analysis showed that sulphate concentrations varied widely throughout the year, ranging over more than 600 mg/L. This coincides with the seasonal variation observed at X4 in the past, in which lowest sulphate concentrations are typically observed in the spring months. Sulphate at X4 has demonstrated a gradual increase since 1998, but in 2010 levels appear to have stabilized somewhat, remaining within range of those observed in 2009 (Figure C-29).

Although total and dissolved zinc concentrations have been steadily increasing at station X4 since 1998, they underwent only a small increase in January 2010 to slightly higher than the previously observed maximum, before dropping down and maintaining levels similar to those from 2009. Total and dissolved zinc at X4 typically demonstrate seasonal variability, with low concentrations in the spring and high concentrations in the fall and winter; in 2010, however, the zinc levels in October were low, and those in December were near levels typically seen in the spring (Figure C-28).

Although total and dissolved iron concentrations at station X4 have been gradually increasing since 2002, they demonstrated a dramatic increase in 2010, reaching new maxima in March more than one and a half times the previous records. Seasonal variability, typical of iron at this site, was also apparent in 2010, with low concentrations in the spring and high concentrations in the winter (Figure C-30).

The pH in the Intermediate Pond demonstrated seasonal variation typical of the site from January through July 2010, with reduced acidification during the spring. However, in August, the pH in the pond increased to above 4 and did not drop below that level through the rest of the year; although this is still quite acidic, pH levels at X4 in the fall and winter have, for the past several years, remained at levels near 3 (Figure C-27). The low pH in the Intermediate Pond may be the result of one or more factors:

- continued acidification of the pond since the introduction of treated alkaline water from the Faro Pit was discontinued in 2001;
- discontinuation of input of alkaline Mill treatment sediments (sludge) via the ETA ditch area (Mill treatment sludge is now deposited to the original tailings impoundment);
- possible poorer water quality exists at lower elevations in the pond, and as the pond is increasingly drawn down to lower levels, poorer water quality is reached; and/or
- the direct discharge to the Intermediate Pond of water collected from the ETA during the summer months of 2007, 2008, and 2009.

When pond elevations are maximums, zinc concentrations are at minimums (supporting the third possibility, above) (Figure C-31).

Total aluminum concentrations in 2010 were high in comparison to long-term historical trends, though somewhat reduced compared to those seen in 2008 and 2009. High levels of iron and aluminum may be attributed to the direct discharge of water collected from the Emergency Tailings Area (via the sump) into the Intermediate Pond.

In addition to the routine water quality monitoring in 2010, the Intermediate Pond influent to the Mill Water Treatment System was sampled on July 18 for hydrocarbons testing. The hydrocarbons monitoring project was begun in response to qualitative changes observed in the appearance of the water running through the Mill Water Treatment System during the 2010 treatment season. Results and discussion for this sampling event were submitted to the Yukon Government in the July monthly report.

3.5.4.2 Groundwater

In 2009, groundwater wells in the Rose Creek Tailings Facility and the underlying native soils (i.e., the aquifer) were sampled as required under the Adaptive Management Plan. The groundwater monitoring wells located at the toe of the Intermediate Dam (i.e. Wells

X24-96D, X25-96(A and B), P01-03, and P01-04(A and B)) were sampled according to the Care and Maintenance contract, with the exception that P01-04B was frozen for the spring sampling event. Water quality at these locations are further discussion in the Adaptive Management Plan 2010 review, included in Appendix I.

3.5.4.3 Lower Guardhouse Creek

Lower Guardhouse Creek (location GDHSECK) receives runoff from some areas of the site and flows into the Intermediate Impoundment. In 2010, sampling of the creek took place along the lower reaches, immediately upstream of the Intermediate Impoundment. Results of sampling in 2010 demonstrated sulphate and zinc concentrations comparable to those seen in recent years in addition to a circum neutral pH typical of the site.

In addition to the routine water quality monitoring in 2010, GDHSECK was also sampled on December 2 for hydrocarbons testing. The hydrocarbons monitoring project was begun in response to qualitative changes observed in the appearance of the water running through the Mill Water Treatment System during the 2010 treatment season. Results and discussion for this sampling event were submitted to the Yukon Government in the December monthly report.

3.6 Water Quality Entering Rose Creek

3.6.1 Effluent Discharge

Location X5 samples the effluent discharged from the Cross Valley Pond as surface outflow. Appendix B of DES's contract requires X5 to be sampled weekly when discharging and also requires a surface grab of the Cross Valley Pond to be sampled monthly when there is no discharge (X5P).

The Mill Water Treatment system was successfully operated in 2010 as described in Sections 2 and 5 of this report. The treatment system and the "polishing" action of the Cross Valley Pond were effective in maintaining compliance with the effluent discharge criteria for water released via location X5 based on weekly grab samples tested by a certified lab. The periods and volumes of effluent release are described in Section 2.

In addition to the chemical analyses at the external laboratory, frequent in-house analyses for total zinc were performed on-site to provide site management with an immediate indication of effluent quality. (This is described in further detail in Section 6 of this report.) The Rose Creek drainage water quality results from the on-site lab are described and reported in Appendix C, including temporal trend graphs.

In 2010, samples were collected at X5/X5P for acute lethality testing using rainbow trout (96-hour LC_{50}). All tests passed by >100%, with no mortalities. (Appendix C)

In addition to the routine water quality monitoring in 2010, water from X5, the Clarifier, and the Thickener (in the Mill Water Treatment System) were sampled on July 15 for hydrocarbons testing. The hydrocarbons monitoring project was begun in response to qualitative changes observed in the appearance of the water running through the Mill Water Treatment System during the 2010 treatment season. Results and discussion for this sampling event were submitted to the Yukon Government in the July monthly report.

Furthermore, in July 2010, samples were taken from X5 and from a depth of 2.0 m in the north corner of the Cross Valley Pond for a multi-laboratory cyanide comparison study. Details of this study were also submitted to the Yukon Government in the July monthly report.

3.6.2 Cross Valley Dam Seepage

Seepage from the Cross Valley Dam is monitored just downgradient of the toe at location X13. There are three individual seepages that report to location X13: locations X11, X12 and WEIR3. Location X11 is the primary seepage stream and collects seepage from the north abutment of the Cross Valley Dam. Location X12 collects seepage from the south abutment of the Cross Valley dam. Location WEIR3 collects seepage from the central area between locations X11 and X12.

Flow rates at these locations are reported in Appendix B of this report, and the implications with regards to the geotechnical performance of the Cross Valley Dam are described in the accompanying geotechnical inspection report prepared by Kejeh Neyeh Golder.

Water quality at location X13 was monitored throughout 2010, and nearly all parameters remained within the maximum allowable discharge limits outlined in Appendix B of the Care and Maintenance contract; the exceptions were colour and turbidity, which remained generally within the range previously observed, and ammonia, which reached the highest level seen since 1990 in September. Although dissolved zinc has remained at fairly low concentrations for several years, concentrations in 2010 were quite erratic and spiked substantially, reaching a new maximum of 0.138 mg/L in September, though still remaining below the compliance limit of 0.5 mg/L. Sulphate concentrations have been gradually increasing at X13 since 1997, and continued to do so throughout 2010. Both TSS and pH remained at levels typical of the site.

Routine quarterly bioassay samples for acute lethality testing using rainbow trout (96-hour LC_{50}) were collected in March, June, September and December of 2010 at location X13. All tests passed with no mortalities. A summary of bioassay results in included in Appendix C.

Water quality at locations X11, X12, and WEIR3 was tested twice in 2010, in the summer and winter. At all three locations, sulphate has been increasing gradually since 2001/2002, and continued to do so in 2010, reaching new maxima for X11 and X12 in March (1500 and 700 mg/L, respectively) and a new maximum for Weir 3 in August (890 mg/L). X11 has consistently shown the highest sulphate concentrations of the three seeps since monitoring of the sites began. Dissolved zinc concentrations at X11 and X12 were similar to those observed in previous years; dissolved zinc at Weir 3 spiked to a new maximum in March 2010 (0.0397 mg/L), but reverted to levels typical of the site by the summer sampling event.

In addition to the routine water quality monitoring in 2010, locations X11 and X13 were sampled on August 5 for hydrocarbons testing, and locations X11, X12, X13, and Weir 3 were sampled on November 4 for ammonia, nitrate, and nitrite. The hydrocarbons monitoring project was begun in response to qualitative changes observed in the appearance of the water running through the Mill Water Treatment System during the 2010 treatment season. Results and discussion for this sampling event were submitted to the Yukon Government in the August monthly report. The nitrogen-related sampling of the seepage sites downstream of the Cross Valley Dam was undertaken in response to the ammonia compliance limit exceedance at X13 seen in September 2010. The results and discussion for this sampling event were submitted to the Yukon Government in the November monthly report.

3.6.3 Groundwater

Groundwater quality is monitored below the Cross Valley Dam. A portion of the groundwater from the underlying aquifer is thought to discharge to the surface and enter Rose Creek in the general vicinity of sampling location X14, and some portion is thought to remain in the aquifer as groundwater flow.

Groundwater was monitored at well locations X16A/B, X17A/B, X18A/B, P01-01A/B, P01-11 P01-02A/B, and P09-C1, -C2, and -C3, downgradient of the Cross Valley Dam.

It is anticipated that figures of the water quality at these groundwater monitoring locations will be included in the 2010 Annual Groundwater Review (RGC) and are therefore not included in this report.

A study of the Rose Aquifer water quality and sources waters by RGC, with monitoring support through DES, was scheduled for 2010, but was deferred to early 2011.

3.7 Receiving Water Quality

3.7.1 Rose Creek Diversion Channel

Rose Creek is monitored upstream (location X3) and downstream (location X10) of the constructed diversion channel that passes Rose Creek around the Rose Creek tailings facility. Beginning in September 2010, in accordance with revisions to Appendix B of the Care and Maintenance Contract, an additional site, X3A, was established at the head end of the Rose Creek Diversion Channel, downstream of X3 and slightly upstream of the Rose Creek Staff Gauge #4.

Station X3 is located at the outflow of the pumphouse pond. Monitoring this water includes evaluating all flow from the South Fork of Rose Creek and a majority of the flow from the North Fork of Rose Creek via location X2. A small portion of the flow from the North Fork of Rose Creek bypasses the pumphouse pond via a secondary diversion channel that was constructed in previous years. This “bypass” flow enters the Rose Creek diversion channel immediately downstream of the pumphouse pond. Monitoring at the new station X3A allows for the evaluation of all flow entering the Rose Creek diversion channel. On October 21, 2010, a low flow mixing study was carried out at X3A to ensure water quality at the site was uniform across the channel and representative of the flow entering the diversion; the observed variation in the results was no greater than that typically observed in split quality control samples, and so it was concluded that the water at the site was sufficiently mixed in low flow. Details of the study were submitted to the Yukon Government in the October monthly report.

Location X10 is located near the downstream extent of the Rose Creek diversion channel adjacent to piezometer X16. In addition to monitoring at X3, X3A, and X10, samples were also collected from the Rose Creek diversion at Rose Creek Staff Gauge #4 (RCSG#4) in January, and from March through August 2010 following observations of staining on the ice in the diversion in December 2009.

In 2009, sulphate and zinc concentrations at location X3 adhered to previously established seasonal trends, with maximum levels observed early and late in the year, and minimum levels observed in the late spring and early summer. For both parameters, peak concentrations were lower than those seen in 2009 and earlier years, likely a result of the groundwater collection system installed in the S-Wells area. Zinc and sulphate concentrations at RCSG#4 and X3A were very similar to those seen at X3 with the exception of a small spike in zinc at X3A in November and at RCSG#4 in

August. Lead and iron concentrations at X3 for 2010 were comparable to those from previous years, with lead maintaining levels at or near detection limits and iron demonstrating the typical spike in May; X3A and RCSG#4 were similar to X3 for lead and iron, also, though iron showed a small spike at X3A in November, and at RCSG#4 in August. Cadmium concentrations remained low throughout 2010 and were comparable to concentrations observed previously at location X3; cadmium concentrations at X3A and RCSG#4 were similar to those seen at X3. (Figures C-32 to C-36).

Sulphate and zinc at location X10 likewise demonstrated concentrations typical for the site and differed little from those observed at location X3, with lower peaks for sulphate and zinc than in 2009 and earlier. Lead, iron, and cadmium concentrations at X10 remained within typical ranges throughout the year. (Figures C-32 to C-36).

Locations X2, X3, and X10 generally follow the same trends in zinc and sulphate concentrations, with seasonal fluctuations of both zinc and sulphate and higher concentrations typically observed during winter months. Zinc and sulphate results from X3A and RCSG#4 also demonstrate these seasonal fluctuations.

3.7.2 Rose Creek Immediately Downstream of the Mine Area

Rose Creek immediately downstream of the confluence with effluent discharges (locations X5 and X13) is monitored at location X14. Appendix B of DES's contract requires that X14 be sampled monthly or weekly when effluent is being released via location X5. This station typically reports higher zinc and sulphate during periods of effluent discharge in comparison to sampling periods with no active discharge from the Cross Valley Pond.

In 2010, sulphate and zinc concentrations were slightly lower than those seen in 2009, but, overall, similar to those observed at the site in recent years.

Water quality at X14 is assessed on a monthly basis as part of Adaptive Management Plan, and results with figures are presented in the 2010 Annual Adaptive Management Plan report.

4. WATER QUALITY MONITORING – VANGORDA CREEK DRAINAGE

4.1 Overview of Water Quality Monitoring Program

The water quality monitoring program for the Vangorda Plateau mine site in the year 2010 was completed in accordance with Appendix B of the Care and Maintenance Contract and water treatment process requirements. Details about the routine water quality monitoring program sites and frequency for 2010 are included in Appendix A.

The monitoring program is carried out by staff employed at the mine site by Denison Environmental Services (DES). Various professional laboratories have been used to provide the sample analyses over the life of the monitoring at the Faro site. Laboratories are selected on the basis of certification with the Canadian Association of Environmental Analytical Laboratories, service and other factors. In 2010, most of the water analyses were conducted by Maxxam Analytics. Analytical data for 2010, including bioassay results, are provided in Appendix D (surface water, seeps and groundwater). Graphs of water quality trends for Vangorda Creek Drainage sites are also included in Appendix D.

The monitoring program also makes extensive use of the unique capability for on-site zinc analyses to provide immediate feedback to site managers regarding effluent quality. On-site analyses of effluent zinc concentrations are conducted on a daily, or more frequent basis, when treated effluent is being released. Results from on-site analytical testing in the Vangorda Creek drainage are also included in Appendix D (tables and figures).

The monitoring locations are illustrated in site plans included in the Figures section of this report.

A brief review of the 2010 routine water quality monitoring results is provided in the following sections.

4.2 Vangorda Creek – Background / Upstream Sites

Water quality upstream of the areas of former and current mine and Care and Maintenance activities was monitored at V1, located in Vangorda Creek upstream of Blind Creek Road, at V19 in the northwest interceptor ditch and at V20 in the northeast interceptor ditch.

4.2.1 Upper Vangorda Creek

V1 is located in the Main Fork of Vangorda Creek immediately upstream of mine activities. This location provides background reference information for Vangorda Creek upstream of the mine site. Sulphate concentrations in 2010 ranged from 13.0 to 5.5 mg/L and continued to display a seasonal trend with lower concentrations observed in the summer months (Figure D-1). In 2010, total zinc concentrations ranged from 0.00080 to 0.0064 mg/L and remained consistent in variability relative to results observed in previous years (Figure D-2). pH levels at V1 remained neutral throughout 2010, consistent with previous years. Cadmium concentrations have been in a stable trend since June 2003 which continued through 2010 (Figure D-3).

4.2.2 Vangorda Northwest Interceptor

V19 is located in the Vangorda Pit Northwest Interceptor Ditch, which drains into Vangorda Creek at the plunge pool. In 2010, V19 was removed from the 2010 revised Appendix B of the Care and Maintenance Contract. Therefore, only one sample was required by DES to collect in the spring of 2010. At the time of sampling, V19 was dry and no sample could be collected.

4.2.3 Vangorda Northeast Interceptor

V20 is located in the downstream end of the Vangorda northeast interceptor ditch, which passes clean runoff water that would originally have flowed directly into Vangorda Creek around the east and south sides of the Vangorda pit and rock dump area. This diverted water then enters Shrimp Creek. Flow at location V20 has, historically, been intermittent and an investigation conducted in 2002 identified the cause of this poor performance as ditch leakage into Vangorda Pit. In response to this, physical maintenance work was performed to the ditch in the summer of 2002, which resulted in the effective diversion of water around the Vangorda Pit, per the original intent for the ditch.

In 2010, V20 was removed from the 2010 revised Appendix B of the Care and Maintenance Contract. Therefore, only one sample was required by DES to collect in the spring of 2010. An alternate monitoring site was established in Dixon Creek upstream or the confluence with drainage from the northwest inceptor ditch in October 2010, as the larger component of flow that drains to Shrimp Creek originates in with the Dixon Creek flowpath.

In 2010, sulphate (3.8 mg/L) and cadmium concentrations remained comparable with spring results in previous years (Figures D-1 and D-3, respectively). pH levels remained neutral to slightly alkaline which is consistent with previous years. A relatively high zinc concentration (0.02140 mg/L) was observed in the spring sample (Figure D-2). These results were not retested and the number stands.

4.3 Open Pits and Rock Dumps

4.3.1 Grum Pit

Water quality in the Grum Pit is monitored at location V23 (pit pond). Location V23 has been routinely monitored (grab samples from the surface of the pit pond) since mine shut down (February 1998) and represents the accumulation of water in the pit in the absence of dewatering activities.

No water was added to the Grum Pit in 2010. The only input was from the usual groundwater and seepage occurrences.

In 2004, a pilot project of biological pit lake treatment using algae was implemented at the Grum Pit as part of ongoing studies for the development of the FCRP. Reductions in zinc concentrations observed during the first year of treatment prompted continuation of the treatment program. Zinc concentrations throughout 2010 are comparable to those prior to pit lake treatment implementation (2005), with seasonal trends defined by lower concentrations typically observed during the summer months. The concentrations of total and dissolved zinc (Zn) ranged from 2.01 mg/L to 5.14 mg/L and from 1.72 mg/L to 4.96 mg/L, respectively, in 2010 (Figure D-4). The concentration of sulphate remained consistent with previous years, ranging from 350.0 mg/L to 530.0 mg/L. The pH remained neutral to slightly alkaline in 2010 ranging from 7.6 to 8.1.

The water quality of the Grum Pit is monitored and assessed over depth intervals as part of the Pit Lakes studies. The results of pit lakes monitoring are included in Appendix D. It is understood by DES that results are assessed as component of closure planning and is therefore not repeated in this report.

In 2010, two (2) wells were monitored in the Grum Slot Cut. Monitoring frequencies for each site are found in Appendix A. Analytical data for each site are displayed in Appendix D.

4.3.2 Grum Rock Dump

4.3.2.1 Grum Rock Dump Drainage – Southeast Side

V15 is located in a small draw, which naturally collects some surface seepage flow below the Grum Rock Dump including drainage from the area occupied by a sulphide cell. A sump collects flow and promotes settlement of suspended sediment. Flow from this location used to enter Grum Creek upstream of monitoring location V2. Elevated zinc concentrations observed in 2007 prompted redirection of water from location V15 to V2A for preservation of downstream water quality at location V2. This action was taken in response to the activation of a trigger under the Adaptive Management Implementation Protocol (Event 4). In August 2007, a small ditch was constructed and from that point on water flowed via gravity to V2A. In 2010, work took place to cover the Grum Waste Rock Sulphide cell directly upstream of the V15 collection area. The water quality in this area, including surface water, seepage water and groundwater is reviewed in detail as part of the 2010 Annual Review of the Adaptive Management Plan. Therefore, water quality in this area is only briefly summarised in this section.

Surface water/seepage water locations monitored in this area as part of the Care and Maintenance Contract include V14, V15, V16, Moose Seep, V2, and V2A. In addition to surface water monitoring, monitoring at SRK05-09 (Moose Well 2), P96-9A, BH05-9B-R (P96-9BR), SRK05-05C, SRK05-7 and SRK05-8 also took place in 2010.

Results of water quality monitoring at V14 and V16 demonstrated a continuation of historical trends in zinc and copper throughout 2010, with concentrations comparable to those observed in previous years. Contrary to the decreasing trend that has been observed since 2006, sulphate concentrations spiked in June 2010. However, due to the large site variability it is unclear what the significance of this high value is. V16 sulphate concentrations were higher than results seen in September 2009, but the concentration was consistent with the high variability observed in previous years.

In 2010, copper concentrations at Moose Seep remained consistent with trends observed in previous years, displaying an increase in concentrations throughout the summer months. Zinc concentrations in 2010 were erratic compared to previous years with spikes occurring during summer and fall. A new zinc concentration high was observed in June 2010 (17.4 µg/L). Sulphate concentrations at Moose Seep were high but stable throughout 2010 with new concentration highs observed several times during the year (1300 mg/L)

In 2010, zinc and copper concentrations at SRK05-09 (Moose Well 2) were erratic (as is typical for the site) with several spikes in zinc concentrations occurring throughout the year. A new zinc concentration high was observed in November 2010 (81.2 µg/L). Sulphate concentrations at SRK05-9 were high but relative stable in 2010 with a new concentration high being observed in September 2010 (1400 mg/L).

Water quality in this area is further discussed in the AMP review of Event 4 (Appendix I).

4.3.3 Vangorda Open Pit

Vangorda Pit water is monitored at location V22. During the period of active mining (pre-1998) when pit dewatering was underway, location V22 was sampled at the outflow of the dewatering pipe. Following the suspension of mining activities (and dewatering) in February 1998, location V22 has been sampled in the pit pond. The water that has accumulated in Vangorda Pit since mine shut down has included natural inflows, water pumped periodically from Little Creek Dam and water pumped/siphoned periodically from the Sheep Pad Pond.

The water level in the Vangorda Pit is maintained below a defined maximum desired level to provide for emergency storage below the overflow elevation to accommodate unforeseen events. Water is pumped from the Vangorda pit to the Grum/Vangorda water treatment plant and, after treatment and removal of metals, is released to Vangorda Creek via the Grum Interceptor Ditch to the Sheep Pad Pond and monitoring location V25BSP. The pumping and release of water is further described in the Water Treatment Plant performance review that is documented in Sections 2 and 5 of this report.

The increasing trend from 2009 of zinc concentrations at V22 continued throughout 2010 (Figure D-6). The sharp increase in zinc in 2002 may have been related to maintenance and repairs to one of the freshwater diversions, the Northeast Interceptor Ditch, in 2001. This repair work substantially improved the efficiency of the ditch to pass clean water around the Vangorda pit to Shrimp Creek. It is possible that this work removed a relatively large inflow of clean water and resulted in the increased concentrations observed in the pit. Also, zinc concentrations were observed to increase with depth in a 2000 pit survey and it is possible that the variability of zinc concentrations in surface grab samples is related to seasonal effects such as pond turnover.

The concentrations of sulphate in 2010 continued to remain elevated when compared to pre-2009, ranging from 1100 mg/L to 1600 mg/L (Figure D-5).

The pH ranged from acidic to neutral in 2010 with a range of 3.1 to 7.2. A decrease in pH was observed throughout the beginning of 2010 with levels increasing again from June 2010. These measurements could be attributed to seasonal effects such as the aforementioned pond turnover (Figure D-7).

The water quality of the Vangorda Pit is monitored and assessed as part of the Pit Lakes studies, over depth intervals. The results of pit lakes monitoring are included in

Appendix D. It is understood by DES that the results are assessed as a component of closure planning and is therefore not repeated in this report.

4.3.4 Vangorda Rock Dump

4.3.4.1 Surface Seepage

Six transverse drains were constructed in 1994 that pass toe seepage from the Vangorda rock dump through the till containment berm that rings the dump. These six drains represent monitoring locations V28 through V33 (sites correspond with Drain number 1 through 6).

Sites V29, V30, V31, V32, V33 were scheduled for monitoring on a spring/fall frequency in 2010 (Appendix A). Due to low flow conditions, sampled were successfully collected from V30 and V33, but none of the other toe drains sites, in 2010. Analytical data for these sites is displayed in Appendix D. Temporal trends for sulphate and zinc (dissolved) are shown in Figures D-21 and D-22.

In 2010, sulphate at V30 (Drain 3) ranged from 6,000 to 7,200 mg/L while zinc (dissolved) ranged from 575 to 594 mg/L. While the sulphate concentrations at this site rival those seen in the shallow aquifer of the S-wells area, the zinc concentrations are lower. The pH was approximately 6 in 2010.

In 2010, at V33 (Drain 6) sulphate ranged from 81,000 to 87,000 mg/L, an order of magnitude higher than observed at V30, and this highest of all Faro Mine Complex sites. Temporal trends show a rapid rise in sulphate in 2004, with a stable to increasing trend, from this time. Zinc (dissolved) ranged from 12,600 to 13,700 mg/L, also the highest observed on site. Zinc concentrations at this site have been steadily increasing. pH at the site is acidic, measuring 4.8 to 5.5 in the field and 3.7 in the lab.

Water seeping from the toe drains is directed to the Vangorda Dump drainage ditch. The ditch leads to Little Creek Dam Pond, where water is collected, and then pumped to Vangorda Pit.

4.3.4.2 Little Creek Dam

Little Creek Dam (LCD) is the collection point for surface run off from the Vangorda Rock Dump, toe seepage from the Vangorda Rock Dump, local area run off from its catchment area and direct precipitation. Prior to the shutdown of mining activities in February 1998, the Vangorda Pit was dewatered directly into Little Creek Dam and all water was pumped from Little Creek Dam to the water treatment plant for treatment and discharge. Since the mine shut down, water from Little Creek Dam has been pumped into the Vangorda Pit. This has been required on a seasonal basis and has occurred once or twice per summer.

The pumping procedure has maintained an appropriate water elevation in Little Creek Dam such that the risk of release of non-compliant water was minimized. Little Creek Dam was previously sampled in 2000 and then again from 2004 to 2008. LCD was sampled as per the water monitoring schedules for 2010, with the frequencies summarised in Appendix A.

In 2010, the high concentrations of zinc at LCD observed in 2009 continued. (Figure D-8), with an observed range of 203 to 1160 mg/L. These results coincide with an increase of sulphate concentrations (ranged from 1,600 to 8,100 mg/L in 2010) and a drop in pH. This is likely due to an increase in acid mine drainage that seeps from in and around the Vangorda waste dump.

In 2010, five (5) wells were sampled to monitor drainage from LCD to Vangorda Creek, P09-VC1, P09-VC2, P09-LCD1, P09-LCD4, and P09-LCD6. Monitoring frequencies for each site is summarised in Appendix A. Analytical data for each site is displayed in Appendix D.

4.3.4.3 Groundwater Seepage

Monitoring wells V34 through V37 (which correspond with locations GW94-01 through GW94-04) were installed in 1994 around the toe of the Vangorda Rock Dump to allow monitoring of groundwater seepage below the collector ditch. In 2010, all of these sites were sampled with the frequencies summarised in Appendix A.

In 2010, V34 and V35 saw a spike in zinc concentrations compared to the normally low levels observed, with V34 spiking at 0.0822 mg/L in September and V35 at 0.0564 mg/L in June. V36, however, continued to increase from June, 2008, reaching a new high of 0.0748 mg/L in June, 2010. V37 continued to show low level concentrations of dissolved zinc (Figure D-9).

V34 is starting to show an increasing trend reaching a new high of 260 mg/L in September, 2010. V35 continued to show variability in sulphate concentrations, and is showing an increasing trend reaching a new high of 1,700 mg/L in June, 2010. At V36, an increase in sulphate was observed, with a new high of 1,300 mg/L being reached in June. V37 is starting to show an increasing trend reaching a new high of 170 mg/L in September, 2010. V34 and V37 have remained consistently lower than V35 and V36. (Figure D-10)

A series of piezometers V39 to V47 (correspond with P94-01 through P94-04) are installed in the till berm which surrounds the base of the rock dump and through which the transverse drains pass seepage water. No water quality monitoring has been a part of routine monitoring since 1998. However in June, 2010 samples were requested as part of a special project and were collected and a memo submitted to the Yukon Government detailing the results of this work.

In 2010, five new wells DH1 through DH5 (correspond with PW-10-01 to PW-10-05) were installed. In October and November, 2010 preliminary samples were requested, collected and a memo was submitted to the Yukon Government detailing the results of this work.

Two additional monitoring piezometers were installed in 2001 around the toe of the Vangorda rock dump to allow monitoring of groundwater seepage below the collector ditch, P2001-02 and P2001-03. Piezometer P2001-02 is a nested well in one drill hole, P2001-02A and P2001-02B. All of these piezometers were sampled twice during 2010, with the frequencies summarised in Appendix A. P2001-2A and B and P2001-3 continued to show low metal concentrations and neutral pH. At P2001-3 zinc and sulphate concentrations remained consistent with previous years' data. However, at P2001-A and B a slight increase in sulphate levels were observed.

4.4 Water Quality Entering Vangorda Creek

4.4.1 Sheep Pad Pond

Location V25BSP represents all water that enters Vangorda Creek via the Sheep Pad Pond including water discharged from the water treatment plant/clarification pond and natural runoff. V25BSP is a point of compliance for water entering Vangorda Creek from the Sheep Pad Pond. Sampling is undertaken weekly during periods of discharge from the water treatment plant and monthly at other times.

Sulphate concentrations at V25BSP remained consistent with previous years, ranging from 100 to 1,300 mg/L in 2010. Trends show an increase in sulphate as treated water enters V25BSP and a decrease again at the cessation of water treatment (Figure D-11).

In 2010, zinc concentrations at V25BSP remained consistent with previous years, ranging from 0.0326 to 0.101 mg/L, demonstrating variability in values throughout the year (Figure D-12).

In 2010, pH levels were neutral to slightly alkaline. These results are consistent with previous years' data.

Bioassay samples were collected at location V25BSP in 2010. All samples passed at 100% concentration over 96 hours with no mortalities occurring. The results from the Bioassays are summarised in Appendix D.

During water treatment, water quality samples are collected at the influent (V24) and effluent (V25) areas of the Vangorda Treatment Plant. Sulphate and zinc concentrations at V24 were similar to at V22, as expected. At V25, sulphate ranged from 1,300 to 1,500 mg/L in 2010. Zn-T at V25 ranged from 0.0589 to 0.60 mg/L, with a median of 0.095 in 2010. Water quality at V25 and V25BSP were tested daily during water treatment at the Faro Mine Complex lab. Results of monitoring through the FMC lab are shown in Tables D-9 and D-10, and in Figures D-19 and D-20.

4.4.2 Grum Creek

Location V2 is in Grum Creek upstream of entry into Vangorda Creek. The changes to the water management system implemented during 1995 and 1996 diverted a large portion of the Grum Creek catchment area into the Sheep Pad Pond and this, in combination with the interception of shallow groundwater by the Grum open pit, reduced the flow in Grum Creek substantially from its original (i.e. pre-mine) levels.

The changes to the water management system implemented during 1995 and 1996 also allowed the diversion of a portion of the remaining Grum Creek water into the Moose pond where the water is observed to seep into the ground. This diversion was put into place as part of the mitigation plan for reducing suspended sediment loadings entering Vangorda Creek via Grum Creek and remained in place through 2010. The diverted Grum Creek water is sampled at location V2A prior to entry into the Moose Pond.

An increasing trend in sulphate concentrations at location V2 triggered the Adaptive Management Plan, when it became effective in 2004. The investigations that have been undertaken in the area of Grum Creek and drainage from the Grum Rock Dump to the east/southeast since 2004 and in 2010 are detailed in the AMP 2010 Annual Report - Event 4 (Appendix I of this report).

Note that in December 2010 the seep site SRK-GD1, located at the head of Grum Creek, became a routine monthly monitoring site for DES and analytical data are displayed in Appendix D.

Bioassay samples were collected at location V2 in 2010. All samples passed at 100% concentration over 96 hours with no mortalities occurring. The results from the bioassays are summarised in Appendix D.

4.4.3 AEX Creek

Location V17A is sampled at a small stream that crosses the Vangorda haul road containing natural run off from the slopes north of the Grum pit as well as surface run off from the north side of the Ore Transfer Pad. This stream then passes into AEX Creek.

In 2010, V17A was removed from the 2010 revised Appendix B of the Care and Maintenance Contract. Therefore, only two samples were required by DES to collect in March and June. However, due to glaciations in March only one sample was collected in June, 2010.

The zinc concentrations at V17A were similar in 2010 (0.0894 mg/L) to June results in previous years. In 2010, the pH level remained slightly alkaline, as is typical for the site. Sulphate concentrations (18.0 mg/L) remained comparable with previous June concentrations.

In 2010, five piezometers were scheduled for sampling to monitor drainage from the Grum Rock Dump to the west and southwest, P09-GW1, P09-GW3, SRK08-P14, SRK08-P15, and SRK08-P16. P09-GW1, P09-GW3, and SRK08-P16 were dry, and samples could therefore not be collected. The results of water quality monitoring at the remaining two sites are discussed further in the 2010 AMP annual review – Event 4 (Appendix I).

As previously noted, it is expected that RGC will be including these sites in its Annual Review.

4.5 Receiving and Water Quality

4.5.1 Shrimp Creek

Location V4 is in Shrimp Creek upstream of the confluence with the Main Fork of Vangorda Creek. This location provides reference information regarding water quality in the Shrimp Creek area and includes inflows from the upstream tributary sampled at location V20.

Sulphate concentrations observed at V4 were variable throughout 2010, ranging from 31 to 92 mg/L, and was within ranges previously seen at this site (Figure D-13). Sulphate results at V4 appear to be higher in the winter than the summer (winter flows are largely provided by groundwater recharge to the creeks), although sampling at this site, which can be difficult to access, has been infrequent in the winter in the past five years.

In 2010, zinc at location V4 ranged from 0.00080 to 0.0607 mg/L and remained comparable to data from previous years. A single high spike was observed in December 2010, however this result was not matched with an increased in dissolved zinc value (Figure D-14). In 2010, pH levels at V4 were normal, with neutral to slightly alkaline measurements.

A low flow loading study was completed in early November on Dixon / Shrimp Creeks, from the newly established site V20A (Dixon Creek, upstream of confluence with water draining from the Vangorda northeast interceptor) and concluding with site V4. While the study was limited by flow measurements in marshy waters, the study showed that sulphate loading to the creek was occurring as creek flow increased from the start of the study reach to the end, and concentrations of sulphate also increased. The study was summarised in a memorandum and submitted to the YG-AAM (refer to Section 1 of this report).

4.5.2 Upper Vangorda Creek

"Upper" Vangorda Creek is the primary receiving water for mine site discharges and is sampled upstream on mine activities at V1 (previously discussed) and locally downstream of mine activities at V27, just above the confluence with Shrimp Creek (access to V27 is limited by safety concerns, especially during the winter and spring freshet).

Location V27 is in the Main Stem of Vangorda Creek upstream of the confluence with Shrimp Creek and provides information regarding effects of the mine facilities on Vangorda Creek. All surface water from the Grum Rock Dump, the Grum Interceptor Ditch/Sheep Pad Pond, and the Vangorda Northeast Interceptor Ditch reports to location V27 via Grum Creek or the Vangorda Creek plunge pool. Extremely steep terrain creates unsafe access to this sampling location, as previously noted, at some times of the year (particularly winter and spring freshet) and water sampling is conducted accordingly, with maximum recognition of worker safety.

Sulphate concentrations at V27 ranged from 47 mg/L to a new high in July 2010 of 380 mg/L (Figure D-15). This likely due to increases in source waters to the Vangorda treatment plant that are then discharged to Vangorda Creek. Generally, sulphate concentrations are used as an indicator of possible metals concentration increases, but in treated water, increases in sulphate do not correlate with increases in metals. Sulphate is higher in Vangorda Creek in years when the treatment plant is in operation.

In 2010, total zinc concentrations at V27 ranged from 0.015 to 0.064 mg/L and were observed to be variable throughout the year. These values and variation are consistent with concentrations observed in previous years (Figure D-16). The pH levels at V27 remained neutral to slightly alkaline and are consistent with historical measurements.

4.5.3 Lower Vangorda Creek

The water quality in Lower Vangorda Creek represents natural run off and some mine site drainage originating from AEX Creek, the Vangorda haul road and a small portion of the Grum Rock Dump.

Water quality in the West Fork of Vangorda Creek, a tributary of Vangorda Creek is monitored at location V5.

Water quality in lower Vangorda Creek is monitored at location V8.

4.5.3.1 West Fork

Location V5 is the West Fork of Vangorda Creek just upstream of the confluence with the Main Fork. V5 receives drainage from AEX Creek (location V17A) and, thereby, potential influences from surface drainage from the north portion of the Ore Transfer Pad. Both AEX Creek and the West Fork of Vangorda Creek receive run off from the Vangorda haul road and the mine access road. There is a small portion of the Grum Rock Dump that drains into the West Fork of Vangorda Creek between AEX Creek and V5.

Sulphate concentrations at V5 in 2010 displayed the pre-existing seasonal trend of higher concentrations in the winter months and ranged from 47 to 180 mg/L. Zinc concentrations at V5 have remained consistently low since 1999 and this trend continued throughout 2010 (0.00180 to 0.0182 mg/L). The pH levels at V5 remained neutral to slightly alkaline in 2010, comparable to historical measurements.

4.5.3.2 Lower Vangorda Creek

Location V8 is in lower Vangorda Creek downstream of the confluence of the West Fork (location V5) and the Main Fork.

In 2010, water quality parameters varied within the normal historic range that has been observed at V8 in previous years. In 2010 at V8, sulphate ranged from 59 to 230 mg/L, while total zinc ranged from 0.0072 to 0.0255 mg/L.

Further discussion of water quality at V8 is presented in the 2010 Annual AMP review – Event 2 (Appendix I), including a review of total suspended solids, which have at times been elevated at V8 with respect to historic results, likely due to a washout area located downstream of the former mine site activities.

5. WATER TREATMENT PLANT PERFORMANCE

5.1 Introduction

5.1.1 Overview of Water Treatment Strategy

Providing adequate treatment for mine water that cannot be released directly to the receiving environment is one of the fundamental purposes of the Care and Maintenance activities carried out at the Faro Mine Complex. The DES Care and Maintenance Contract specifies the maximum allowable concentrations of contaminants in any water released to the receiving environment.

Heavy metals, most notably zinc, which are mobilized into water from tailings, rock piles and open pit walls, are the primary contaminants of concern and the focus for water treatment at the Faro Mine Complex. Water treatment for removal of heavy metals is carried out at three locations:

1. Grum/Vangorda Water Treatment Plant; (Treats water from the Vangorda Pit)
2. Faro Mill Water Treatment System; [Treats water pumped from the Faro Main pit (i.e. Faro Pit) and Intermediate pond]; and
3. Down Valley Water Treatment System. (Treats water siphoned from the Intermediate Pond of the Rose Creek Tailings Facility)

Water that is treated through the Mill and Down Valley water treatment systems is combined in the Cross Valley Pond prior to discharge into Rose Creek as a single effluent stream (location X5). Water that is treated through the Grum/Vangorda water treatment plant is released into Vangorda Creek via the Grum Interceptor Ditch (location V25BSP).

All three treatment systems reduce metal concentrations in water through pH-modification with lime followed by settlement of treatment sediments, either with or without the aid of flocculants. pH “normalization” after treatment is through natural atmospheric processes.

The water treatment systems are operated in a coordinated manner during the summer season. Each system is operated to reduce water levels in the source ponds to the point where treatment is not required until the subsequent summer season. This seasonal process has been undertaken since 1998 and will be required until such time in the future when closure activities may reduce or eliminate some treatment requirements. Improvements to the general process and to the treatment systems have been implemented, when and where possible, and will continue to be implemented as opportunities are identified.

5.1.2 Coordinated Operating Procedures

The treatment systems are operated in a coordinated manner through site management. There are a number of coordinated procedures that enhance the efficiency of the process as a whole as described below.

5.1.2.1 Personnel and Safety

Each treatment system is operated on a 24 hour basis, split between two 12 hour shifts with one or two dedicated operators per shift. A dedicated 2-man crew is present for 12-hour day and night shifts at the Grum/Vangorda Water Treatment Plant. One or two operators are present for shift work in the Faro Mill and typically only one operator if the Down Valley system is required. All operators maintain contact to the security attendant at the guardhouse via radio and routine safety checks. The site Superintendant or site Manager is on call at all times, and weekend supervision during the treatment season is provided by senior members of the crew on an “on-call” rotation.

On weekdays, an extended work crew is present that includes electrical and mechanical maintenance personnel, equipment operators, operations personnel and site foreman. This extended crew completes routine maintenance and any required repairs related to the treatment systems and other related facilities.

The treatment system operators maintain a logbook at each location of activities, and operational readings related to operation of the treatment system and related facilities are recorded.

A centralized first aid/security attendant is present on-site at all times when any one of the treatment systems is operating (i.e., 24-hours/day). The attendant is located in the Faro guardhouse and is in contact with each of the treatment locations via radio contact and scheduled safety checks.

The process is managed by the Site Superintendant who oversees all of the treatment systems and verifies that activities are carried out in a coordinated and efficient manner.

All of the activities related to water treatment are carried out according to comprehensive site-wide operations, contingency, emergency response and safety plans.

5.1.2.2 Water Quality Sampling

Water Treatment Plant (WTP) operators record manual pH readings at key locations within the treatment systems on a routine basis. This provides a frequent check on the installed pH probes that, in some cases, control the automated lime-addition circuitry.

Water samples for in-house use are also collected at key locations within the treatment systems on a routine basis. These samples are analysed in-house for total zinc. These results serve as a management control tool for operating the systems.

The analytical procedures for the on-site analyses were in practice since 1998 and used professional grade AA (atomic absorption) equipment operated by trained and experienced chemists and environmental technicians until 2009. In 2010, the new on site lab with an ICP-OES was commissioned to provide the primary analytical results. The AA instrument remained on-site and provided backup analysis. A log of zinc analyses is maintained by the environmental staff at the mine site. The results of monitoring are included in the water quality section of this report.

Finally, water samples are collected for external analyses on a weekly schedule when treated water is being released, as required by the Care and Maintenance Contract, Appendix B. The external analyses provide verification of compliance and also serve as a calibration check on the in-house assay procedures. Additionally, quarterly acute lethality tests (LC_{50} bioassays) are required for effluents.

5.1.2.3 Treatment Chemicals

Lime and Flocculant are ordered in bulk to provide reagents for all three water treatment systems.

Flocculant is ordered and delivered in 25 kg bags with 40 bags per pallet. Pallets of Flocculant are stored in the former shop area and are distributed to the treatment systems on an as-needed basis.

Pulverized lime is currently delivered to the site in modified 20 foot sea-containers (sea-cans). Lime product is produced in the Tacoma, Washington area and shipped in the sea-cans to Seattle. In Seattle, the sea-cans are loaded on a barge and shipped to Skagway, Alaska. From Skagway, the sea-cans are hauled via truck to the Faro Mine Complex.

Distribution of the lime containers on site is provided by a specially outfitted dump-style truck. Containers are tipped up with the back doors of the sea-can open and the lime is dumped into a hopper at either the Faro Mill WTS or the Grum/Vangorda WTP. The

Down Valley WTS does not accept lime in this manner. There are three methods of lime transport available for the Down Valley WTS:

1. Specially fabricated two tonne containers are filled with pulverized lime at the Faro Mill WTS and transported by Hiab truck to the Down Valley WTS where they are suspended with the crane over the lime hopper and tipped to dump;
2. Using a specialty “super-sack” that contains one ton of lime that is suspended over the hopper with the Hiab crane and cut open to release the lime: and
3. Filling a tank, mounted on the Hiab deck with lime slurry produced in the Faro Mill WTS and transporting it to the Down Valley WTS where it is gravity fed into the lime slurry holding tank.

5.2 Faro Mill Water Treatment System

5.2.1 Overview

The Faro Pit pumping/treatment program is carried out on an annual seasonal (summer) basis. The program uses a water pumping system that was initially installed in 1997 to provide recycle water to the mill prior to mine shut down in February 1998. Since the mine shut down, the system has been used exclusively to pump water from the Faro Pit to the Faro Mill WTS. This program maintains the in-pit water level within the pre-determined “safe” operating range. In 2001, the Faro Mill was converted to operate as a water treatment system, capable of treating approximately 19 m^3/min. (~5,000 USgpm).

The Faro Pit currently receives inflow from precipitation and spring freshet, seepage from the Faro Creek Diversion Channel, seepage from a short section the existing Faro Creek Valley (not captured by the diversion), groundwater seepage along the pit wall and water pumped from the Zone II well and the S-wells Pumping System.

From 1997 through 2001, water pumped from the Faro Pit was mixed with lime slurry in an open mix box behind the mill and allowed to flow to the Intermediate Impoundment for settlement. This was an inefficient use of lime but provided for pre-treatment of a dominant inflow into the Intermediate Pond such that the requirement for treatment at the outflow of the Intermediate Pond was reduced compared to what would otherwise have been required.

In 1997 and 1998, outflow from the Intermediate Pond (location X4) became compliant with the Water Licence (<0.5 mg/L zinc) following approximately 4 to 6 weeks of inflow of pre-treated water from the Faro Pit. As a result, lime treatment of the outflow was discontinued for the remainder of those pumping/treatment seasons. The lag-time was anticipated given the need for displacement of non-compliant water that was in the pond initially. In 1999, 2000 and 2001, the concentration of zinc in the Intermediate Pond effluent (location X4) was reduced but not to the licence limit and, therefore, treatment of the effluent in the outflow spillway was continued for the duration of the pumping/treatment seasons.

This manner of treatment was an inefficient use of lime and created risk at the Intermediate Dam by having the pond water constantly at the full supply level. The risk was related to both the physical stability of the dam and to the lack of any emergency freeboard to contain and hold high or unexpected flow events. Therefore, to mitigate these risks and to provide for a more efficient treatment process, part of the mill was retrofitted in 2001 to serve as a water treatment system. This included both activation of existing equipment and installation of new equipment. Further refinements and optimizations have been implemented since 2001.

5.2.2 Faro Pit Pumping System

The Faro Pit Pumping System is made up of the following primary components:

1. Floating steel barge with walkway to shore;
2. Electric submersible pumps mounted on the barge. Barge arrangement allows for installation of three pumps;
3. Barge mounted valving, flex hose and header to combine flow from all pumps into one pipeline;
4. 760 mm (30 inch) HDPE pipeline from the barge to the mill with flexible sections (flex hose) near the barge to prevent damage to the pipeline;
5. Transformer and electrical control house on shore by the barge; and
6. Overhead powerline (4160 volt) from the mill substation to the 600 volt transformer adjacent to the pumping barge.

Each of the 225 HP barge mounted pumps is capable of delivering water to the Faro Mill WTS at a flow rate between 7.6 m^3/min. (~2,000 USgpm) and 19 m^3/min (~5,000 USgpm). Flow rate is controlled by a manually operated valve on the barge. In the past, typically only one pump was operated to deliver water as the Mill WTS was only capable of treating 19 m^3/min (~5,000 USgpm). However, pumps can be run in tandem to supply more water to the mill if required.

5.2.3 Intermediate Pond Pumping System

The Intermediate Pond Pumping system was installed in 2006 to better manage water levels and reduce risk associated with consistently high water levels in the Intermediate pond.

The historic components of the Intermediate Pond Pumping System were:

1. A steel barge complete with walkway to shore;
2. Vertical turbine pump, rated at ~2,200 USgpm, at a total dynamic head of 300 ft at 1750 rpm;
3. CAT 3306 diesel motor, coupled to a Johnson H250 gear drive to drive the pump;
4. Fuel tank on shore to supply fuel to the diesel motor;
5. Barge mounted valving, piping and flex hose; and
6. 350 mm (14 inch) HDPE pipeline from the I-pond to the Faro Mill.

In 2009, pumping began using this existing system; however, flow rates were not as high as historic records and well below the rated pump capacity of 2,200 USgpm. The Johnson gear drive was also operating at a very high temperature and there were fears that the unit would fail if pushed to achieve a higher flow rate. A new spare pump on site was installed in place of the existing pump with thoughts that the existing pump may be worn due to the low pH of the I-pond water. Installation of the new pump did not result in a higher flow rate or lower operating temperature of the gear drive.

In order to achieve the desired pond drawdown, a replacement diesel pump (rental) was sourced and installed on-site in mid April, 2009. Mechanical problems with the initial rental pump required nearly immediate replacement. The replacement pump was installed and continued to operate until late June. During the middle to late June, flow rates from the pump were observed to be decreasing, as a result of impeller wear due to the acidic water. The original barge pump was re-started in early July and pumped until mid August.

During the fall, a new Stainless Steel diesel pump was purchased and arrived to site. Late fall pumping was carried out with the new pump to lower the I-pond water level to the target elevation, as advised by YG in late August.

To improve the pumping system at the IP, several projects were undertaken in 2009. A new power line was installed to the Down Valley area in preparation for modifying the IP Pump System to operate with electrically driven pumps. Design for the new electrically driven pump system began in late 2009 and was completed in early 2010.

Installation of the new IP pump system was carried out in the early spring of 2010.

The new pump system is made up of the following components:

1. Steel barge with walkway to shore, modified to accommodate electric motors and pumps. In the summer of 2010, a second section of walkway and support pontoon was added to increase the distance of the barge from shore to reach deeper water (required due to increased drawdown of the Intermediate Pond);
2. Two barge mounted 150 hp electric motors coupled to two Robbco 9T, 4 stage stainless steel vertical turbine pumps, c/w electrical cables and controls;
3. Barge mounted valving, piping and flex hose;
4. 10” HDPE discharge pipe to the valve house sea-container;
5. Two, 20’ sea-containers – one to house all electrical MCC’s, starters, Variable Frequency Drives, HMI, PLC and associated electrical cables, the other contains instrumentation, isolation valves, surge protection valve and provision to connect the 14” IP pipeline to the discharge end of the sea-container; and
6. Existing 14” HDPE pipeline from the IP to the Faro Mill.

Foundation preparation work and sea-can installation took place in March. Nu-line electrical contractors were on site in the latter part of March to run electrical feed from the transformers to the sea-cans and also to carry out wiring between the sea-cans. Precision and Advanced Drives reps were on site in early April to assist with instrumentation, wiring, and programming.

To get an early start on water treatment, the Godwin pump was used from April 6th to April 14th to pump IP water to the Faro Mill. By April 14th, the new electric pump system was commissioned and began delivering water to the Faro Mill for treatment.

The new pump system operated very well through the 2010 treatment season. The system was operated with both pumps in tandem and with only one pump at times, in order to maintain the maximum recommended IP drawdown rate of 2.5 cm per day.

5.2.4 Faro Mill Water Treatment System

The Faro Mill WTS was constructed in 2001 and has been successfully operated annually since 2002. Water from the Intermediate Pond is pumped to the Mill WTS to be mixed with the Faro Pit water at a historic maximum flow capacity of approximately 19 m^3/min (~5,000 USgpm), although it was rarely operated at this flow rate. In 2009, the overall mix ratio for the treatment season was approximately 72% Faro Pit water to 28% Intermediate Pond water. Due to increased drawdown of the IP with the new electric pump system the 2010 ratio of Faro Pit to IP water treated through the Faro Mill changed to approximately 62% to 38%.

Effluent from the WTS is discharged into the Cross Valley Pond. During treatment system start-up, or in the event of an upset condition in the plant, the effluent water can be released into the Intermediate Pond through a valve arrangement on the 24 inch HDPE effluent pipeline.

Treatment sediments (sludge) are settled out in a Thickener and Clarifier, and periodically removed from the system via underflow pumps (located below the tanks in tunnels) and pumped to a series of cells excavated on the Original (First) Tailings Impoundment.

The clarity and quality of the influent water (from the Faro Pit) has, in the past, been acceptable for reagent mixing when needed. The current procedure is to utilize influent water from the Faro Pit to mix reagents until the Clarifier is full. Once the Clarifier is full of treated water, a submersible pump is suspended near the water surface and used to supply treated water for lime and flocculant mixing.

To enable the Faro Mill WTS to handle the poorer water quality coming from the Intermediate Pond, the system was modified utilizing the Mill's high intensity conditioners and an additional set of lime conditioning cells (i.e. flotation units). Water was pumped from the Intermediate Pond into two high intensity conditioners. Operational monitoring identified that the agitators were too aggressive in breaking down the flocs and as a result hindered settlement. In response, the agitators were subsequently shutdown allowing the conditioning tanks to operate as an extension of the intermediate pipeline within the mill, where the water was directed to the head-end of the mill circuit for pH adjustment by the addition of lime. In 2008, the high intensity conditioners were bypassed and a new section of pipeline was added to direct the water straight from the I-pond to the head of the circuit where it mixes with Faro Pit water before being divided between the parallel sets of flotation cells.

In 2009, modifications were made to the original system to allow for treatment through both the Thickener and Clarifier in parallel. Water quality results during the 2009 treatment season identified that acceptable effluent quality was being achieved at the outflow of the Thickener before entering the Clarifier for secondary settling. In many instances, the quality of the water at the outflow of the Thickener was actually better than the outflow from the Clarifier. With the results of water quality testing, it was concluded that flow could be split between the Thickener and Clarifier and that each tank could settle a portion of the total flow and still achieve the required quality of effluent. By treating the water in parallel through the settling tanks, flow can also be increased as each tank would have the capacity to treat the original design maximum flow rates of approximately 19 m^3/min (~5,000 USgpm). To split the flow, a 12" pipeline was added to the distribution box that would feed water directly to the Clarifier center well. A new discharge box and HDPE pipeline were also installed on the side of the Thickener to allow for discharge directly to the effluent pipeline. With two lines now exiting the mill, a "Y" was used to combine flow from the two discharge pipes into the existing 20-inch pipeline to the CVP.

During testing of the parallel settling tank configuration in the fall of 2009, flow through the treatment system was increased to approximately 23 m^3/min (~6,000 USgpm) to determine if there were any other restrictions that would prevent operation at a higher flow rate. It was identified that the first set of conditioning cells leaked a large amount of water through the upper portion of the cells where extension boards are installed. The extension boards were old, dried out and not sealed. In the early winter of 2009, sealing of these extension boards was carried out in all of the conditioning cells by filling large gaps with caulking and coating the entire surface using a foundation sealer.

During the 2010 operating season it was discovered that the Clarifier tank was not able to contribute a substantial increase in treatment capacity. It is suspected that due to the shallow tank configuration and existing tank discharge arrangement, settling of precipitate is not as effective as in the deeper Thickener tank. During operation, approximately 20 to 30 percent of the flow was directed to the Clarifier, with the bulk continuing to be treated through the Thickener.

Maintenance and cleaning was performed during the winter of 2009/2010 and consisted of:

- As per a recommendation from Hatch, the rakes for the Thickener tank were removed and used as a template to fabricate a new rake structure. The new rake structure installation was complete by March 17th, 2010;

- A large agitator shaft in the pH conditioning cells that broke off near the end of the operating season was replaced with a spare unit; and
- The underflow tunnel sump pump was replaced with a spare sourced from within the mill.

Upgrades, to improve treatment system performance and efficiency, and maintenance in the fall/winter of 2010 consisted of:

- Fabrication of an insulated enclosure around the floc mix and holding tank area to eliminate freezing of floc lines during spring start-up. The operators office was also expanded to increase space for supplies and clothing/PPE;
- Completion of cleaning of the underflow tunnels;
- Removal of one old pump box beside the underflow tunnels, expansion of overhead protection and installation of stairs for access to the underflows (PAW);
- Modification and upgrade of the lime silo lower cone and valve assembly, auger, dry lime chute and mix tank set-up (PAW);
- Adding lengths of HDPE pipe to the lime loop to bring it past the Thickener discharge box so supplementary lime can be added to the Mill effluent for CVP pH buffering, if necessary (PAW);
- Addition of a flow meter into the 30” Faro Pit water supply line (PAW);
- Replacement of the gland water lines and upgrading to complete a loop that returns to the gland water box, also to avoid issues with freeze-up in the spring. This work began in 2010 but was not completed, work will continue into 2011; and
- Re-routing of the sludge lines in the underflows. Pipes were moved from the middle of the tunnels to the sides to reduce restriction. The base for the Thickener underflow was also re-built due to deterioration.

After the 2010 treatment season ended, the Thickener overflow ring was cleaned of accumulated dirt and debris with the intention to achieve radial overflow for 2011 and improve effluent water quality by eliminating the existing single discharge point at depth in the tank. During testing of the overflow launder at the end of the operating season it was observed that the launder did not have the capacity to convey all the water to the existing single discharge box. As a result, fabrication of a secondary discharge off the Thickener tank overflow launder was also carried out. An existing overflow box was used off the south side of the Thickener and a 14” line will be plumbed out the back wall of the mill and tee'd into the Clarifier effluent line with a saddle clamp. This work was not completed by the end of 2010 and will be carried over into 2011.

The current Faro Mill WTS includes the following primary components:

1. A mixing box that combines water pumped from the ETA, Intermediate Pond and the Faro Pit and divides it between the parallel conditioning cells (former floatation cells);

2. Four banks of conditioning cells (operated as two parallel lines), each divided into three chambers with an agitator in each;

3. Automated lime addition system complete with controllers, probes, supply pipeline and pumps;

4. 600 mm (24-inch) HDPE pipeline from the conditioning cells to a distribution box that can direct all water to the Thickener or divide water between the Thickener and Clarifier;

5. Lime delivery and transfer system, and silo for storage;

6. Lime slurry make-up system complete with mixing tank and transfer pump;

7. Two large lime slurry holding tanks;

8. Two settling tanks (previous Thickener and Clarifier) operated in series or in parallel;

9. Instrumentation and control systems;

10. Flocculent mixing and distribution system;

11. Dual (20-inch) effluent pipelines that Y together into the existing (20-inch) pipeline with optional discharge into the Intermediate or Cross Valley Pond;

12. Sludge removal pumps and pipeline; and

13. Sludge storage cells on the Original Tailings Impoundment (installed 2005).

5.2.5 Clean Water Diversions

Clean water is diverted around the Faro Pit and the Intermediate Pond through the Faro Valley Interceptor Ditch, the Faro Creek Diversion, the Rose Creek Diversion Channel and the North Wall Interceptor Ditch.

5.2.5.1 Faro Valley Interceptor Ditch

Runoff from the hillsides north and northwest of the Faro Valley Rock Dump is intercepted by the Faro Valley Interceptor Ditch and directed into the Faro Creek Diversion.

Maintenance work performed on the ditch from 2002 through 2005 substantially restored its effectiveness in passing clean runoff water to the Faro Creek Diversion. The work consisted primarily of bottom grading and excavation of slumped and eroded sections of the ditch.

These improvements to the Faro Valley Interceptor Ditch also contribute to the improvements and benefits described for the Faro Creek Diversion.

No maintenance of the Faro Valley Interceptor Ditch was required in 2010.

5.2.5.2 Faro Creek Diversion

The Faro Creek Diversion collects water from the original Faro Creek channel upstream of the Faro Pit and diverts the water around the northeast side of the Faro Pit and into the North Fork of Rose Creek.

Maintenance work was performed on sections of the diversion channel in 2002 and 2003 that is considered to have substantially reduced leakage from the diversion channel into the Faro Pit. The work consisted of bottom grading, excavation of a pilot channel for low winter flows and placement of a geo-membrane liner and rip rap erosion protection in select locations. Follow-up work has also been completed since 2003 that includes maintenance of roadside ditches and grading of the road surface away from weaker areas of the pit wall. Site management staff noted a reduction in pit inflows following the 2002/03 work.

No maintenance was required on the Faro Creek diversion during 2010.

5.2.5.3 Rose Creek Diversion Channel

The Rose Creek Diversion Channel passes Rose Creek water around the Rose Creek Tailings Facility. The Diversion was developed in two stages, referred to as the Upper and Lower Diversions. The Upper Diversion was constructed in 1974 in conjunction with the development of the Second Tailings Impoundment. The Lower Diversion is an extension of the Upper Diversion. It was constructed in 1980-81 in conjunction with the development of the Intermediate Tailings Impoundment.

Water from both the South and North Forks of Rose Creek enters the upper section of the Rose Creek Diversion Channel. The upper section is a predominantly straight channel that includes a number of drop weirs in addition to riprap for erosion protection.

The lower section passes water along the south side of the Intermediate Impoundment and returns flow into the natural Rose Creek Channel downstream of the Cross Valley Dam. The lower section includes a series of boulder-lined drop structures and a sharp corner at the downstream end. The lower section is constrained by natural slopes on the south side and by a till dyke on the north side. The crest of the diversion dam, which diverts the flow from the upper section into the lower section, was constructed approximately 1 m lower than the crest of the adjacent diversion canal dyke, and armoured with riprap. This was done to ensure that any flows in excess of the design flow overtop the diversion dam at that location into the Intermediate Impoundment. In 2004, the containment dyke (roadway) along portions of the lower section was rebuilt to restore the freeboard necessary to safely pass the design (1:500 years) flood.

The channel is prone to ice build up over the winter and clearing of ice has been required on occasion. Visual inspection and instrumentation have been used to monitor the condition of the channel. In the past, repairs to the back-slope and dyke crest have been completed to maintain conformance with design parameters.

In 2009, as a result of recommendations from the annual inspection, tests were performed to determine if vegetation could be removed from the diversion channel banks without resulting in damage to the core of the structure. The largest observed specimens of several species of vegetation were removed by pulling them out with the Hiab crane. The upstream gravel shell protecting the glacial till core is approximately 6 feet wide and there was negligible material disturbed when removing the vegetation root ball. It was determined that this is an effective way to remove the vegetation from the diversion channel.

During the late summer and fall of 2010, woody vegetation growing along the banks of the RCDC was removed. Access to both sides of the diversion channel was achieved by installing a temporary walking bridge across the channel. Removal of woody vegetation was carried out from the fuse plug to where the diversion channel drops in elevation through a series of riffles and pools, approximately 200 meters west of the Intermediate dam. Removal was carried out by manually cutting the brush with shears.

5.2.5.4 North Wall Interceptor Ditch

The North Wall Interceptor Ditch (NWID) intercepts clean runoff from the north side of the Rose Creek Valley and diverts it around the north abutment of the Cross Valley Dam.

The NWID is an open ditch excavated in a variety of materials, ranging from silty sand and gravel till to coarse sand and gravel alluvium and bedrock. The ditch has performed reasonably well although erosion and sedimentation have caused partial blocking of this ditch at times. Periodic maintenance and repairs have been completed as required. In 2005, water diversions above the north area of the Faro Main Pit were upgraded, which improved the diversion of clean water away from the pit and into the catchment area of the North Wall Interceptor Ditch.

No maintenance was required along the upper reach of the NWID during 2010. Winter maintenance activities are required along the lower portion of the NWID between the 6" culvert (just west of the DVTS) and the twin culverts at the X5 sample location (CVP discharge). Due to the low flow of water during winter months, this section of the ditch continually glaciates and removal of ice is required periodically. Ice is removed with an excavator and hauled away to a downstream stockpile using the loader.

5.2.6 Contaminated Water Collection and Pumping Systems

There are currently five contaminated water collection systems that contribute water to the Faro Pit, the Intermediate Pond or directly to the Faro Mill. They are:

1. The (backfilled) Zone II Pit Pumping System;
2. The Emergency Tailings Area Sump Interceptor System (ETA SIS);
3. The S-wells Pumping System;
4. Seepage past the ETA SIS and drainage from the Old Faro Creek; and
5. Lower Guardhouse Creek.

As of 2009, contaminated water originating from seepage past the ETA SIS and from the Old Faro Creek and Lower Guardhouse Creek are collected in the Intermediate Pond and pumped to the Mill WTS.

5.2.6.1 Zone II Pit Pumping System

Contaminated water is collected in the backfilled Zone II Pit. This water is runoff and seepage through the various rock dumps that lie within the catchment area of the former Zone II Pit. Currently, an 8" steel well casing is installed to a depth of approximately 70 meters and a submersible well pump is used to pump accumulated water to surface, through a four inch pipeline that drains into the Faro Pit at the southeast corner. In the past, pumping was typically required on an occasional basis through the summer season only.

In 2009, operation of the Zone II pump was carried out as it had been in the past. Water level in the pit was allowed to recharge for several weeks before turning the pump on to drain the accumulated water. This method of pumping in the Zone II pit is thought to be inadequate at preventing contaminated sub-surface water from seeping towards the North Fork of Rose Creek. The preferred practice would be to keep the Zone II Pit water elevation lower than the elevation of the North Fork of Rose Creek. Investigation of the current well was carried out in late 2009 by removing the pump and trying to determine total well depth. Obstructions in the well casing prevented accurately determining the depth to well bottom.

To determine well casing condition and cause of the obstructions, a contractor was brought to site in February 2010. Aqua Tech arrived on site to investigate the obstructions in the Zone II well with camera equipment. Two 1" pipe sections, cable debris and numerous electrical tie wraps were observed at the bottom of the well. A special tool was used to retrieve one section of the 1" pipe along with a tangle of old float level cable. During all pipe removal work, the powerline to the Zone II area and S-Wells was isolated for safety. In total, three separate 1" pipe sections were removed from the Zone II well. A one foot long section remains at the bottom of the well and cannot be retrieved.

Based on information gathered by Aqua Tech, it was decided that the existing well casing would not be suitable for a new pumping system. A well drilling contractor was brought to site to drill a new well in the late fall of 2010. Foundex drilled a new Zone II well, deeper than the original and about 50 feet north of the existing well location. Denison was not involved with the design or oversight of this drilling program.

5.2.6.2 Emergency Tailings Area Sump Interceptor System

Various studies carried out in past years concluded that surface and groundwater flows through the Emergency Tailings Area (ETA) contribute a significant contaminant load to the downstream area and that a portion of this contaminate loading was escaping collection leading to possible contaminate loading to the aquifer below the Rose Creek Tailings. In response to this issue, a collection system for the ETA water was designed and installed during the fall and winter of 2006/2007. This resulted in the delivery of increased volumes of poor quality water to the Intermediate Pond in 2007.

Starting in the spring of 2007, water runoff from the Emergency Tailings Area (ETA) was directed into a collection sump and pumped through a ten inch High Density Polyethylene (HDPE) pipeline directly to the wet area of the Intermediate Pond. The current system is operated seasonally during the late spring to late winter months. The water from the Intermediate Pond is then pumped using the floating barge pump system to the Mill Water Treatment System to be treated. The existing system is effective at capturing some of the ETA run off, but losses to seepage continue.

The 2009 Emergency Tailings Area Sump Interceptor System (ETA SIS) consisted of the following primary components:

1. Concrete water collection sump approximately three meters deep;
2. 4” HDPE pipelines directing water from two separate upstream pools into the sump;
3. One 6” HDPE pipeline directing water that passes through the main road culvert into the sump;
4. Upstream (of the main road), rock bermed settling area to reduce tailings sands from entering the concrete sump and causing pre-mature pump wear;
5. 250 mm (10 inch) pipeline installed along the north side tailings area access road and out into the wet zone of the Intermediate Pond;
6. Two pumps installed in the sump for conveyance of water to the Intermediate Pond: a 5.8 HP Flygt pump and a 30 HP Flygt pump, both with a 100 mm (4 inch) discharge;

Design of a new sump/pump system was started in 2010 but was not completed. The intent of a new pumping system is to reduce the amount of water being collected in the Intermediate Pond and reduce seepage into the groundwater aquifer below the tailings impoundment. A new power line was installed in 2009 to provide a safer power feed to the proposed new system.

In 2010, DES was asked to install a temporary pipeline from the existing concrete sump to the Faro Mill with available HDPE pipe that was on site. DES was directed to utilize existing on-site scrap pipe of variable age and dimension to construct the temporary line. Enough 8” HDPE pipe was sourced from a garbage pile of pipe. The pipeline to the Mill was completed and commissioned in June 2010. An existing 30 hp pump was used to pump the ETA water directly to the Mill (rather than the IP) for the remainder of the treatment season. Pumping of ETA water to the Mill ceased on August 30th. From Sep. 1st to Sep. 27th, ETA water was pumped through the 10" pipeline directly to the Intermediate Pond. On Sep. 27th, the 30 hp ETA pump was removed from the sump and put into winter storage.

In July and early August 2010, work was also carried out to excavate loose shale and scale the canyon walls downstream of the existing sump location. This was performed by DES at YG's direction to investigate foundation conditions downstream of the sump for a possible dam location.

5.2.6.3 S-wells Pumping System

In the spring of 2009, a new pumping system called the S-wells Pumping System was commissioned to collect and pump zinc contaminated water from an area on the south east corner of the Faro waste rock pile to the Faro Pit.

The main components of the S-wells Pumping System include:

1. Excavated and rip rap backfilled sump interceptor trench;
2. Sump collection system approximately 25 feet deep;
3. Two groundwater wells containing small pumps that pump contaminated groundwater into the sump;
4. 15 HP submersible pump;
5. 8 x 10 foot sea-can installed over the sump complete with all piping, valves, meters, controls and discharge pipeline;
6. 2" insulated HDPE pipeline (with heat trace) from the sea-can to the southwest corner of the Faro Pit and a vacuum break at the pipeline high point; and
7. New power line installed in late 2009 to extend power feed from the Faro Pit to the S-wells electrical control shed.

Several S-wells component failures occurred in the 2009. Problems with poor heat trace installation caused several failures that required significant time to troubleshoot and repair. The electronic control system (Scadapack) housed in the sea-can failed early in the year and required a replacement.

During spring freshet 2009, it was determined that the system did not have the capacity to manage spring high water flow conditions. Several days of sump trench bypass occurred due to sump inflows exceeding maximum pump/pipeline output. Both groundwater well pumps were shut off during this time but inflow to the sump was still greater than what the pump system could remove. Plans were developed during late 2009 to install a second pipeline, parallel to the existing 2” but with a 4” diameter. This uninsulated 4” HDPE pipeline would be used during spring freshet to increase the maximum flow capability of the pumping system and eliminate bypass. Installation of the 4” pipeline was started in 2009 and was completed in late January 2010.

Studies carried out by SRK during the summer 2009 season indicated that sump performance was adequate, but could be improved. Elevation of water within the sump was still near equal with the elevation of the North Fork of Rose Creek. A gradient increase towards the sump would reduce the possibility of contaminated seepage entering the North Fork of Rose Creek. Several options were discussed to achieve a lower water elevation in the sump. A decision was made to hire a diving crew to remove rock and gravel from the bottom of the sump and lower the pump. In the late fall of 2009, the dive crew was on site and successfully removed enough material from the sump to lower the pump approximately 1.75 meters. Downstream groundwater well dataloggers have been monitored since the lowering of the pump and all indications are that the modification successfully achieved a positive gradient from the North Fork of Rose Creek towards the sump trench.

In mid November of 2009, surface seepage was observed downstream of the existing sump trench, just even with the eastern extent. Samples of the seepage were collected and analyzed on site. Results of the water testing indicated that the seepage water contained elevated zinc levels. Test holes were excavated to determine where the surface seepage was originating. It was observed that the seepage was originating from upstream of a row of monitoring wells. A decision was made to extend the original trench to the east to capture this seepage water and direct it to the sump. A 45 foot long trench was excavated to a depth of approximately 10 feet, with gradient toward the original trench. The sub-surface seepage was captured, as well as more seepage just to the east of the original trench at a depth of approximately 8 feet. Both sources of seepage were observed to be successfully flowing into the original trench. The bottom and downstream face of the new excavation was lined with Bentomat, and carefully backfilled with rip rap. Since completion, no surface seepage has been observed.

Another modification carried out in 2009 was to extend the 2” pipeline into the pit to discharge at a depth of approximately 30 meters, such that discharge would occur below an existing chemocline.

Due to issues with precipitate formation in the 2" pipeline, thought to be caused by high iron levels in the SPW-1 groundwater well water, the SPW-1 pump was left off for the entire 2010 pumping season.

On April 19th 2010, inflow to the sump exceeded the capacity of the 2" pipeline. The 4" pipeline was commissioned and resulted in a significant increase in pumping capacity, as well as much lower operating pressure. Maximum flow rate through the 4" pipeline was observed at 5.1 L/second at approximately 135 psi. The 4" pipeline was utilized, when required during the spring freshet, to keep S-well sump water levels from overtopping the sump.

On Apr. 26th, as per a recommendation from Brodie consulting, an aeration test was performed on the water from the SPW-1 groundwater well. Water from SPW-1 was pumped into a poly tank and aerated using an air compressor. No visible precipitate formed in the tank after aeration.

Pumping of two small pools of water downhill from the S-well sea-can was carried out during the spring and through the early summer as required. Sampling of these pools has indicated elevated zinc levels so the water is pumped back into the sump trench.

The only significant work required for the S-well system in 2010 was repositioning the 2" and 4" discharge pipelines in the Faro Pit. Due to low water level during the early part of the winter, it is suspected that the pipelines were encased in ice. During the spring thaw, ice movement in the Pit caused the pipelines to be moved towards the shoreline to a shallow bench. Both pipelines were removed from the Pit, anchors re-secured and several more added before re-sinking in the desired location of the pit.

5.2.7 2010 Operations

5.2.7.1 Water Quantities

Approximately 3.26 million m^3 of water was treated through the mill in 2010, compared to an estimated 2.96 million m^3 in 2009 and 3.16 million m^3 in 2008. 2.01 million m^3 was treated from the Faro Pit, 1.21 million m^3 from the Intermediate Pond and approximately 34,000 m^3 directly from the ETA. There were a total of 146 pumping days to the Mill WTS from April 6th to August 30th, inclusive of occasional brief shut downs for maintenance or power outages.

5.2.7.2 Lime Usage

A total of 650 tonnes (716 short tons) of lime were utilized in 2010 in the mill with a lime usage rate of 0.20 g/L. Lime usage has been reported in the Annual Environmental

Reports since 2004 as listed below. No treatment was carried out using the Down Valley Treatment System therefore no lime was used for this purpose.

Summary of Faro Mill Lime Usage

Year	Est. Mill Lime Usage (g/L)
2004	0.12
2005	0.11
2006	0.16
2007	0.29
2008	0.13
2009	0.17
2010	0.20

The above summary shows that the Faro Mill WTS lime usage was again higher in 2010 compared to 2009 and 2008. The main factor contributing to the increased lime usage rate was the increased volume of low pH water pumped from the IP compared to any other year on record. Lime usage, in total on the Faro side, is further discussed below.

5.2.7.3 Water Quality

To monitor the treatment performance of the Faro Mill WTS, water samples of the (treated) effluent were routinely collected and analysed in-house for total zinc. Water samples were collected more frequently and at additional locations as required to manage the system.

Water Treatment Plant (WTP) operators recorded manual pH readings at the outflow of the Mill WTS at least twice per day as a check on the automated pH monitoring probes. Records of pH levels and other routine treatment system checks were recorded in a logbook and on a Daily Shift Report that is submitted to the Superintendant on a daily basis. Manual checks were recorded more frequently and at additional locations as required to manage the system.

Treated water was released into the northeast corner of the Cross Valley Pond, using an inflow area that had been prepared for this purpose in early 2005. The inflow area provides a discharge/stilling well (vertical culvert pipe) to dissipate the energy of the incoming water and a (rock) bermed settlement area to contain solids and to further still the water prior to flowing into the main body of the pond.

The water released from the Cross Valley Pond (location X5) is the final effluent discharged to Rose Creek and includes water treated in the Mill from both the Faro Pit, the Intermediate Pond, the ETA as well as water siphoned (with treatment) from the Intermediate Pond, when necessary. Water quality for the final effluent (location X5) is described in Section C.

Changes to the siphon intake were implemented in 2010 to draw water into the siphon from as close to surface as possible. A 90 degree elbow and short piece of straight pipe was attached to the end of the siphon and a larger piece of HDPE pipe was fit over the short piece of pipe to create a well that would only allow water from the surface to enter the siphon intake.

In mid March 2010, the 10" siphon that was fabricated during the fall of 2009 was started to slowly draw water out of the CVP. In April, the 10" siphon was removed to install the same type of suction assembly as the 16" to draw water from as close to surface as possible.

In June, a 30" piece of HDPE was used to create a mixing chamber that both the 10" and 16" siphons could connect to and maintain a single discharge point. This allowed running both siphons simultaneously when conditions (water quality, drawdown rate etc.) permitted.

5.2.7.4 Treatment Sediments

Treatment sediments from the Faro Mill WTS were deposited to the Intermediate Pond from 2001 to 2004. This was accomplished by periodically pumping the sediment that settles to the bottom of the Thickener/Clarifier tanks into the pipeline that passes across the Emergency Tailings Area to below the mine access road where it flows on surface to the Intermediate Pond.

A sediment management study was completed by SRK Consulting and submitted to the Water Board in 2004. The study recommended that sediments from the Mill be deposited within a containment berm on the Original (First) Tailings Impoundment. This location is already disturbed by mining development (tailings) and provides an adequately large working space. The 2004 sediment study provided an estimated annual sediment production rate of 4,400 m^3/month for the mill, based largely on data from the 2003 operating season.

The disposal area and a gravity-operated pipeline that connected to, and lengthened the former sludge line in the ETA, were constructed during winter 2004/05 to take advantage of frozen conditions on the tailings for construction of a containment berm. The containment berm was constructed by excavation of tailings (cut and fill) to a size estimated to contain treatment sediments for several years of operation.

The disposal of treatment sediments (sludge) to this area began in 2006 and continued to be successfully utilized in 2010. Estimated sludge production for 2010 was 25,700 m^3. In the early spring of 2010, bulking up of the sludge in the containment area was initiated to make room for sludge produced during the 2010 water treatment season.

In early 2009, modifications to the sludge cell were carried out. The former system used a set of three cells to settle the sludge and reduce water content, before decanting water out of the final cell. The new set of three cells constructed in 2008 was parallel to the existing cells. A series of berms and spillways were constructed to utilize all 6 cells for settling.

In 2010, a significant amount of work was carried out throughout the treatment season to improve upon the modifications made during early 2009. The first two settling cells were combined into one, as a result of limited space from the amount of accumulated sludge from past years. Several berms dividing cells were widened and raised to allow for better access and spillway pipes were added to reduce the chances of washouts between cells. Due to the amount of sludge produced in 2010, all five settling cells accumulated sludge. A 4” trash pump was used during the latter part of the treatment season to decant water from the final settling cell.

5.2.7.5 2010 Operating Issues

Similar to 2009, the biggest operational problem during 2010 was the early start-up of the mill during cold weather. The flocculent pump and distribution line were freezing up quickly and required constant attention for the first several weeks of Mill operation. Gland water lines were also freezing and required thawing periodically. By mid May, warmer weather eliminated the problems with frozen equipment and lines.

General maintenance to pumps and instrumentation was carried out during the year. There were no major breakdowns and all maintenance issues addressed were due to normal wear.

5.2.7.6 Comments for 2011 Operations

The performance of the Mill WTS with regards to water quality and mechanical availability has continued to be meet the needs of site water management. However, as the age of the system increases, the mechanical reliability of the plant will decrease. Numerous critical spare components were purchased in early 2010 to increase availability of parts on site and provide for repairs should break downs occur.

The addition of a flow meter and other possible instrumentation for the Faro Pit influent pipeline will improve data collection and aid in assessing overall treatment plant performance.

A significant concern of DES is the condition and function of the existing lime handling system. DES has made recommendations to YG throughout 2010 to replace the existing lime handling tractor/trailer with a newer model, and to replace the existing free-dump sea-can approach with a closed circuit pneumatic system. These recommendations were made with the intent to increase mechanical reliability as well as to reduce safety hazards inherent to the existing system.

5.3 Down Valley Water Treatment System

5.3.1 Overview

Water treatment at the outflow of the Intermediate Pond (the “Down Valley Water Treatment System”) was started in 1992. Water treatment has continued, on an as-required basis, since that time, although the process by which water is treated has changed several times since 1992. The methods employed for the treatment have involved raising the pH of the Intermediate Pond effluent with lime and subsequently utilizing the Cross Valley Pond for settlement of the treatment sediments. The pH modification has been accomplished at various times by:

- Hauling lime slurry mixed in the Mill to a gravity feed tank for addition into the outflow spillway;
- Delivering lime slurry mixed in the Mill to the outflow spillway via an overland pipeline;
- Re-circulating CVP water, with lime addition, back into the southwest corner of Intermediate Pond;
- Inflow into the upstream end of the Intermediate Pond of water pumped from the Faro Pit that was pre-treated with lime at the Mill, in conjunction with supplemental treatment with lime slurry delivered to the outflow spillway; and

- Mixing of lime slurry at the Intermediate Dam outflow spillway and addition into overflow or siphoned outflow entering the Cross Valley Pond.

From late 1997 through 2001 water flowing from the Intermediate Pond was treated with lime slurry delivered to the outflow spillway via either an overland pipeline or tanker truck to a stationary tank (~10,000 gal) with gravity feed into the spillway. This was an inefficient use of lime and an awkward and labour intensive system. The overland pipeline was prone to breaks, sanding up and freezing. Haulage via tanker truck required numerous trips and near-continuous attendance at the gravity drain tank/valve. Settlement of lime in either the overland pipeline or the stationary tank was also problematic as regards to sanding of pipes and valves and inefficient use of lime. Additionally, this approach produced a large build up of sediment at the base of the spillway due to inefficient lime mixing and general over-addition of lime.

In 2002, the manner of treatment at the Intermediate Dam outflow spillway was upgraded with the installation of a treatment system that mixes lime slurry from dry lime for direct addition into the contaminated water. Water is siphoned from the Intermediate Pond into a treatment tank where the lime slurry is added and mixed by the force of the incoming water and baffles inside the tank. Water from the mixing tank then flows through a discharge pipeline and into a stilling well (vertical culvert pipe) to dissipate the energy of the water before entering the CVP for settlement of treatment sediments. Refinements and improvements to this system have been implemented since 2002 and the system continued to be effectively used through 2006 and again in 2008 and 2009 to manage water levels in the Intermediate Pond. The system was not used in 2010.

The current Down Valley WTS is a semi-portable water treatment system constructed in 2002 to treat water from the Intermediate Pond. Operational design capacity of the treatment system is approximately 6.8 m^3/min. (~1,800 USgpm), however, the system has been run successfully at flow rates of up to 11.3 m^3/min. (~3,000 USgpm). The treatment system does not provide the high level of controlled lime conditioning, flocculation and settlement that is provided in the Faro Mill WTS. As a result, the lime usage in the Down Valley system is high and the confidence is not as high as for the Mill system. Also, the Down Valley WTS generates a large volume of treatment sediments that accumulate in the CVP. The sediments are contained and subsequently removed from a settling area that has been constructed in recent years.

The current Down Valley Treatment System consists of the following primary components:

- 300 mm (12-inch) siphon line from the Intermediate Pond to a treatment tank;

- 28 m^3 capacity steel treatment tank with internal baffles in which I-Pond water and lime slurry are mixed;
- dry lime hopper with capacity of approximately 3 tons;
- lime mixing tank and agitator for slurry production;
- portable water pump and associated support barge and pipeline to provide lime mix water (from the Cross Valley Pond);
- lime slurry storage tank (capacity of 55 m^3);
- lime feed pump and hose from the lime slurry storage tank to the treatment tank;
- pipeline from the treatment tank to the Cross Valley Pond discharge/stilling well;
- bermed settling area with storage capacity for approximately 2500 m^3 of sludge;
- Overhead power line to supply grid electrical power; and
- portable office for operator use.

5.3.2 Clean Water Diversions

Clean water is diverted around the Intermediate Pond to as great a degree as practical through the North Wall Interceptor Ditch and the Rose Creek Diversion Channel, as noted above in previous sections.

5.3.3 Contaminated Water Collection

Prior to 2007, contaminated water flowed to the Intermediate Pond by gravity drainage via (lower) Guardhouse Creek, the old Faro Creek channel and across exposed tailings. Lower Guardhouse Creek is a small portion of the original catchment of Guardhouse Creek that receives some of the runoff from the mill area. The old Faro Creek channel is the drainage path for seepage from the rock dumps and millsite areas. These channels are relatively short and lie completely within the Intermediate Pond catchment area such that little maintenance is required. Maintenance work in this area has focused on maintaining culverts at road crossings.

Changes implemented in 2007 included the capture of contaminated water from the Faro rock piles (location X23) and the Emergency Tailings Area as discussed above.

5.3.4 2010 Operations

As a result of the improved IP pump system installed in the spring of 2010, no treatment was necessary using the Down Valley Treatment System.

In April of 2010, as a result of establishing grid power to the DVTS, the existing fuel tank and generator shed were removed from the roadside. The operator's office building (ATCO trailer) was also moved to the south side of the road to provide more room for vehicles passing the DVTS loading ramp.

5.3.4.1 Lime Usage

Historical lime usage for the Down Valley WTS is summarized below:

Year	Down Valley Est. Lime Usage (g/L)
2004	0.26
2005	0.34
2006	0.48
2007	0.00
2008	0.18
2009	0.17
2010	0

5.3.4.2 Water Quality

Treated water is released into the north side of the Cross Valley Pond, into a small settling area that had been prepared for this purpose in early 2005. The settling area provides a stilling well (vertical culvert pipe) to dissipate the energy of the incoming water and a (rock) bermed settlement area to contain solids and to further still the water prior to flowing into the CVP.

To monitor the performance of the Down Valley WTS, manual pH measurements at the outflow of the treatment box (where lime slurry is added into the water siphoned from the Intermediate Pond) are recorded in a logbook on an hourly basis, in years that the system is operating. The target pH is generally 10.8 to 11.0. The target pH is substantially higher than for the other treatment systems because of the lower level of lime conditioning and absence of flocculation.

5.3.4.3 Treatment Sediments

In 2002, a large quantity of treatment sediments had accumulated in the Cross Valley Pond at the base of the inflow spillway. The sediments were negatively affecting water quality in the Cross Valley Pond through re-suspension on windy days. A large portion of the sediments (that portion that was accessible) was removed in 2002 and transported to the Faro Pit to restore the efficiency of the Cross Valley Pond for settlement of treatment sediments.

A sediment management study was completed by SRK Consulting and submitted to the Water Board in 2004. The study recommended that sediments from the Down Valley WTS be removed from the bermed settling area and deposited within a containment berm on the Original Tailings Impoundment. The 2004 sediment study provided an estimated annual sediment production rate of 1,400 m^3/month for the Down Valley WTS, based largely on data from the 2003 operating season.

During 2008, a vacuum truck system was used to enhance the sediment recovery process from the bermed settling area. A bell attachment was connected to the vacuum truck suction hose and the 40 ton Omega crane was used to manipulate the suction bell. This method of sludge re-location proved inefficient and costly and was not utilized in 2009. In addition to using the vacuum truck, sludge removal was carried out by using an excavator to dig, spread, pile and freeze the sludge for removal via dump truck. In 2008 and 2009, approximately 2,800 and 2,300 m^3, respectively, was transferred from the Cross Valley Pond settling cell to the Original Tailings containment area. No sludge removal was conducted in 2010.

5.3.4.4 Comments for 2011 Operations

For future operation of the Down Valley Treatment System, pH alarms should be installed to indicate any low or high pH conditions to the operator immediately, thereby reducing the chance of an upset condition between hourly pH checks.

Grid power is also available to the Down Valley Treatment System via the new power line for any future operation, if required.

5.4 Grum/Vangorda Water Treatment System

5.4.1 Overview

The Grum/Vangorda Water Treatment Plant ("WTP") is a conventional lime treatment plant that was constructed in 1990. The WTP was successfully utilized during mine operations at the Vangorda Plateau mine site (1990 through 1997) to treat water pumped from the Grum and Vangorda Pits. The WTP was closed when mine operations were suspended in early 1998 and was reactivated in 2002.

The need for reactivation of the WTP stemmed from the level of water in the Vangorda Pit. In early 2002, the water level had reached the maximum desired elevation and, therefore, the water level needed to be drawn down to maintain adequate emergency storage capacity.

From 2002 through 2005, the WTP was operated during the summer season, fundamentally as it had been during mine operations (pre-1998) although some mechanical and electrical upgrades were installed. Water was pumped to the WTP from the Vangorda Pit on a seasonal summer basis to draw the pit water level down so that it remained below the recommended maximum elevation.

In 2006 and 2007, the WTP was not operated because a sufficient volume of water from the Vangorda pit had been treated in 2005. In 2008, the WTP operated from June 5 to August 20 with several shutdowns during the pumping period. In 2009, the treatment season began on June 12 and continued to September 1. In 2010, initial water treatment started on June 9, and was halted for just over a week from June 12 to June 21, for water quality testing, and then operated continuously until July 15, when Vangorda Pit target water levels were reached..

The WTP was designed by Cominco Engineering Services Limited (CESL) and constructed in 1990. The process is a “conventional” lime treatment system that was designed to treat 2,000 USgpm (454 m^3/hr) at the water influent quality predicted for mine operations. The primary components of the treatment system are as follows:

- Lime delivery and transfer system to deliver lime into the storage silo;
- Lime storage silo (capacity of approximately 40 tons);
- Freshwater supply for reagent mixing;
- Lime slurry mixing system (does not include any grinding or heat-controlled slaking)
- Lime slurry storage tank;
- Lime addition system (can be managed manually or by automated pH control circuitry);
- Dual lime conditioning tanks [provides total 14 minutes strong mixing at maximum design flow;

- Flocculant mixing system (can be managed manually or by automated control circuitry);
- Flocculant addition system;
- Flocculant agitation tank (provides 2 minutes light mixing at maximum design flow);
- Clarification pond influent pipe; and
- Clarification pond with effluent discharge pipe (provides design 36 hours retention time at maximum design flow).

5.4.2 Operations

5.4.2.1 2008 System Operations and Modifications

During the treatment season, operating issues were encountered with the Vangorda Water Treatment Pumping and Delivery System. The Vangorda booster pump failed and was replaced on July 8, 2008 and the system was put back on-line July 9, 2008. Inspection of the pump showed that the fifth and sixth stages of the pump had failed. It was also identified that excessive wear of several components was occurring on an accelerated basis and the cause was believed to be due to the low pH (< 2.5) in the pit water along with scale buildup in the pipeline. During the balance of the month, the system was shut down on several occasions due to the ongoing component failures related to the low pH, having a direct impact on the equipment. Parts replaced on the system included a drain line at the barge, check valves for the gland lines, and a drain line for the booster pump used for low flow control to the water treatment plant. In response to ongoing equipment failure, the Vangorda water treatment system was shut down on August 21, 2008. The booster pump was also worn out and the header pipes on the booster pump were worn and leaking.

Due to the heavy rainfalls that occurred during the operating season and numerous shutdowns caused by the failure of the equipment, the low water level target was not achieved for the Vangorda Pit in the 2008 operating season. A detailed inspection of the pumps, valves, pipe, and barge, determined that major refurbishment of the delivery system for the Vangorda WTP operation was required prior to the spring start up in 2009.

As a result of the inspection, recommendations were prepared by site management in October 2008. It was recommended that stainless steel pumps should be purchased, including a spare pump in case of a breakdown, along with replacement of portions of the steel pipeline and the various valves within the system. New HDPE Pipe was recommended for purchase to replace the existing steel pipeline. The barge was found to be in acceptable condition.

It was decided by the Federal and Yukon Governments that the delivery system for the water treatment operation be replaced as required. Deloitte & Touche Inc. was authorized to order the necessary pumps, components and piping for delivery to the site prior to March 2009. This would allow for installation of the new components in time for the spring start-up of the Vangorda Water Treatment System.

5.4.2.2 2009 System Operations and Modifications

DES installed the new stainless steel pumping system and 16 inch HDPE pipeline and successfully began pumping Vangorda Pit water to the Vangorda ETP for treatment in mid June. Flow rates measured through the new pumping system and pipeline are significantly greater (~2700 USGPM) than historic records while still maintaining compliant effluent.

Work to install the new system began early in the spring. The biggest task in installing the new system was fusing approximately 1.5 km of new 16 inch, heavy wall HDPE pipe. Due to the high working pressure of the new pipeline, a representative from McElroy Ltd. was hired to come to the site and train a group of employees on proper fusion technique when using the McElroy fusion equipment.

Concerns over pipeline quality were raised by the McElroy representative during the training course. During fusion training, several lengths of pipe were examined and determined to be marginal according to industry standards. Sections of pipe were sent out for testing, and pictures were taken and also sent to several third party sources and the manufacturer for input and recommendations. Some sections of the pipeline identified as the poorest quality were set aside and not used during construction of the pipeline. The rest of the pipe, though marginal in quality, was determined to be satisfactory for installation and use.

Installation of the new pipeline included a significant amount of earthwork to ensure complete drainage of the pipeline when the system was shut down. A section of the 16 inch HDPE pipeline passes over a channel where water is discharged directly to Vangorda Creek. To reduce risk of a spill entering the fresh water system, a ditch was constructed to route potential spills to Vangorda Pit. Construction of the ditch required the extension of a large culvert downstream of the V25BSP weir.

During installation of the barge and booster pumping systems, it was discovered that several key components were not on-site. Rush orders were placed for several valves.

Due to the long lead time on stainless steel valves, the decision was made to install several steel valves in the hopes that they would last until the new stainless steel parts arrived. A 10 inch steel isolation valve installed in-line along the main 10 inch pipeline at the booster station began to leak after only 24 days of operation. With no new stainless steel valve on site yet, modifications were carried out by the site welder to eliminate the valve for the remainder of the operating season. For the 2010 operating season, all valves installed will be stainless steel.

Due to the complex nature of the existing booster station arrangement, it was critical that the newly fabricated stainless steel components be an exact replica of the original steel components. Several components of the barge and booster pumping system fabricated off-site were discovered to be different than the existing arrangement. Several items were sent back to the machine shop for modification which caused some delay in the installation of the new system. Plans are in place to modify the current booster station arrangement before the 2010 operating season to simplify the set-up which will reduce time and effort if a component needs to be replaced or removed from the system for inspection.

During commissioning of the new pumping system, problems were discovered with the existing 350 HP electric motors used to drive the barge and booster pumps. These electric motors were salvaged from the former fresh water pumphouse and are quite old and maintenance history is not well documented. The site electrician spent several hours making adjustments and performing several tests to try to start the motor and keep it running. The motor would start but would shut down immediately due to overloading. A decision was made to remove the motor and replace it with the on-site spare. The on-site spare was installed and started with no problem, indicating that the originally installed motor was in need of inspection and repair. The original motor was sent out for inspection and repair to a certified repair facility in Edmonton. The spare motor was used for the remainder of the treatment season, but it also had mechanical problems. Due to the specialty application and arrangement of these motors, no suitable spare was found after contacting numerous vendors and suppliers. In the late stages of the treatment season the booster station motor also began to show signs of possible mechanical problems. Both motors operated for the treatment season but a decision was made to send both out for inspection and repair. As of the end of 2009, all three motors are back on site, fully inspected refurbished.

The 2009 treatment season was successful at lowering the Vangorda Pit level beyond the end of season target level provided by YG.

5.4.2.3 2010 System Operations and Modifications

Prior to the 2010 operating season, significant effort was put into cleaning and improving the lime slaker function. Several water addition lines, previously used for the original automated water addition were removed. New water lines were installed with control valves to have better control of the (now) manual water addition points into the slaker. Many years of lime scale build up was also cleaned from the slaker tank and mixer paddles. Several broken mixer bar paddles were also repaired. During the short 2010 operating season, treatment plant operators reported that the time required to mix a batch of lime was reduced with these improvements.

A modification to the floc addition system was also carried out prior to the 2010 operating season. In an effort to simplify site inventory and critical spare requirements, the floc addition pump was changed to the same style of pump used at the Faro Mill. The new pump worked well and no issues were encountered during operation.

No changes were made to the barge or booster stations in 2010. Critical spare valves, to reduce interruption time should a failure occur, were purchased in early 2010 and are available on site if necessary.

In September 2010, a contract sandblaster was hired to prepare the barge and booster surfaces for re-lining. The previous lining on the Vangorda Pit barge and walkway pontoon showed signs of wear and deterioration. A small airless sprayer was purchased and a professional paint/coating supplier was contacted to recommend a suitable lining to use in the low pH water contained in the Vangorda Pit. Both the IP and Vangorda barges and pontoons were sandblasted and painted. The Omega crane was used to lift the barges onto their ends so the sandblaster could prep the bottoms. Once the surface was cleaned, the site welder used the airless paint sprayer to coat the barges and pontoons with the chemical/acid resistant liner. Minor repairs were completed prior to painting and an additional wear plate was welded to the Vangorda barge near the pump intake to eliminate the possibility of the acidic water wearing through the barge structure.

Also in September, both 350 hp electric motors were sent back to Engineered Electrical Controls (EEC) in Ontario for repair work. The motors had been sent out in 2009 for repair but minor oil drips were identified prior to use and was documented and discussed with EEC. EEC indicated that they would look at the drips and possibly offer the repairs under warranty if it was an oversight. Upon investigation, it was determined that the leaks were not identified during the first round of repairs in 2009, but was not warranty work as the leaks could have been caused during shipping. Repairs were completed and the motors were shipped back in early 2011.

Both of the pumps used for the Vangorda pump system were also sent back to the manufacturer for inspection and repair in September of 2010. Both Vangorda pumps showed significant wear on the shafts and the manufacturer has indicated it may be better to use a 316 SS shaft instead of the 416 SS shaft currently installed on the pumps. New shafts were installed and the pumps modified to use a mechanical seal. Both pumps were shipped back to site in early 2011.

5.4.3 Clean Water Diversions

Clean water is diverted around the Vangorda Pit via the following systems:

1. Vangorda Creek Diversion Flume;
2. Northeast Interceptor Ditch;
3. Northwest Interceptor Ditch; and
4. Old Vangorda Creek channel.

5.4.3.1 Vangorda Creek Diversion Flume

The Vangorda Creek Diversion Flume is a 2.4 m diameter half-culvert placed in a rock cut channel on the upper benches of the north wall of the pit. The upper reach of the channel is cut into native soils beyond the pit wall. The flume passes the flow of Vangorda Creek around the pit to its natural channel below the mine haul road. The flume was constructed in 1991 and has experienced localized failures and damage due to soil slumping, rock falls and large flow events.

Substantial restorative and repair work was completed from 2002 to 2006 and resulted in the general restoration of a continuous positive grade, reduction in risks of rock falls, reduction in risk of overtopping, and a general improvement in the physical condition and stability of the flume sections. In 2005, an emergency overflow channel was excavated at the headworks dam that would allow extreme flood flows to pass directly into the Vangorda Pit, thereby reducing the risks of overtopping and damage to the flume.

In 2010, daily inspections of the Diversion Flume were conducted. Very little maintenance was required through the spring, summer and fall months. During freeze up, several days of manual work with hand tools and the steam truck were required to remove ice dams that caused water to back up in the flume.

5.4.3.2 Northeast Interceptor Ditch

The Northeast Interceptor Ditch is an open channel excavated into the native soils with some channel reaches lined with synthetic materials to reduce seepage.

In 2010, maintenance work was carried out to remove slumped gravel material from the interceptor ditch. Pooling of water was reduced, but it was not possible to totally eliminate the pooling. To eliminate all pooling, a significant amount of work would be required to gain access to the north side of the ditch. Monitoring will continue and more work may be required in the future.

5.4.3.3 Northwest Interceptor Ditch

The Northwest Interceptor Ditch is an open channel excavated into the native soils and surficial bedrock above the Vangorda Creek Diversion Flume at the top of the northwest wall of the Vangorda Pit. This ditch passes clean water around the northwest area of the pit to Vangorda Creek.

No maintenance work was required on the Northwest Interceptor Ditch in 2010. Monitoring will continue in 2011.

5.4.3.4 Old Vangorda Creek Channel

Natural runoff water collects in the old Vangorda Creek channel immediately above the Vangorda Pit. There is a small catchment area that lies below the Vangorda Creek Diversion Flume. Without intervention, this clean water flows into the Vangorda Pit and becomes contaminated by flushing contaminants from the pit walls. Since 2002, this water has been pumped into the Vangorda Creek Diversion Flume during the summer season from a natural depression in the old Vangorda Creek channel. This is a reactivation of a procedure that was previously utilized during mine operations.

In 2010, similar to previous years, a small Flygt pump was installed in the small depression and under control of a float switch, automatically pumped water to the Vangorda Flume. Automated pumping continued until the fall when ice interfered with operation of the float control. For the last few weeks before ice was too thick, the pump was operated manually every couple days to keep water level in the pond as low as possible. Once the ice was too thick, the pump was removed and put into winter storage.

5.4.4 Contaminated Water Collection

Contaminated water is actively collected from two locations related to the WTP, namely the Vangorda Rock Dump seepage collector ditch and Little Creek Dam Pond.

5.4.4.1 Vangorda Rock Dump Seepage Collector Ditch

Runoff and seepage water from the Vangorda rock dump is contaminated with metals and requires treatment before it can be released to Vangorda Creek. An open ditch around the toe of the rock dump intercepts runoff and seepage water that would otherwise enter Vangorda Creek directly. The ditch directs water into Little Creek Dam Pond.

In the spring of 2009, maintenance work was required to excavate ice from the ditch to allow spring melt water to flow, unobstructed, to Little Creek Dam. In 2009, to improve the performance of this ditch and reduce the chance of overtopping in the spring, a berm was constructed along the edge of the access road that runs parallel with the ditch. This berm increases the capacity of the ditch along a low section of the road. To further improve performance, an excavator was used to remove sediment that had built up in the bottom of the ditch along the south side of the rock dump as a result of erosion. The ditch was also excavated along the west side of the rock dump to provide for a more positive gradient to Little Creek Dam and improve flow.

In the spring of 2010, minor maintenance was also required during the spring melt to remove ice blockages and allow water to flow to the Little Creek Dam holding pond.

5.4.4.2 Little Creek Dam

Little Creek Dam (LCD) is a water retention dam that forms Little Creek Dam Pond. The water retained behind Little Creek Dam originates from the Vangorda Rock Dump Seepage Collector Ditch and from direct runoff and seepage from the Vangorda rock dump.

This water is pumped into the Vangorda Pit as required where it is incorporated into the treatment system. Pumping has typically been required on one or two occasions during the summer.

In 2009, the Little Creek Dam pump was operated several times to maintain the water level as low as possible. Some ditching work was carried out in the fall along the edges of the LCD access road to prevent downstream erosion of the dam face. The ditching also serves to provide a ditch that would capture contaminated water being pumped to the Vangorda Pit from LCD and direct it back into the LCD pond should a pipeline failure occur.

The summer of 2010 was relatively dry and pumping was only carried out three times to maintain the desired low water level for seasons end.

5.4.5 2010 Operations

5.4.5.1 WTP Start Up

The Clarification Pond was drained of water at the end of the 2005 treatment season. Sediments that accumulated in the pond from the 2005 treatment season remained in the pond through 2006 and 2007. In 2007, in preparation for the 2008 treatment season, an estimated 4,000 m^3 of treatment sediments were transferred to the containment cell in the Grum Overburden Dump.

The start up phase for the Vangorda WTP at the beginning of the 2008 treatment season followed the established procedure of filling the Clarification Pond with treated water (90% full) and allowing to settle for several days before final bio-assay testing. At this time the WTP is placed on hold, pending verification from the external laboratory that the pond water is compliant. In 2008, start up pumping took place in May.

For the 2009 treatment season start-up, the same procedure was followed to fill the pond and allow settling time before bio-assay testing was carried out. Start up pumping took place in mid June. Water quality samples were sent to the external laboratory and compliance was confirmed (including LC_{50} bioassay). The Vangorda WTP was restarted and effluent release began on June 23.

Following established protocol, the Vangorda pump system was started on June 9th 2010, and the treatment plant operated until the Clarification Pond was near capacity on June 12th when at 6:15 pm the pumps were shut off. Bio-assays were collected after allowing the Clarification Pond to settle for a few days. Once the Bio-assay results confirmed acceptable water quality, the Vangorda pump system was re-started on June 21st and operated continuously until July 15th. By July 15th, the Vangorda Pit water level was well below the season end target.

5.4.5.2 Water Quantities

An estimated 389,533 m^3 was treated through the WTP in 2010 from June 9 to July 15. The water level in the Vangorda Pit ended the treatment season at an elevation of 1082.98 masl, which was 5.0 m lower than the start of the treatment season. The year ended with a water level of 1085.093 which was about 0.5 m lower than the beginning of the year.

5.4.5.3 Lime Usage

As outlined below, a total of 140 tonnes (154 short tons) of lime was utilized in 2010 in the WTP with a lime usage rate of 0.36 g/L.

Summary of Vangorda WTP Lime Usage

Year	Vangorda WTP Lime usage (g/L)
2002	0.18
2003	0.19
2004	0.26
2005	0.21
2008	0.28
2009	0.37
2010	0.36

5.4.5.4 Water Qualities

Location V25BSP represents the compliance point as being representative of effluent entering Vangorda Creek. Weekly compliance water samples were collected at location V25BSP during discharge, as required by the conditions set out in Appendix B of the Care and Maintenance contract, and analysed at the external laboratory.

Additionally, pH readings were routinely recorded by the operators on a twice-per shift schedule at the following locations:

- Discharge from Clarification Pond (location V25); and
- Grum Interceptor Ditch below Sheep Pad Pond (Location V25BSP).

The pH readings that were collected by the Vangorda WTP operators confirm that the Vangorda WTP was operating effectively. The pH readings also document that effluent pH generally decreased along the length of the Grum Interceptor Ditch/Sheep Pad Pond, as anticipated, due to dilution and exposure to the atmosphere.

Daily water samples were collected, generally at the time of manual pH checks by the Vangorda WTP operators. These samples were analyzed in-house for pH and total zinc.

Vangorda WTP operators recorded manual pH readings at key locations within the treatment circuit on a 2-hour basis to provide a frequent check on the installed pH probes that control the automated lime-addition circuitry.

5.4.5.5 Treatment Sediments

At the end of the 2003 treatment season, treatment sediments from both the 2002 and 2003 treatment season had accumulated in the Clarification Pond. A study on sediment management options was completed by SRK Consulting and submitted to the Water Board in 2004. The study recommended that sediments be deposited on-land within a containment berm on the Grum Overburden Dump. This location is near the WTP, is already disturbed by mining development and provides an adequately large working space.

The initial disposal cell was prepared in April 2004. A containment berm was constructed using the till overburden to a height of approximately 0.5 m enclosing an area of approximately 30 m X 30 m (900 m^2). Sediment was excavated from the Clarification Pond to the disposal area in April and May 2004 which filled the cell. A snow fence was installed around the perimeter of the storage cell to discourage wildlife from entering the area. A new cell was constructed in September 2004. The treatment sediments produced during the 2004 treatment season were excavated from the Clarification Pond to the disposal area in December 2004. This filled the new cell to approximately 90%.

In 2005, to provide for the additional storage of treatment sediments, an additional cell was constructed and filled to capacity by the end of February 2005. The containment cell was then extended in 2006. Sediments that accumulated in the pond from the 2005 treatment season remained in the pond through 2006 and 2007. In 2007, in preparation for the 2008 treatment season, an estimated 4,000 m^3 of treatment sediments were transferred to the containment cell in the Grum Overburden Dump.

During the 2008 treatment season, sludge was removed from the Vangorda Clarification Pond using the vacuum truck. At the end of the treatment season in August, removal of sludge was carried out utilizing the vacuum truck with approximately 40 loads of sludge removed with the remaining sludge needing to be excavated and transferred using the conventional excavator and dump truck operation. This was scheduled to be carried out in October 2008.

In September 2008, due to ongoing precipitation at the site, pumping of excess water collecting in the clarification pond was discharged back to the Vangorda Pit. In October, twenty loads of rock were hauled and placed inside the pond for equipment access. Sludge was excavated and trucked to the containment cell although progress was slow due to the consistency of the sludge. Due to above normal temperatures in November, the Vangorda Clarification Pond sludge removal was put on hold until the material had a chance to freeze for transport by conventional dump trucks. In total, by year end, 419 half truck loads or approximately 1,900 m^3 of treatment sediments were removed from the pond and transferred to the containment cell. The sediment removal and transfer was completed by February 2009. A total of 900 more loads of sludge were removed in the late winter/early spring of 2009 to completely remove sediment and create capacity for the 2009 treatment season.

On September 1, 2009, the ETP Clarification pond had reached capacity for sludge storage and treatment was shut down. The Clarification pond was allowed to settle before installing a barge and 30 HP pump to decant as much water off the top of the sludge as possible. The 30 hp pump ran for several days to pump water back to the Vangorda Pit via the influent pipeline. For 2009, the estimated sludge production was approximately 6,400 m^3. In December of 2009, an excavator was used to begin digging and mixing the accumulated sludge to aid the freezing process.

In January of 2010, mixing of sludge from the 2009 treatment season was carried out to promote freezing. Once most of the sludge had been mixed and frozen, dump trucks were used to haul the frozen sludge to the sludge containment cell on the Grum overburden pile. Hauling of sludge began during the last week of January, carried on through the entire month of February and into the first week of March. At times, two excavators were used in the Clarification Pond, one to load trucks and the other to continue mixing to promote freeze up. The total amount of sludge hauled to the containment cell was 1,275 truck loads which was estimated to be approximately 10,000 m^3, significantly more than the sludge production estimated during the treatment season.

Once treatment was complete for the 2010 season, the 30 hp pump was again installed in the Clarification Pond on a floating pontoon to decant clean water off the top of the sludge. Testing of the surface water was completed to ensure it met discharge criteria prior to decanting the top several feet of water to the environment. Once the clean water was decanted, the pump was attached to the 4” pipeline that connects back into the 16” pipeline from the Vangorda Pit. The remaining water from the Clarification Pond was pumped back to the Vangorda Pit. Due to early shut down of the treatment plant, more water was able to be decanted through the fall compared to 2009 which helped consolidate the sludge and reduce the amount of water contained in the sludge and should reduce the number of truck loads to empty the pond.

5.4.5.6 Comments on 2010 Operations and Recommendations for 2011

During spring freshet in 2009, water with elevated TSS levels was discharged from the Sheep Pad Pond. To minimize chances of this happening in 2010, an 8” siphon was fabricated and installed in the lower Sheep Pad Pond. The siphon was used in early April 2010 to drain the lower pond prior to freshet to increase capacity for the initial runoff. DES intends to continue this approach in 2011.

The addition of a flow meter and other possible instrumentation for the Vangorda Pit influent pipeline would improve data collection and aid in assessing overall treatment plant performance. DES understands that YG is investigating this possibility.

A significant concern of DES is the condition and function of the existing lime handling system. DES has made recommendations to YG throughout 2010 to replace the existing lime handling tractor/trailer with a newer model, and to replace the existing free-dump sea-can approach with a closed circuit pneumatic system. These recommendations were made with the intent to increase mechanical reliability as well as to reduce safety hazards inherent to the existing system.

6. FARO MINE COMPLEX LAB, QUALITY ASSURANCE/QUALITY CONTROL, AND DATA MANAGEMENT

6.1 Faro Mine Complex Laboratory

The Faro Mine Complex (FMC) utilizes an onsite laboratory to ensure efficient water treatment and protection of the environment by providing analytical support to onsite care and maintenance activities (primarily through aqueous zinc analysis). As previously noted, prior to 2009, zinc analysis was undertaken using an AA instrument.

In 2009, construction of a new analytical laboratory was undertaken at the FMC with the aim of developing a proper facility with greater analytical capabilities than had been available on-site for a number of years. By February 2010, the majority of the construction activity was completed and it was possible to begin analytical work in the new facility.

Throughout 2010, second to providing analytical support to water treatment operations, development and verification of new analytical methods was carried out. Part of the construction of the new laboratory had included the installation of a previously purchased (but thus far unused) Perkin Elmer 7300 Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) and Multiwave 3000 Microwave Digestor. Development of a method for zinc analysis involving both pieces of equipment was carried out in March 2010, with application of the method beginning on March 22, 2010, when discharge of water via the X5 siphon began for the year. The AA remained a working component of the lab, in a back-up capacity.

Throughout the summer and fall of 2010, environmental staff at the FMC laboratory worked on the development of analytical methods for additional parameters to allow for more extensive in-house analysis of water samples collected on-site. Parameters that were included in the method development process were:

- Acidity (pH 8.3) - Titration
- Alkalinity (pH 4.5) - Titration
- Ammonia - Ion Selective Electrode
- Conductivity - Conductivity Meter
- pH - Potentiometric
- Total Dissolved Solids (TDS) - Gravimetric
- Total Suspended Solids (TSS) - Gravimetric
- Turbidity - Colorimetric
- Hardness (Total and Dissolved) - Calculated
- Metals - ICP-OES:

- o Aluminum
- o Antimony
- o Arsenic
- o Barium
- o Beryllium
- o Bismuth
- o Boron
- o Calcium
- o Cadmium
- o Chromium
- o Cobalt
- o Copper
- o Iron
- o Lead
- o Magnesium
- o Manganese
- o Molybdenum
- o Nickel
- o Potassium
- o Scandium
- o Selenium
- o Silver
- o Sodium
- o Strontium
- o Sulfur
- o Tin
- o Thallium
- o Titanium
- o Uranium
- o Vanadium
- o Zinc
- o Zirconium

In order to allow for analysis of these additional parameters, a number of new items were purchased for the FMC laboratory in 2010 including:

- A Denver Instrument Model 250 pH/Ion/Conductivity Meter with high and low range conductivity probes and an ammonia selective electrode;
- A LaMotte 2020we Turbidity Meter;
- A Norlake Scientific Laboratory Refrigerator;
- Three new micropipettes:
    - o One Socorex 5-50 uL;
    - o One Socorex 20-200 uL;
    - o One Eppendorf 100-1000 uL;
- Various miscellaneous laboratory hardware; and
- Various miscellaneous consumable items required for analysis.

In addition, at the end of 2010, a Hach Pocket Colorimeter II was purchased for residual chlorine analysis in anticipation of the completion of construction on the new fresh water supply well. Development of a method for daily residual chlorine analysis to allow for onsite monitoring of the new fresh water supply is scheduled for early 2011.

In 2010, water suitable for use for analytical purposes and clean-up was purchased and shipped to the lab. In 2011, it is anticipated that running water in the lab will facilitate lab analysis and clean-up procedures, and that the polisher will provide the lab grade water required.

In October 2010, following issues with sending out samples to an external laboratory for turbidity analysis within the recommended holding time for this parameter, turbidity analysis was taken over by the FMC laboratory, beginning in November 2010. This decision allowed for the time between turbidity sample collection and analysis to be minimized, ensuring more accurate results. In 2011, it is anticipated that turbidity analysis required by all water quality monitoring programs, including those for which DES representatives do not collect the samples, will be undertaken through the FMC Lab.

Lab development in 2010 also included modifications to the ICP gas introduction systems to facilitate efficient changing of supply bottles.

Clean room procedures were put into effect in 2010 to minimise risk of contamination of samples in the lab.

6.1.1 Lab Information Management

Results of analysis through the Faro Mine Complex Lab were reported internally for assessment of water treatment processes and discharge compliance verification. Discharge zinc (total) concentrations were introduced into the daily reports in 2010.

The lab reported results of construction phase water quality monitoring, including zinc and TSS, on a weekly basis.

In 2010, the results of depth profiles in the Cross Valley Pond, were imported to emLine.

In conjunction with the start of official turbidity analysis in the FMC laboratory, the FMC laboratory module of emLine was activated in order to determine if it would be an appropriate method of handling turbidity data produced by the FMC laboratory and transferring it to the FMC main emLine module, in place of a full Lab Information Management System. As of the end of 2010, continuation of use of the laboratory module was still under consideration.

Improvements to the lab reporting methods are anticipated in 2011, following formalisation of lab quality assurance and quality assurance protocols.

6.1.2 Lab Staffing

The FMC Lab analytical services are required every day during the water treatment process, including over weekends. This includes periods when the Faro Mill and Vangorda Treatment Plants are not in operation, but discharge from clarification and polishing ponds is in progress. Monthly depth profiles in the Cross Valley Pond are also analysed at the FMC Lab.

In 2010, the lab was operated (and methods developed) by two full time chemists. Primarily to aid with staff rotations for water quality analysis during water treatment, an environmental chemistry student from the University of British Columbia (Kelowna) was hired as a summer student and worked in the laboratory from May through the end of July, 2010. This student also assisted on occasion with lab method development activities.

6.1.3 Proficiency Testing

By fall, 2010, analytical methods had been developed for all the parameters listed above. In order to assess the reliability of the newly developed methods, the FMC laboratory participated in the October 2010 Proficiency Testing (PT) Program organized by the Canadian Association of Laboratory Accreditation Inc. (CALA). Although proficiency testing for all parameters listed above was not available through CALA, the FMC laboratory participated in testing for all parameters that were included in the CALA PT Program:

- Alkalinity (pH 4.5) - Titration
- Ammonia - Ion Selective Electrode
- Conductivity - Conductivity Meter
- pH - Potentiometric
- Total Dissolved Solids (TDS) - Gravimetric
- Total Suspended Solids (TSS) - Gravimetric
- Turbidity - Colorimetric
- Hardness (Total and Dissolved) - Calculated
- High Range and Dissolved Metals (0.25-1.60 mg/L)- ICP-OES:
    - Aluminum
    - Barium
    - Boron
    - Calcium
    - Chromium
    - Cobalt
    - Copper
    - Iron
    - Lead
    - Magnesium
    - Manganese
    - Molybdenum
    - Nickel
    - Potassium
    - Sodium
    - Strontium
    - Thallium
    - Titanium
    - Vanadium
    - Zinc

Following proficiency testing, the FMC laboratory was granted “Proficient” status by CALA in all parameters for which it was tested except conductivity. The details of the study and results of the FMC laboratory’s participation were outlined in greater detail in a memo included in the December 2010 Environmental Monthly Report.

While the FMC laboratory is still undergoing development, the work that was done in 2010 represents a large step in the advancement of laboratory capabilities. While at the start of the year only zinc and TSS analyses were possible, the FMC laboratory now has a long list of parameters for which it has the ability to test. Participation by the FMC laboratory in the CALA PT Program provided a means of evaluating the quality of the analytical work and the validity of the data produced by the laboratory, and the results showed that the FMC Lab can now produce results that are comparable with other labs across Canada, including certified labs.

Increased usage of the expanded capacity of the FMC Lab in 2011 depends in part on whether or not certified results are required, the costs of analysis, the turn-around time required (from sample collection to results reporting) and on detection limits required.

Development of the FMC laboratory is expected to continue throughout 2011. A second round of proficiency testing is scheduled for March 2011.

6.2 Quality Assurance and Quality Control

The field QA program is a series of procedures that are undertaken to maximize the accuracy by reducing introduced variability to ensure the program's success. DES field staff worked to maintain consistency and were diligent while in the process of collecting, preserving, filtering and shipping samples. The QC component is incorporated to minimize potential imprecision and bias in the data and provide checks of field and laboratory methods.

QC samples collected during the 2010 field program consisted of the following:

- Field Blanks – assessment of potential samples collection and shipping process contamination;
- Field Splits and Field Replicates – assessment of laboratory repeatability and sampling variability, respectively;
- Laboratory Replicates – assessment of analytical precision.

Split samples are collected using the same filtering equipment and by splitting the sampling stream between individual bottles to obtain two or more identical samples. This was done to verify laboratory repeatability. Replicate samples are separate samples taken immediately after the original sample using identical sampling methods, but different filtering equipment.

6.2.1 General QA/QC Measures

The following quality assurance and quality control (QA/QC) procedures were incorporated into the 2010 sampling events:

1. All samples collected for dissolved metals analyses were filtered and preserved in the field, immediately after sampling. New, sterile disposable 0.45-micron filters were used to filter each sample immediately after collection.

2. Field measurements of pH, conductivity and temperature were recorded. The pH probes were calibrated daily and conductivity probes were calibrated weekly. Calibration was verified periodically in the field.

3. Field split samples and field replicates were collected and results assessed using the relative percent different (RPD) method. The Relative Percent Difference (RPD) is the difference between the sample result and replicate (or split) result, divided by

$$\%RPD = \frac{2(C_1 - C_2)}{(C_1 + C_2)} * 100$$

   the average of the sample result and replicate result, as described below:

   Where: C_1 = The concentration of the first sample;

   C_2 = The concentration of the second sample (i.e. the split sample).

   An RPD of <50% can be used as a benchmark whereby an RPD of greater than 50% warrants further consideration, so long as both results being compared are greater than the Practical Quantitation Limit (PQL), where PQL is 5 times the Method Detection Limit (MDL). If one or both of the results are less than PQL, then RPD is not useful.

4. Following sample collection, all samples were stored in a cooler with ice packs and/or in the on-site lab fridge and either transported to the certified laboratory or analysed on-site within the allotted holding periods, wherever possible.

5. Chain of Custody Reports were completed for the samples submitted for analysis for the purpose of tracking the samples collected and to ensure that the parties involved were properly informed as to the nature of the samples. These reports were made up prior to delivering the samples to the laboratory and normally include the following information: project number; sample ID's, type of analysis required, sampling date and time, matrix sampled, sampler's name, and Project

Manager's name. Copies of the Chain of Custody forms are retained by DES and are used by the lab as a guide to complete the analytical laboratory reports.

6. Internal laboratory QA/QC procedures were also maintained by Maxxam Analytics (as reported in the laboratory reports provided in monthly reports to YG).

7. Ion charge balance reports were requested from Maxxam Analytics.

8. Field pH and conductivity values were compared with lab pH and conductivity values on a monthly basis. Where errors were observed, steps were taken to correct the errors prior to including the data in this report. Corrections were also made in emLine, where applicable, with appropriate notations included.

9. For groundwater monitoring, wells were purged to remove standing water from the well and packed area around the well screen (three well volumes). In most cases, field parameters were monitored as the well was purged. [Note that previously at this site, a comparison of samples collected from multi-level wells was undertaken (either by Environment Canada or GLL, now AECOM) after one to three well volumes revealed that one well volume was sufficient purge volume for the multi-levels, as described in the 2005 groundwater sampling report.]

10. To reduce the risk of cross-contamination, samples were collected in order of least potentially contaminated to most potentially contaminated, as practical. For groundwater, for the tailings area multi-level wells, deeper monitors screened in the aquifer were purged and sampled prior to monitors in tailings.

11. Especially with respect to groundwater monitoring, caution was exercised when handling sampling equipment and working at sites with exposed tailings at surface to minimize the risk of possible contamination from tailings during sample collection and handling.

12. In addition to the QA/QC measures described above, a further measure of quality control came from the ability to compare certified zinc results (total and dissolved) obtained from Maxxam Analytics to the results obtained by the on-site FMC Laboratory (which, while not certified, was granted "proficient" status by CALA for zinc analysis in October November 2010). This comparison, in addition to providing a means of checking results from both labs, also provides a measure of the variability between on-site and certified off-site results; this is important as the results from both labs are often used interchangeably in decision making on-site. Sample handling and analysis procedures differ somewhat between the two laboratories: Maxxam Analytics receives preserved samples typically 1-5 days

following sample collection and analyzes using an Inductively Coupled Plasma Mass Spectrometer (ICP-MS), whereas the FMC Laboratory receives unpreserved samples immediately following collection and analyzes using an ICP-OES (and in some instances an AAS). Comparison of Maxxam Analytics and FMC Laboratory results is accomplished using the RPD method described above

6.2.2 Summary of QA/QC Assessment – Rose Creek Drainage

In 2010, a total of 573 surface, seep, and ground water samples were collected at sites encompassed by the Rose Creek Drainage system. In order to ensure the quality of the analytical results, 81 quality control samples (corresponding to 14.1% of the total), consisting of splits, blanks, and duplicates were also collected and analysed. Extensive comparison of the quality control and corresponding primary sample results using the RPD method outlined above was carried out and is discussed briefly below. Documentation of the QA/QC program for monitoring in the Rose Creek Drainage is included along with the monitoring results from the drainage in Appendix C.

Blanks analysis accounted for 26 of the 81 quality control samples collected on the Faro side of the mine site in 2010. Results of the blanks analysis were compared to those from an analysis performed by Maxxam Analytics on their own deionized water. Review of the comparisons revealed that, while there were several values flagged on different samples throughout the year, there were particular parameters that were flagged repeatedly. Those flagged most frequently were lead (total and dissolved), zinc (total and dissolved), manganese (dissolved), and ammonia. Retests requested on lead, zinc, and manganese typically returned values similar to those received originally; however, retests requested for ammonia often returned values much lower than those originally received. This has been discussed with representatives from Maxxam, and submission of a few non-preserved samples is on the workplan for 2011, to look into the ammonia analysis methods further.

Duplicate and split analysis accounted for 29 and 26 of the 81 quality control samples collected on the Faro side in 2010, respectively. Fewer flagged values were observed in these comparisons than in the case of the blanks results, but, as with the blanks, a few parameters were repeatedly flagged. Those seen most frequently were lead (total and dissolved) and, in the case of groundwater, total suspended solids (TSS). As with the blanks retest requests, the retests on the lead often returned values comparable to those originally obtained; TSS retests were not possible for any of the flagged values because the contract laboratory had insufficient volume to reanalyze in all cases.

Quality comparison analysis using the RPD method was also applied to field and lab data (pH and conductivity) where values from both sources were available. When large discrepancies between lab and field values were observed, the cause was investigated. If none could be identified, a retest was requested on the lab value; however, due to the short hold time for both pH and conductivity, reliable retests were often not possible.

On a weekly basis during periods of treated water discharge from the Cross Valley Pond, samples are collected from sites X5 and X14 for analysis at both the FMC Laboratory and Maxxam Analytics. In 2010, there were 54 sampling events from which both Maxxam Analytics and the FMC Laboratory received samples for total and dissolved zinc analysis. Table F-1 in Appendix F shows both sets of results for the two sites in 2010, as well as the results of the RPD comparison between the two data sets. In general, the results for both total and dissolved zinc from the FMC Laboratory in 2010 were lower than those from Maxxam Analytics. In addition, the difference in results is more distinct in the dissolved zinc results than in the total zinc results.

DES anticipates that in 2011, the frequency of quality control and assurance sampling will be reduced to approximately 10%, with a higher ratio of duplicates and splits that blanks.

6.2.3 Summary of QA/QC Assessment – Vangorda Creek Drainage

In 2010, a total of 297 surface, seep, and ground water samples were collected at sites encompassed by the Vangorda Creek Drainage system. In order to ensure the quality of the analytical results, 76 quality control samples (corresponding to 25.6% of the total), consisting of splits, blanks, and duplicates were also collected and analysed. Comparison of the quality control and corresponding primary sample results using the RPD method outlined above was carried out and is discussed briefly below. Documentation of the QA/QC program for monitoring in the Vangorda Creek Drainage is included along with the monitoring results Appendix D.

Blanks analysis accounted for 32 of the 76 quality control samples collected on the Vangorda/Grum side of the property in 2010. Results of the blanks analysis were compared to those from an analysis performed by Maxxam Analytics on their own deionized water. Review of the comparisons revealed that, while there were several values flagged on different samples throughout the year, there were particular parameters that were flagged repeatedly. Those flagged most frequently were lead (total and dissolved), zinc (dissolved), manganese (dissolved), and, to a lesser extent, barium (dissolved). Retests requested on these parameters typically returned values similar to those received originally.

Duplicate and split analysis accounted for 31 and 13 of the 76 quality control samples collected on the Vangorda/Grum side in 2010, respectively. Fewer flagged values were observed in these comparisons than in the case of the blanks results, but, as with the blanks, a few parameters were repeatedly flagged. Those seen most frequently were lead (total and dissolved), zinc (total and dissolved), manganese (dissolved) and, in the case of groundwater, total suspended solids (TSS). As with the blanks retest requests on the lead, zinc, and manganese often returned values comparable to those originally obtained; TSS retests were not possible for any of the flagged values because the contract laboratory had insufficient volume to reanalyze in all cases.

Quality comparison analysis using the RPD method was also applied to field and lab data (pH and conductivity) where values from both sources were available. When large discrepancies between lab and field values were observed, the cause was investigated. If none could be identified, a retest was requested on the lab value; however, due to the short hold time for both pH and conductivity, reliable retests were often not possible,

On a weekly basis during periods of treated water discharge from the Vangorda Treatment Plant Clarification Pond, samples are collected from sites V25 and V25 BSP for analysis at both the FMC Laboratory and Maxxam Analytics. In 2010, there were 9 sampling events from which both Maxxam Analytics and the FMC Laboratory received samples for zinc analysis. Table F-2 in Appendix F shows both sets of results for the two sites in 2010, as well as the results of the RPD comparison between the two data sets. In general, the results for both total and dissolved zinc from the FMC Laboratory in 2010 were lower than those from Maxxam Analytics. In addition, the difference in results seems to be more distinct in the dissolved zinc results than in the total zinc results.

6.3 Data Management

The analytical data obtained from historical sampling programs, both former Water Licence requirements and others, was managed and maintained through an electronic database that was managed by DES in 2010. In 2009, historical water quality data was transferred from the AECOM historic database to “emLine”, the new Faro database, and as emLine was developed, analytical data for 2009 from the certified lab were entered into it. In January 2010, 2009 field data was added. Access to the database has been provided to YG-AAM by DES since 2009 and access to the site was provided to other consultants early in 2010.

A representative of Projectlines Solutions visited the Yukon in April 2010, and provided training on the use and functionality of emLine for YG-AAM representatives in Whitehorse and to DES staff at the Faro Mine Complex. The work scheduling function of emLine was developed at this time, and then was revised according the 2010 revision of the Appendix B of the Care and Maintenance Contract, and implemented as of September 2010. Activation of this function permitted the direct entry of field monitoring results into emLine, rather than the two step procedure used previously, in addition to scheduling.

In 2010, groundwater modules were developed in emLine, including entry of wells and piezometers installation characteristics, the establishment of parameters related to logistics of groundwater monitoring (for example stick-up and depth to bottom), and the preliminary development of field forms.

As previously noted, a second emLine site was established in 2010 to serve as a preliminary Lab Information Management system, and to develop a method to of reporting FMC lab results to the overall emLine site concurrent with lab quality and management data to the lab only site.

Flow rate monitoring modules were also developed in emLine in 2010.

Reporting functions in emLine were further developed in 2010 to facilitate quality assurance and quality control RPD assessments.

Revisions to the database in 2010 included successfully addressing a data gap issue (approximately 1 year's worth of data from 2008 was imported into the database).

In 2011, it is anticipated that meteorological data and geotechnical data modules will be developed.

7. METEOROLOGICAL MONITORING

7.1 General

Three climate stations were in operation at the Faro Mine Complex in 2010:

- Faro Climate Station;
- Grum Climate Station; and
- Vangorda Climate Station.

The Faro Climate Station is located on the plateau of the Faro Waste Rock Dump. (See Figure 3-1).

The Grum Climate Station, at the beginning of 2010, was located on the Grum Waste Rock Dump, near the Haul Road. It was required that the station be relocated in June of 2010, as previously noted, to accommodate the Grum Sulphide cover project. Several alternate locations were considered, and a summary memo was submitted documenting criteria, locations considered, and the reinstallation of sensors *("Grum Climate Relocation – Summary Brief", dated July 15, 2010*) in the June 2010 Environmental Monitoring Report. The station was moved on June 21, 2010 to a former gravel pit, located north of Grum Overburden vegetation trials. (See Figure 3-1). Soil temperature, moisture and heat flux sensors were re-installed on June 24, 2010.

The Vangorda Climate Station is located on the top of the Vangorda Waste Rock Dump, (See Figure 3-1) and was installed as a component of the cover trials projects. While regular station checks and data downloads were undertaken by DES, the set up and data analysis of the Vangorda Climate Station was undertaken through SRK Consulting, and is therefore not included in this report.

The Faro and Grum climate stations were initially installed in December 2003, with soil moisture and temperature sensors installed in June 2004, to provide support data for cover design. Based on review of available documentation, climate station sensor configuration has remained unchanged since the initial installation, with the exception of the precipitation gauges, which were upgraded in 2008.

7.2 Faro and Grum Climate Station Sensors

The Faro and Grum Climate Stations sensors measure the following climate parameters:

- Temperature;

- Relative humidity;
- Wind speed;
- Wind direction;
- Soil moisture;
- Soil temperature (at two depths);
- Soil heat flux;
- Net radiation;
- Albedo;
- Solar radiation (incoming);
- Snow depth; and
- Precipitation.

Averages of sensor measurements taken every 5 seconds were logged on an hourly basis in 2010. Climate stations data was downloaded on a monthly basis. This data was reported in tables, monthly, along with figures of temperature, precipitation and wind roses. Figures graphing the results of 2010 meteorological monitoring at the Faro and Grum climate station are included in Appendix G.

When the Grum climate station was moved, efforts were made to verify that the station was installed at a similar location, elevation, and soil type, to where it had been previously. Soil temperature, moisture and heat flux sensors were re-installed at the same depths as where they had been. Data from the Grum climate station is reported in Appendix G as one continuous record, with the exception of wind data, which has separate wind roses for before and after the move. The station transition date is noted on graphs. A correction factor was been applied to wind direction to adjust for the station move, until the wind direction sensor was recalibrated in January of 2011. Snow depth sensor installation was evaluated after the move, and based on preliminary evaluation, no correction factor was required.

7.3 Faro and Grum Climate Station Operations and Maintenance

Throughout 2010, the climate stations sensors functioned successfully, with a few minor exceptions, which were identified upon monthly review of data. (All issues identified in 2010 were regulated.)

The stations were maintained through replacement of dessication packs at intervals, recharging of precipitation gauges, and snow brushing from long and short wave radiation sensors.

Calibration and parts replacement is recommended for many climate station sensors and the dataloggers. It is unknown when instruments were last calibrated, or bearings / kits replaced.

7.4 Snow Pack Monitoring

In addition to (sonic) snow depth monitoring at the climate stations, a series of snow depth gauges, installed at successive elevations, are located on each aspect (north, south, east and west) of the Faro Waste Rock Dump and on the south and west aspects of the Vangorda Waste Rock Dump. The snow depth gauges were read twice in 2010 and results reported in a memo.

The snow depth gauge readings were supplements by snow surveys. Two snow courses on each of the Vangorda Waste Rock Dump and the Faro Waste Rock Dump were included as part of the snow pack monitoring, along with an additional snow course in the forested area upgradient of the Intermediate Pond. As the snow surveys built on historic programs, the results could be readily evaluated.

2010 snow pack monitoring was undertaken with the objective of providing a preliminary indication of volumes of water that would have to be managed in the spring. The snow courses on the waste rock dumps were developed historically, with the objective of advancing cover design requirements. It is recommended in 2011 that vegetation, elevation and catchment delineation be evaluated to determine whether or not revisions to the snow courses locations, for the objectives of the monitoring, are required.

8. PHYSICAL STABILITY MONITORING

Physical stabilities monitoring is a daily component of the site activities, as observations of structures constructed to manage water are checked continually as work progresses around the site, in addition to the formal daily and monthly inspections. Visual inspections of dams and diversions are supplemented with instrumentation. The required / recommended 2010 routine geotechnical instrumentation monitoring program is set out in Appendix A of this report. Sites monitored under the 2010 geotechnical monitoring program are shown in Figures 2-1 to 2-7, in the Figures section of this report. Results of monitoring are included in Appendix H.

2010 geotechnical monitoring was divided among the following programs:

- Rose Creek drainage (or Faro Side);
- Faro Pit Slope Stability Monitoring;
- Vangorda and Grum East (or Vangorda Side);
- Grum Pit slope Stability.

In addition to the above, in 2010, an instrumentation review was carried out by Brodie Consulting Ltd (BCL), with the primary focus of instrumentation in relation to the stability of the Intermediate Dam, the Cross Valley Dam and the Little Creek Dam.

8.1 Rose Creek Drainage (Faro Side)

The routine geotechnical monitoring program undertaken in 2010 in the Faro Creek drainage section of the Faro Mine Complex, was largely as recommended by BGC Engineering Inc. (BGC) in the "*2009 Annual Geotechnical Evaluation and Instrument Review – Various Facilities at Faro Mine, Yukon*", (a component of the 2009 Annual Environmental Monitoring and Activity Report, submitted under separate cover, in 2 volumes).

Faro side monitoring focuses primarily on the stability of the dams (Intermediate Dam and Cross Valley Dam), but also includes stability of:

- The Secondary Tailings Dam;
- The Faro Creek Diversion;
- The North Fork of Rose Creek Rock Drain;
- The K8 Rock Drain;

- The Rose Creek Diversion (Canal); and the
- The North Wall Interceptor Ditch.

Daily and monthly inspections were carried out by DES staff. Monitoring of thermistors, hydraulic and pneumatic peizometers, slope indicators, water level elevations, and water stage and discharge was also completed by DES staff.

In September 2010, Kejeh Neyeh Golder (KNG) was contracted to perform the Faro Side annual geotechnical inspection and instrumentation monitoring review. The site visit for purposes of inspection took place in the fall of 2010, at a time when water levels were relatively low across the site and when retention ponds elevations were at historic lows. Results of 2010 monitoring completed by DES were forwarded to KNG. Interpretation was added to the DES role as of 2010, to facilitate quick preliminary assessment of data, when potential issues arise and to permit rapid retesting in the event that verification of results is required.

The findings of the 2010 annual inspection and of the results of review instrumented monitoring are included in:

Golder Associates; "*2010 Annual Geotechnical Dam inspection, Faro Mine Complex, Faro, Yukon";* February 2010.

This report is submitted as a component of this annual report, under separate cover.

KNG noted that:

> *"In general, the Faro Mine Complex tailings management and water management infrastructure which are covered by this inspection effort, including tailings dams and diversion channels are considered geotechnically stable and are performing satisfactorily during the current low storage impoundment and low creek and diversion channel flow conditions."*

Specific comments and recommendations are listed on a structure by structure basis. KNG recommended that visual monitoring and reading of instrumentation in 2011 be continued much as it was in 2010. KNG recommends that the results of slope indicator measurements and temperature depth profiles be reviewed to determine a period of time after which conditions, barring planned changes to the structures, show little change over time, or are consistently warm at depth during measurement periods, and that monitoring of these instruments should therefore be discontinued.

8.2 Faro Pit Slope Stability

Surface water runoff from areas north and east of the Faro Pit are conveyed around the Faro Pit in the Faro Creek Diversion, paralleling the pit's east crest for a portion of the flow path. The east wall has experienced instability in the past, and therefore assessments continued in 2010 to evaluate the integrity of the east wall.

2010 monitoring of pit wall stability included:

- Crest regression measurements (by DES staff);
- Prism surveys (by Yukon Engineering Services in 2010);
- Visual inspection, including photo documentation of the east wall (by DES staff); and
- Review of the above data by Golder Associates.

The results of monitoring and assessment as completed by Golder Associates are included in Appendix H of this report:

Golder Associates; *"Report on 2010 Faro Pit Slope Stability Monitoring Data Review"*; February 23, 2010.

In the report, it is noted that:

> *"The absence of a significant increase in instability on the backscarps of the North and South instability zones and no evidence of the development of deep seated failure surface indicating that large scale deformation associated with major instability of the east wall does not appear to be occurring."*

Continued monitoring in 2011 is recommended. The locations of monitoring, types of monitoring and frequency of monitoring recommended for the 2010 monitoring program are deemed adequate for monitoring in 2011, with a few minor modifications.

In 2009, a site inspection by a geotechnical engineer took place as part of Faro Pit slope stability monitoring. Based on inspection and 2009 monitoring results, alternate year inspections was deemed to be a sufficient frequency for pit wall site inspection. No site inspection took place in 2010. Site inspection is proposed for 2011.

8.3 Vangorda Creek Drainage (Vangorda Side) Stability

The routine geotechnical monitoring program undertaken in 2010 in the Vangorda Creek drainage section of the Faro Mine Complex, was based on recommendations from SRK Engineering Consultants (SRK), as recommended in their "*2009 Annual Inspection – Waste and Water Management Facilities – Vangorda / Grum, Faro Mine Complex, Yukon*"; February 2010, and was modified based on discussions following site inspection in June of 2010.

Vangorda / Grum side monitoring focuses primarily on the stability of the Little Creek Dam, and Vangorda Waste Rock Dump (including seepage collection system), but also includes:

- The Vangorda Creek Diversion;
- The Sludge Pond Embankment (Vangorda Treatment Plant);
- The Grum Settling Pond;
- The Grum Interceptor Ditch and Sheep Pad Settling Pond; and the
- The Grum Dump and V15 Collection Ditch.

Daily and monthly inspections were carried out by DES staff. Monitoring of thermistors, hydraulic and pneumatic peizometers, and water level elevations was also completed by DES staff.

A site visit for purposes of inspection took place in early June, 2010. Note that water levels were relatively low in 2010, in addition to the pumping which kept Little Creek Dam water levels low. Results of monitoring were interpreted by DES and raw and interpreted data were forwarded to SRK. As with the Faro side, interpretation was added to the DES role as of 2010, to facilitate quick preliminary assessment of data, when potential issues arise and to permit rapid retesting in the event that verification of results is required.

In 2010, an evaluation of thresholds and trigger levels in relation to monitoring findings was completed by SRK to update and clarify earlier protocols. This documentation is included in Appendix H of this report.

The findings of the 2010 annual inspection and of the results of review instrumented monitoring are included in:

SRK; "*2010 Annual Inspection – Waste and Water Management Facilities – Vangorda / Grum, Faro Mine Complex, Yukon*"; February 2011.

This report is submitted as a component of this annual report, under separate cover.

In part, to evaluate water levels within the Vangorda Waste Rock Dump, new pumping wells were installed in the dump in 2010. In the report it was noted that:

> *"...while there appears to be a perched water table in the till dyke, the water table within the waste dump, based on the 2010 drill hole data, appears to be at or slightly below the original ground and does not present an immediate stability problem".*

Specific comments and recommendations are listed on a structure by structure basis. SRK recommended that visual monitoring and reading of instrumentation in 2011 be continued and identified sites and frequencies of monitoring that are similar to 2010, with the addition of monitoring of new wells installed in the Vangorda Waste Rock Dump in 2010. The installation of shallow piezometers at the toe of the Vangorda Waste Rock Dump till dyke is recommended, as is the installation and monitoring of continuous water level loggers in existing piezometers/pumping wells.

8.4 Grum Pit Slope Stability

As part of follow-up to the 2009 Grum Pit slope stability assessments (Golder, 2009), pins were installed in June and July of 2010 to monitor slope stability along the west crest of the pit, in two locations. (The locations are shown on the geotechnical figures.)

Results of monitoring were included as a component of monthly reports, and are included in Appendix H for 2010.

It is anticipated that monitoring of the pins will continue on a monthly frequency through 2011.

8.5 Geotechnical Instrumentation Review

As previously noted, a review of instrumentation used for monitoring dam stability was completed in 2010 by BCL.

In general, the review concluded that existing instrumentation was sufficient, with the exception of improvements to phreatic surface monitoring during spring (when existing instruments may be limited by icy or frozen conditions). BCL recommended to installation of vibrating wire monitors, at existing sites (which were also used for the groundwater quality monitoring program in 2010).

It is anticipated that the recommendations from this assessment and the other assessments completed in 2010 will be reviewed and direction determined to define and clarify the overall 2011 geotechnical monitoring program.

8.6 Mapping of geotechnical Monitoring sites

Following receipt of the Faro Mine Complex digital elevation models (DEMs) and orthorectified satellite photos from YG, DES was able in 2010 to prepare additional site mapping. However, while several geotechnical instrumentation sites were surveyed in 2004, DES recommends that additional sites be surveyed / resurveyed in 2011 to more accurately locate some sites and to assess for shifting over time.

OPERATIONAL AND MAINTENANCE ACTIVITIES

8.7 General

Operation and maintenance tasks performed by on-site personnel in 2010 included:

- Mechanical maintenance and repair of light and heavy duty vehicles and equipment;
- Road and culvert maintenance as required, including culvert defrosting and seasonal snow removal;
- Minor repairs and cleaning of debris and ice from ditches;
- Road grading, ditching and alignment improvements to maintain safe access;
- Repair and maintenance of electrical instrumentation;
- Maintenance of flow monitoring weirs;
- Repairs, maintenance and where required, replacement of power systems;
- Repairs and maintenance of communications systems;
- Maintenance of Yukon Government houses in Faro;
- Updating inventory control;
- Completing a third party Health and Safety review of the site. Suggested improvements have been incorporated throughout the year and the majority of the elements of the Certificate of Recognition (COR) program have been completed. An external audit is planned for early spring 2011. Improvements in particular include documenting hazard assessments for routine and non routine jobs; safe job procedures and safe work practices; and
- Completing various external and internal training programs e.g., Leadership for Excellence, Chainsaw Safety, First Aid, Transport of Dangerous Goods, Workplace Hazardous Materials Information System (WHMIS), Boat Safety, Bear Aware Safety, Joint Health and Safety Committee, Supervisory Training, Hazard Assessment, Lock out/Tag out, Fall Protection, Arc Flash, ATV/Snowmobile competency, Fire Extinguisher, and Activating Standby Power.

8.8 Site Operating Manuals

In 2010 DES continued to utilize the 2008 operating manuals provided by the Interim Receiver. Many operational changes have occurred throughout 2009/2010 and the manuals will be updated in the winter/spring of 2011.

8.9 Permitting

Permits maintained by DES in 2010 included:

- Solid Waste Permit;
- Special Waste Permit;
- Fuel Vendors Permit;
- Radio License;
- Sewage Disposal Permit; and
- Electrical Permit.

Also in 2010, additional permits / certificates acquired at the FMC include:

- Business Firearms License;
- Storage Tank System Permit (Gasoline Tank);
- Periodic Commercial Vehicle Inspection certificate; and
- Business License.

All permits have been issued by the Yukon Government, except the Radio and Business Firearms License which are issued by Industry Canada and the Royal Canadian Mounted Police respectively. The solid waste, special waste permits expire in 2011, the electrical permit is an annual permit and the sewage disposal permit carries over from the installation carried out in 2004.

8.10 Rip Rap Rock

In 2010, rip rap material from the clean rock quarry on the west side of Grum rock dump was used for Intermediate Pond shoreline support for the new mechanical and electrical sea containers.

Approximately 400 m^3 of rip rap remain stockpiled at the south east corner of the Faro Rock Dump as well at the upper portion of the Faro Creek Diversion for emergency purposes.

In early September, additional rip rap material was required at the Intermediate Pond. The water level had been lowered significantly and more stabilizing was required for safe positioning of the crane and float truck to remove the pumps, barge, intermediate pontoon and walkway structures. Contaminated rip rap material was selected from the rock dumps in the area of Zone II for this project.

A small volume of 4 to 12 inch gradation of cobbles as well as select road topping gravel was screened and produced in the Horse Corral Pit. In September some select sand was screened in Rose Pit for winter sand purposes.

8.11 Waste Oil

In accordance with the special waste permit, approximately 27,850 litres of waste oil were consumed for heating the Norcan and Welding Shop throughout 2010. In 2010, DES recovered used oil generated by Pelly Construction equipment on the Grum Sulphide Cover project, however with reduced asset removal activities there is less oil available for heating purposes, resulting in increased use of diesel for heating.

8.12 Fuel Storage

Fuel remains stored on site in above ground storage tanks. The fuel storage capacity on site includes:

- Two diesel storage tanks with a combined capacity of 140,000 L;
- One regular gas storage tank with a capacity of 35,000 L;
- Two waste oil storage tanks, with a combined capacity of 50,000 L.

Selling fuel products to employees continued for the entire year in 2010. DES obtained a fuel vendor's permit on March 1, 2009 from Yukon Finance and has sold employees fuel for the purpose of travel to and from the site. By the end of 2010, a fuel dispensing station was available in Faro, but operational deficiencies were encountered and as of December 31st it was only operating on an intermittent basis.

In 2010 a new double walled 35,000 L gasoline tank was installed on site in accordance with the Environment Act and Storage Tank Regulation. Permit number 09046 from Yukon Community Services was received on October 15, 2010.

8.13 Lime Storage

Lime is stored in the silos at the Faro Mill WTS and at the Grum/Vangorda treatment plant. Due to fall maintenance work at both of these silos, they were completely emptied of product at the end of the treatment season. There is 120 tons of lime stored in sea containers on-site for emergency use and spring start-up. Also, there are twelve (12) super-sacks, each containing one and a half (1.5) tons of lime stored on site. These sacks are kept in storage for potential emergencies that may arise.

8.14 Waste Rock Dump Safety

In 2010, oxygen monitoring was carried at all secured building structures at the toe and on the slope of rock dumps at the Faro Mine Complex. The monitoring devices consist of fixed mounted sensors as well as hand held portable oxygen sensors. All personnel were notified of potential site hazards during a mandatory site safety orientation prior to entering the property. Oxygen sensors were issued as required to personnel and appropriate call in communication protocols were followed.

8.15 Faro Site Miscellaneous Tasks and PAW Projects

Other various maintenance and improvement tasks completed at the Faro Mine Complex are as follows:

- Installation of an improved Intermediate Pond pumping system;
- Safety and efficiency improvements to the Mill water treatment system;
- Site signage improvements;
- Construction of a new Guardhouse well system (in progress);
- Planning flow monitoring instrumentation (in progress by YG);
- Planning back up power transfer switch for the S Well system (in progress);
- Reviewing communication upgrades (in progress by YG);
- Heavy equipment assessment and recommendations (in progress);
- Completed the installation of a new gasoline tank;
- Zone II – YG drilled a new deeper well about 50 feet north of the existing well;
- Set up a new Guardhouse lunch room facility south of the Dry;
- Electrical improvements including transformer servicing, installation of various air brake switches, modifications to the Guardhouse distribution system, and general maintenance items in the mill.
- Applying a soil sement dust suppressant product on selected areas of the intermediate tailings area;
- Construction of a temporary pipeline between the ETA and the Mill.

- Re-alignment of the pipeline grade between the ETA and the Intermediate Pond;
- Realigned Down Valley access roads to separate mine related traffic from public access to the Horse Corral Pit area. Also carried out numerous road and ditch grading improvements;
- Installation of new security gates in tailings management area as well as signage improvements;
- Site operations were shutdown at the end of the day on December 16, 2010 for the Christmas and New Year holiday period. During the shutdown, the mine site was inspected daily. Employees returned to work on January 3rd, 2011.

8.16 Grum/Vangorda Site Miscellaneous Tasks

Various other maintenance tasks completed at the Vangorda Plateau site are as follows:

- Construction of the Grum V15 pumping system (in progress);
- Construction of a new bypass access road through the former Grum Pit transfer pad and along the north side of the pit to the Vangorda/Grum Treatment Plant;
- Performed maintenance work on ditch along south side of Grum Overburden pile to direct water toward the Grum Slot;
- Sandblasted and painted the walkway pontoon and pump barge from Vangorda Pit.
- Improved access roads on the perimeter benches of the Vangorda dump for geotechnical drilling performed by Foundex.
- Grum Sulphide Cover project under the direct control of the YG was carried out between June and November 2010.

8.17 Other Activities – Faro Mine Complex

Removal of woody vegetation along the Rose Creek Diversion Channel was undertaken as part of the 2010 summer work program. This work was performed by workers of the Dena Nezziddi Development Corporation from Ross River and the Liard First Nation Development Corporation in Watson Lake.

9. STUDIES AND PLANS

9.1 Overview

There are a number of audits and plans required through the Care and Maintenance Contract. A brief description of the status of each of the audits and plans that are listed in the Care and Maintenance Contract is provided below:

9.1.1 Security Plan

The Site Security Audit was completed between October 14 to October 21, 2010. The annual update to the Security Plan was completed on December 16, 2010. The updated document was submitted to YG on January 18, 2011.

9.1.2 Health and Safety Plan

A baseline health and safety plan audit was conducted by Zral Safety services in April 2010. Following this audit, a site risk assessment was conducted by RPM Safety Management in July 2010. DES incorporated improvements to the site health and safety program from both the ZRAL and RPM reviews, completed an internal COR audit in January 2011 and submitted an application for external COR audit to Northern Safety Network Yukon on February 17, 2011.

9.1.3 Fire Prevention and Response Plan

The Fire Prevention and Response Plan Audit was completed between October 14 to October 21, 2010. The annual update to the Fire Prevention and Response Plan was completed on December 16, 2010. The updated document was submitted to YG on January 18, 2011.

9.1.4 Spill Response and Contingency Plan

The Spill Response and Contingency Plan Audit was completed between October 14 to October 21, 2010. The annual update to the Spill Response and Contingency Plan was completed on December 16, 2010. The updated document was submitted to YG on January 18, 2011.