



BGC ENGINEERING INC.

AN APPLIED EARTH SCIENCES COMPANY

DENISON ENVIRONMENTAL SERVICES

2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENT REVIEW

VOLUME 1 OF 2

VARIOUS FACILITIES AT FARO MINE, YUKON

FINAL

PROJECT NO.: 0762-002-05
DATE: FEBRUARY 26, 2010

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BGC ENGINEERING INC.

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Project No. 0762-002-05
February 26, 2010

Mr. Roy Morrell
Site Manager
Denison Environmental Services
P.O. Box 280
Faro, YT Y0B 1K0

**RE: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENT REVIEW
VARIOUS MINE WASTE FACILITIES AT FARO MINE, YUKON**

Dear Mr. Morrell:

Please find attached our final report on the Annual Geotechnical Evaluation and Instrument Review of various mine waste facilities at Faro Mine. This report has been issued to the distribution list shown on the front cover.

If there are any questions regarding this report, please contact the undersigned at your convenience.

Yours truly,
BGC Engineering Inc.
per:

Gerry Ferris, M.Sc., P.Eng.
Geotechnical Engineer

encl.: Final Report

GWF/TMW

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LIMITATIONS OF REPORT

BGC Engineering Inc. (BGC) prepared this report for the account of Denison Environmental Services as operators of the Faro Mine Site on behalf of the Faro Mine Closure office. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of report preparation. Any use which a third party makes of this report, or any reliance on decisions to be based on it are the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

As a mutual protection to our client, the public, and ourselves, all reports and drawings are submitted for the confidential information of our client for a specific project. Authorization for any use and/or publication of this report or any data, statements, conclusions or abstracts from or regarding our reports and drawings, through any form of print or electronic media, including without limitation, posting or reproduction of same on any website, is reserved pending BGC's written approval. If this report is issued in an electronic format, an original paper copy is on file at BGC Engineering Inc. and that copy is the primary reference with precedence over any electronic copy of the document, or any extracts from our documents published by others.

1.0 INTRODUCTION

1.1 Scope of Services

BGC Engineering Inc. (BGC) provided a proposal (No. 09-057) for the annual geotechnical evaluation and instrumentation review work at Faro Mine, dated May 25, 2009, to Mr. Roy Morrell of Denison Environmental Services (Denison), operators of the Faro Mine Site on behalf of the Faro Mine Closure office. The scope of work undertaken on this project included the following components:

1. Input, review and interpretation of monitoring data collected by site staff on the Cross Valley Dam, Intermediate Dam, Secondary Tailings Dam, Rose Creek Diversion Canal (RCDC), North Fork Rose Creek Flow Through Causeway, K8 Creek Rock Drain, and Faro Creek Diversion Canal.
2. A late June/early July site visit by Mr. Gerry Ferris to examine site conditions on major structures following spring thaw.
3. Prepare and submit Annual Geotechnical Inspection report for submission in February 2010.

One site inspection visit was performed in 2009; from June 30th through July 3rd. The purpose of the June/July inspection was to examine site conditions of the major structures following the spring freshet. The structures listed above were assessed.

1.2 General Background Relating to Inspection and Instrumentation

Golder Geotechnical Consultants provided design recommendations for the Down Valley Tailings Disposal Project (Golder 1980). Following the subsequent construction of the facilities (Golder 1982), an extensive geotechnical monitoring program was initiated and is continuing to-date. Golder Associates was responsible for the annual inspection and instrumentation review of the Down Valley Tailings project between 1981 and 1999. Beginning in 2000, BGC has conducted the annual geotechnical inspection and instrumentation review duties.

The report provided herein presents an assessment of the monitoring data collected in 2009. Monitoring data from piezometers, slope inclinometers, thermistors and seepage weirs is collected by site staff. The data is forwarded to BGC for review and inclusion in this report. In addition to reviewing the instrumentation data, visual inspections of the various facilities were undertaken by BGC personnel. This report compiles and reviews the instrumentation and inspection components in order to assess the physical performance of the noted structures.

As required by DES's care and maintenance contract with the Yukon Government, Energy, Mines, and Resources, an annual inspection and review of instruments was completed in 2009. This review follows the format of monitoring that has been completed at the Faro Mine Site since 1982.

The following components of Faro Mine are included within the present report, and are shown in Figures 1, 2 and 3:

- **The Rose Creek Diversion Canal** – The Canal Dike was built as part of the former Down Valley Tailings Project in 1980-81, it was constructed as an expansion of the existing canal which diverted water around the Secondary Impoundment. The Canal Dike separates the diversion canal from the Polishing Pond, the Intermediate Dam pond and tailings deposit. Structures associated with the Rose Creek Diversion Canal include the Canal Dike, the Spoil Piles and the Back Slope.
- **The Intermediate Dam** – The Intermediate Dam was designed to retain tailings solids, supernatant water and run-off water. It was built as part of the Down Valley Tailings Project in 1980-81, and underwent crest raisings in 1988, 1989 and 1991.
- **The Cross Valley Dam** – The Cross Valley Dam was designed to have capacity for 60-day retention of seepage/discharge water from the Intermediate Dam. It was originally used as a polishing pond and later for water treatment residue retention. Built as part of the former Down Valley Tailings Project, it was constructed in 1980-81.
- **North-Fork Rose Creek Flow-Through Causeway (“North Fork Rock Drain”)** - The causeway was built of waste rock in 1987. The causeway was advanced by dumping waste rock from the causeway grade to provide a zone of preferentially larger particles in the lower portion of the fill. This zone conveys creek flows through the structure; the driving head being provided by a small pond of water on the upstream side of the causeway.
- **Faro Creek Diversion Canal and East Wall of Faro Pit** – Faro Creek was diverted around the top of the Faro Pit through the construction of a diversion channel, in 1967/68. The stability of the east wall of the Faro pit has been a concern throughout the lifetime of the pit operation. A number of structural discontinuities within the east pit wall, coupled with seepage from the Faro Creek diversion canal along the top of this pit wall, contribute to the slope instability that has occurred along this pit wall.
- **Faro Waste Rock Dumps** – The Waste Rock dumps were built throughout the operating life of the Faro Pit. These dumps were generally constructed by end dumping and spreading from the final bench elevation of the dump. Portions of the Faro Waste Rock Dumps are adjacent to the North Fork of Rose Creek. Generally, the physical stability of waste dumps are of concern during construction and the first few years following construction. However, given their location adjacent to a creek, these portions of the waste dumps are reviewed on a two-year cycle.
- **Secondary Tailings Impoundment** – Built in 1974 to accommodate expanding tailings storage requirements. The stability of the eastern portion (east of the Diversion Dam) of the secondary tailings component is a concern since it is retaining tailings from the upper section of the Rose Creek Diversion Canal.
- **K8 Creek Rock Drain** – This causeway was built overtop of the K8 Creek in 1987 using mine waste rock. The causeway was advanced by dumping waste rock from the causeway grade to provide a zone of preferentially larger particles in the lower portion of

the fill. This zone conveys creek flows through the structure; the driving head being provided by a small pond of water on the upstream side of the causeway.

1.3 Additional Relevant Studies

In addition to instrumentation monitoring and visual inspections, DES and the Yukon Government have completed a number of assessment studies relevant to structures and facilities at Faro Mine that are discussed in this annual report. These additional studies are documented in the following reports:

1. BGC (2008a) wrote an ERP for potential failure of the dams at the Faro Mine.
2. BGC (2008b), with input from SRK, prepared an OMS for the dams at the Faro Mine site (including Little Creek Dam near the Vangorda/Grum mining area).
3. Klohn Crippen Berger (2008) performed a dam safety review for the Intermediate and Cross Valley Dams and channels at the Faro Mine site. This report presented information on dam classification and methods to improve the dam safety program at Faro Mine.
4. Golder (2009) reported on the performance of the stability of the soil slope between the Faro Pit and the Faro Creek Diversion Canal. Report attached.
5. BGC (2009) wrote a report that updated recommendations on a rapid drawdown for the intermediate and cross valley ponds. Report attached.

These reports, particularly the 2008 OMS, and ERP, should be reviewed in conjunction with the assessment provided herein. Each report provides conclusions and recommendations that are relevant to structures and facilities at Faro Mine and the Down Valley Tailings Project.

2.0 2009 MONITORING PROGRAM

2.1 Introduction

Historically, the monitoring program has been comprised of a specific schedule for reading the instrumentation, which depended on the type of instrument, its location and the performance trend indicated by the accumulated data. In those areas where good performance of the structures was demonstrated over time, the frequency of readings was reduced for reasons of economy or irrelevance of additional data, or because the installations became non-functional. Conversely, there have been some instances where instrumentation and visual observation justified more frequent readings and installation of additional instrumentation. The recommended instrumentation monitoring schedule for 2009 was provided as Figure 38 of the 2008 Annual Geotechnical Inspection report (BGC 2009a).

Instruments in the Rose Creek Diversion Canal (canal dike and spoil piles), Intermediate Dam, Cross Valley Dam, and Secondary Tailings Impoundment Dam were scheduled for monitoring in May or June and September. The proposed schedule was followed with minor changes. All of the instruments within the Down Valley tailings area monitored as part of this evaluation are shown in Figures 2 and 3.

As a complement to the instrumentation data obtained, various components of the Faro Mine were visually inspected by BGC personnel during the periods between June 30th and July 3rd, 2009. Details of the visual inspection are discussed in Section 4.0.

2.2 Elevations within the Down Valley Project Area

Elevations within the Down Valley project were originally documented with respect to the Down Valley Project Datum (DVPD). The DVPD is 32.3 m above the mean sea level datum (m amsl), thus to convert elevation from dvpd to amsl 32.3 m needs to be subtracted from the original elevation. The Interim Receiver completed a program to present information concerning the facilities in terms of metres above mean sea level (or a geodetic datum) rather than in DVPD or mine datum. This is noted since original drawings of the facilities are proved in DVD.

All elevations documented in this report concerning structures and instrumentation are reported with respect to geodetic datum. An elevation survey of all instruments at the Cross Valley and Intermediate Dams was performed in 2004, allowing the data to be presented in terms of the geodetic datum. Surveys of crest and instrument collar elevations for the Diversion Canal (Canal Dike, Back Slope, and Spoil Piles) and the Secondary Tailings Dam were performed in 2005. These surveys have allowed all the instrumentation data collected at the Faro Mine to be presented in terms of the geodetic datum.

2.3 2009 Water Management

Water pumped from the Faro Pit passes through the mill water treatment plant and then flows to a dissipation chamber located at the toe of the Intermediate Dam, discharging to the Cross Valley Pond (“the Polishing Pond”). Water is pumped from the Intermediate Dam pond to the mill water treatment plant, following treatment this water is discharged with the Faro Pit water at the toe of the Intermediate Dam. Occasionally decant siphons are used to convey water from the Intermediate Pond over the Intermediate Dam into the Cross Valley Pond, the water is treated prior to discharge into the Cross Valley Pond. Water from the Cross Valley Pond is then discharged to the environment over the Cross Valley Dam by siphon pipes.

The Intermediate and Cross Valley Pond water levels are measured with respect to a geodetic datum using survey from a local benchmark. Figures 4 and 5 provide a summary of the Cross Valley Pond and Intermediate Pond water levels throughout the year. Table 1 contains the 2009 water level data from the Intermediate and Cross Valley Ponds in tabular format. The water level information is used to aid in the interpretation of the instrumentation response in the following sections.

In 2009, similar to the past few years, the pond levels in both the Intermediate Pond and Cross Valley Pond were kept low since the water quality was suitable for discharge. The Cross Valley Pond fluctuated from a high of 1029.837 m on March 24th down to a low of 1026.96 m on November 2nd. The Intermediate Pond level ranged from a high of approximately 1047.33 m on May 7th to a low of 1045.74 m on November 2nd.

2.4 Precipitation Information

Yearly climatic conditions can significantly affect the performance of water retaining and water conveying earth structures. Table 2 provides a summary, on a month-by-month basis, of the total precipitation at the Faro Airport from 1978 to 2009. At the bottom of the table, the minimum, mean and maximum monthly precipitation values are also provided. Precipitation data from the Faro Airport was only available for eight months of the year. The average annual precipitation at the Faro Airport is 307 mm.

2.5 Air Temperature Information

Yearly climatic conditions can significantly affect the performance of water retaining and water conveying earth structures. Table 3 provides a summary, on a month-by-month basis, of the air temperature at the Faro Airport from 1977 to 2009. At the bottom of the table, the minimum, mean and maximum values are provided. In 2009, the average monthly temperature was slightly lower than the average. The average monthly temperature in 2009 was -2.3°C or 0.1°C warmer than the mean annual value -2.2°C. Overall, 2009 was close to average temperatures for each month, except July, which set a new record high.

2.6 Measured Flow in Rose Creek Diversion Canal

The amount of flow within the Rose Creek Diversion Canal (RCDC) affects the performance of the diversion structure and the expected results in the instruments used to monitor the performance of the Canal Dike. Figure 6 provides a summary of the measured daily flows near the inlet of the Rose Creek Diversion Canal. The flows are determined based on a daily reading (normally early morning) of a staff gauge located about 50 m downstream of the inlet to the Canal. The staff gauge readings are converted to flow based on a rating curve. The peak flow measured in 2009 was 13 m³/sec. Also included in Figure 6 is a summary plot of the peak daily flows measured at this location in the last couple of years (since monitoring began), plus a data point from 1975 (Sigma 1975). The 2009 peak flow value is higher than the average peak flow of 22 m³/sec. The 2009 high reading was taken during late May and likely corresponds with peak freshet flows.

3.0 INSPECTION CONDITIONS AND APPROACH

Mr. Gerry Ferris, P.Eng., from BGC undertook the one site inspection of the Faro mine structures. Mr. Ferris was on site in the late June early July period to perform the annual inspection.

Each of the selected structures was inspected in a walking tour. Pertinent observations concerning both condition and seepage (or lack thereof) were recorded by camera and field notes.

In general, during the June/July inspections, the site appeared in good condition with no major concerns noted, only minor maintenance and monitoring was recommended. The findings were reviewed verbally with Mr. Roy Morrell and Mr. Jon Bronson, before BGC personnel left site. A summary memo pertaining to the conditions and maintenance items was prepared for Denison; a copy is attached in Appendix I.

4.0 FINDINGS AND CONCLUSIONS

The results of the inspections of each of the structures are presented on the following pages in standardized format, complemented by a selection of site photographs. Please refer to Figure 1 for the general location of each structure and to Figures 2 and 3 for the locations of individual instruments within the Down Valley Project Area. Specific maintenance requirements are documented on the individual structure summary sheets and in the summary memos provided in Appendix I. Following the summer inspection, Denison staff completed a number of the recommended construction activities. These are noted in the summary sheets. Instrumentation data reviewed on the summary sheets are attached in Appendix II.

In general, the structures appeared in good condition and the instruments appeared in good working order.

There are a total of 87 active subsurface instruments at the Faro Mine site, which includes 64 piezometers, 12 thermistors, and 11 slope inclinometers. In addition to these subsurface instruments, staff gauges and data loggers are used to monitor the flow in various canal reaches. In total 7 staff gauges and 2 data loggers are in current use. Site staff also perform water elevation surveys of the different pond elevations at the Intermediate and Cross Valley Ponds as well as at the North Fork Rock Drain.

Visual monitoring and reading of instrumentation (as recommended) should be continued and the instrumentation data immediately conveyed to BGC for review. Should any atypical or deteriorating conditions be observed or recorded, BGC should be contacted immediately for comment. Protocols for anomalous readings were reviewed in the OMS Manual and in the ERP (BGC 2008a, b). A summary of the two such atypical conditions that were encountered in 2009 and the response by Denison are contained in Appendix III (related to RCDC staining), and Appendix IV (turbidity encountered at Station X-13).

ROSE CREEK DIVERSION CANAL (RCDC) – CANAL DIKE

LOCATION:	Borders the southern edge of the tailings impoundments (see Figures 2 and 3). The Canal Dike is considered to start at the 1981 Diversion Dam.
FUNCTION:	The Canal Dike separates the diversion canal from the Polishing Pond, the Intermediate Dam pond and tailings deposit. Figures 7 through 9 provide photographs of the RCDC Canal Dike and Backslope.
LENGTH:	3,800 m +/-
MAX HEIGHT:	4 m +/- above downstream toe/native ground.
CREST ELEVATION:	1063.1 m at the start of the dike, grading downwards at 0.3% to the start of the upper weirs, where the crest elevation is 1052.4 m. The dike then grades at 4.6% through the weir sections to an elevation of 1024.9 m. After the weir section, the dike grades at 2.2% to a final elevation of 1014.8 m.
CREST WIDTH AND CONDITION:	5 m +/- wide; No signs of cracking or settlement were noted on the Canal Dike crest.
FLOW	Figure 6 presents the flow quantity (measured at a staff gauge once per day) in the Rose Creek Diversion during 2009. The measured maximum daily flow in 2009 occurred in late May and was 13 m ³ /sec, as compared to the average peak of 22 m ³ /s. The flow in the canal was generally at a lower than typical level for the entire year.
RIPRAP:	The rip rap is in satisfactory condition.
WEIRS:	Central boulders have been displaced downstream slightly, Figure 9. Overall, the weir sections appeared in satisfactory condition.
INSTRUMENTATION:	Readings of the Canal Dike instruments for 2009 were obtained in June and September. Tabulated data and plotted records are presented in Appendix II and summarised in Tables 4, 5 and 6.
PIEZOMETERS:	The observed piezometric pressures generally reflect the anticipated conditions. Figure 10 provides a longitudinal section of the piezometric conditions observed within the canal dike observed during 2009. Additional observations with regards to the 2009 Canal Dike piezometric monitoring data include the following:

ROSE CREEK DIVERSION CANAL (RCDC) – CANAL DIKE CONTINUED

- Data collected from piezometers CD-21, CD-26 and BGC05-06 indicates a downward hydraulic gradient, and low pore pressures at depth indicate that the subsurface is essentially free draining. These pressures are lower than the adjacent water levels in the Intermediate Pond.
- Data collected from CD-13 and CD-15 indicates that a weak upward hydraulic gradient exists at these locations. The upward hydraulic gradient at CD-15 has been consistent since 2002.

During 2009, the water level in the tailings pond retained by the Intermediate Dam was about 0.5 m below full supply in the first part of the year, and then was lowered from the beginning of May till the end of June and was maintained at about 1.5 m below the spillway for the remainder of the year. The average pond level for 2009 was 1046.4 m.

The Canal Dike crest elevation opposite the south abutment of the Intermediate Dam is approximately 1052.9 m. The invert of the 0.6 m deep pilot channel (of the diversion canal) is at approximately 1048.9 m. Fall flows typically just inundate the bench adjacent to the pilot channel, suggesting a diversion canal water surface elevation of about 1049.6 to 1049.7 m, i.e., an elevation approximately two and a half metres above the level of the tailings pond at the Intermediate Dam. The gradient of the Diversion Canal is 0.19%. The tails beach limit, when the pond is at its full supply level, is about 1100 m upstream of the Intermediate Dam. In addition, higher spring and summer flows in the canal will produce a higher driving head for potential seepage.

Based on the above, the difference in elevation between the surface of the water in the Diversion Canal and the base level (water or tailings) upstream of the Intermediate Dam ranges from about 2 m at the Intermediate Dam to approximately 4 m at the beach limit. Upstream of the beach limit, the difference in elevation is about 4 m.

Under these conditions, and a uniform head loss between the Diversion Canal and the tailings pond, piezometric levels recorded by piezometers installed in the Canal Dike should range from about 1049.2 m just upstream of the Intermediate Dam (Sta 2+500), to about 1051.2 m at the limit of the tailings beach (Sta 1+400). The geometry and piezometric assumptions reviewed here are graphically displayed on Figure 11. In general, the piezometer readings are

ROSE CREEK DIVERSION CANAL (RCDC) – CANAL DIKE CONTINUED

within the expected range, however as can be seen on Figure 10, a few exceptions occur, particularly for deep piezometers located near the Intermediate Dam. Those piezometers do not appear to be part of the same groundwater regime, but more influenced by hillside drainage to the Polishing Pond. With the exception of the piezometers installed in 2005, which are at the historical maximum, the piezometers were within the historical range.

THERMISTORS:

The data continues to indicate a slight warming trend at depth at thermistor locations CD-10, CD-21, CD-26, and BGC01-02. Thermistors located at BGC05-04 and BGC05-07 were recently installed and will need further readings to determine any trends. In general, readings from the thermistors in 2009 were slightly warmer than the range measured in previous years.

- At thermistor location CD-15, the cooling trend at 10 m depth measured since 1999 continued. No permafrost can be detected within the 9 m depth that the instrument measures.
- A thermistor string was installed in Borehole BGC05-04 to verify the geothermal conditions indicated by installation CD-19. The data collected in 2008 indicates that permafrost no longer exists within 11.9 m of the ground surface.

SLOPE

INCLINOMETERS:

The slope inclinometer indicated only minor movements in 2009. The majority of the movement, when encountered, was surficial and appeared to be creep. Many instruments showed past evidence of settlement.

In 2007 it appeared that minor shear movements were occurring between depths of 4 and 5 m at CD-10. Following the 2008 and 2009 readings, it appears that this may have been an error in the data or the reading in 2007 as the more recent readings do not show this movement.

In addition to these general comments, the plots for slope inclinometer at BGC01-01 show significant variation to other installations. It was determined that this instrument was not providing useful information anymore and as such it was not read in 2009.

ROSE CREEK DIVERSION CANAL (RCDC) – CANAL DIKE CONTINUED

VISUAL

OBSERVATIONS: In December 2009 reddish staining was encountered in the RCDC just downstream of environmental monitoring station X-3 and upstream of RCDC 4 (a staff gauge). Higher iron levels were measured downstream from the stain location, although most other parameters did not show a similar increase. It was concluded that this stain was due to a leak from the tailings area and that further environmental water quality monitoring in the area immediately downstream from the observed stain should be undertaken. Details of the staining are contained in the two memorandums prepared by Denison which are included in Appendix III.

MAINTENANCE

RECOMMENDATIONS: As part of the on-going maintenance, the crest of the Canal Dike should be graded each September or October after the annual inspection to cover areas where cracks and potholes have developed. The purpose of this treatment is to prevent ingress of surface run-off water that may be concentrated in the settled areas, potentially reducing stability. Blading should be used to accomplish this work. Care must be taken not to disturb the existing instrumentation that has been installed to monitor performance of the dike.

During the 2009 inspections it was noted that there was excessive tree growth in the RCDC. This growth within the canal will begin to affect the integrity of the clay liner that retains water in the canal. This growth should be removed in 2010. For this removal it is preferable that the removal of the growth should include removal of the roots, rather than just removing the surface growth. If the root growth is deep and affects the clay liner repairs should be undertaken on the clay liner. It is understood that DES undertook a trial removal in 2009 and found that the roots are shallow and damage to the clay liner unlikely. This aspect should be carefully monitored during any construction activity.

The upper nodes of the thermistor at BGC01-02 have malfunctioned, and this instrument should be replaced in 2010.

It is recommended that a series of staff gauges be installed within the Rose Creek Diversion Canal to help quantify locations of seepage loss, especially related to the seepage through the spoil pile. This should be done prior to completion of the tree removal, so that any effects of the tree removal on the seepage quantities can be quantified.

ROSE CREEK DIVERSION CANAL (RCDC) – CANAL DIKE CONTINUED

CONCLUSIONS:

The majority of the permafrost that was originally in the Canal Dike has degraded beyond the depth of instrumentation. Given the above summary of monitoring results, it is recommended that selected instruments be monitored in 2010. The select instruments are located in the area of the 2004 dike crest raise and the piezometers throughout the dike crest. Monitoring of all working instruments should be moved to a two year cycle outside of this 1 km zone.

The staining of the water in the RCDC between X-3 and RCDC 4 does not appear to jeopardize the physical stability of the secondary tailings dam or the RCDC. A review of the water elevation in the secondary tailings and the general ground water elevations in the area should be part of the review.

RCDC – SPOIL PILES

- LOCATION:** Downslope of the diversion canal dike, on the southern edge of the tailings impoundments (see Figures 2 and 3).
- FUNCTION:** The construction waste of the diversion canal dike formed the spoil piles. Figure 12 provides photographs of the toe area of the Spoil Pile adjacent to the Cross Valley Pond.
- LENGTH:** Discontinuous over the approximate 3,800 m length of the Canal Dike.
- MAX HEIGHT:** Variable heights, ranging from approximately 1 m to 8 m above downstream toe/native ground.
- SEEPAGE:** Increased seepage quantity and sloughing occurring at the toe of one portion of the spoil piles, located between the Cross Valley and Intermediate Dams. Seepage and related sloughing is caused by very low polishing pond level. This sloughing has been noted since 2005 and appears to be worsening over time. Significant sloughing is occurring and appears to be extending further up the slope, with several head scarps present. The deteriorating conditions should be visually monitored and a study should be carried out to determine the best method to repair the area. In the east zone 12 seepage discharge locations were noted at an estimated rate of 8-9 L/min. There were 13 noted seepage discharge location in the west zone at an estimated rate of 5-6 L/min.
- INSTRUMENTATION:** Readings for the spoil pile instruments for 2009 were obtained in June and September. Tabulated data and plotted records are presented in Appendix II and summarised in Tables 7 and 8.
- THERMISTORS:** Thermistors SP-2, SP-3, and SP-5 indicate that there is no longer any permafrost above a depth of 10 m at this location. A slight warming trend is apparent in the data.
- SLOPE INDICATORS:** Inclinator SP-2 showed some significant downslope creep movement in 2009. The spoil pile has settled in the vicinity of Station 1+530, based on the distinctive shape of the deflection versus depth curves for data obtained from SP-2. This area should be continually monitored and inspected by a geotechnical engineer in 2010.

RCDC – SPOIL PILES CONTINUED

MAINTENANCE

RECOMMENDATIONS: Increased seepage quantity and sloughing occurring at the toe of the spoil piles, located between the Cross Valley and Intermediate Dams, likely caused by low polishing pond levels. Visually monitor sloughing and retrogression for the short term and a study should be undertaken in 2010 to determine the best method to repair the affected area. The area shows signs of active failure and remediation work should be done to ensure long term acceptable performance.

It is recommended that two piezometers be installed through the spoil pile to record the piezometric conditions within this known seepage area. One slope indicator casing should be installed on the lower road to monitor for soil movements. Information from flow quantities in the RCDC will be helpful in characterizing this seepage area.

Visually monitor the area of the spoil pile where slope indicator SP-2 is located. Attempt to determine if movement is occurring or if the 2009 readings are inaccurate.

CONCLUSIONS:

Continued monitoring is required along the toe of the Spoil Piles between the two dams. Based on visual assessments it appears that the seepage in this area is increasing. The seepage loss from the canal can be approximated from the proposed staff gauges recommended for the Rose Creek Diversion. In addition, two piezometers are recommended to be installed in the spoil pile above the seepage area to monitor the pressures in the slope. A slope indicator casing should be installed to monitor for soil movement extending further up the slope. Plans for remedial construction in this area should be developed.

The spoil pile is experiencing some on-going creep movements near SP-2, which are located downslope from areas of the canal dike that have moved in the past. There is no measured permafrost remaining in the foundations of the spoil piles. Monitoring of the spoil pile thermistors currently is on a two year cycle; this schedule should be continued. Monitoring of the slope indicators should be completed on a yearly basis. The newly recommended piezometers should be monitored on a twice yearly basis.

RCDC – BACKSLOPE

- LOCATION:** Upslope of the Canal Dike, on the southern edge of the tailings impoundments (see Figures 2 and 3).
- FUNCTION:** Forms part of the canal excavation above the elevation at which water will flow. The Canal Backslope was constructed when the Canal was excavated. Figures 7 to 8 provide photographs of the Canal Backslope.
- LENGTH:** 3,800 m +/-, the entire length of the Canal Dike
- INSTRUMENTATION:** Readings of the Canal Dike Backslope instruments for 2009 were obtained in both July and September. Tabulated data and plotted records are presented in Appendix III and summarised in Tables 9, 10 and 11.
- PIEZOMETERS:** Two piezometers located in the Backslope, BS-5 and BS-9, were read. Pore pressures measured at both locations are generally in the historical range, decreasing slightly from the 2008 readings.
- THERMISTORS:** Steady temperatures were noted in both instruments in BS-12 and BS-10. No frozen conditions were measured at BS-12, while the depth to permafrost at BS-10 was steady at approximately 8 m, although it was noted to be approximately 6.5 m in depth 5 years ago. BS-5 yielded poor readings with only one responding node. The one functioning node indicated freezing temperatures at a depth of approximately 7.5 m.
- SLOPE INDICATORS:** No significant movement was measured in the 2009 period, although some minor creep movement was measured in the upper 1.5 m at BS-9.
- OBSERVATIONS:** Approx. 2H:1V slope and in good condition with no signs of settlement. A minor slump of the back slope was noted in 2008. This slump is located approximately at the Intermediate Dam. This small headscarp should be visually monitored to ensure that it does not become more significant. This slough is likely a result of surficial saturation of the backslope materials. It should be noted that the Backslope area was not inspected by foot in 2009, it was originally scheduled for the September inspection trip, which was not carried out. This should be scheduled for 2010.

RCDC – BACKSLOPE CONTINUED

MAINTENANCE

RECOMMENDATIONS: Monitor sloughing on backslope and assess for deteriorating conditions.

CONCLUSIONS: The Canal Backslope is performing satisfactorily with some minor occurrences of local sloughing within the granular material and erosion.

The Canal Backslope is supposed to be monitored every two years, and the instruments were read twice in 2009. Consequently, readings should be taken again in June and September of 2011, and the historical two year reading cycle should be continued to odd number years (i.e.2011, 2013, 2015etc). The Backslope area should also be inspected on foot in 2010, as a foot inspection was not carried out in 2009 due to no September inspection taking place. This 2 year inspection cycle should now be offset to even number years (i.e.2010, 2012, 2014etc).

NORTH VALLEY WALL INTERCEPTOR DITCH (NVWID)

- LOCATION:** North side of the valley containing the tailings impoundments, along the north side of Rose Creek Valley (see Figure 1).
- FUNCTION:** The NVWID diverts the water from the Upper Guardhouse Creek around the tailings and polishing ponds. The NVWID was constructed in 1980/81 as part of the Down Valley Tailings Project. The design flood for the ditch was the 50 year return period flood with one half (0.5) meter freeboard above the design flood level (Golder, 1980). Figure 13 provides photographs of the NVWID.
- LENGTH:** 3,000 m +/-
- GRADIENT:** 1.25 to 2.5% in the Mine Leg; 1.5% in the Borrow Area "F" Segment; and 4.5 to 5% at the north abutment of the Cross Valley Dam (the "Outfall Section").
- INSTRUMENTATION:** None.
- OBSERVATIONS:** The culvert located in the outfall section continues to experience icing problems. The timing of when the icing occurs varies with the stream flow and temperature. Blockage of a culvert in this area has been an on-going issue throughout mine life.
- A new access road was constructed across the diversion, in the guard house section of the diversion. The access road was created to provide a route to the newly installed water well, and consisted of placing two culverts in the canal. It is not known if the two culverts have the appropriate capacity to pass the design flow.
- MAINTENANCE**
- RECOMMENDATIONS:** Continue "steaming" of the culvert within the Outfall section to ensure passage of water throughout the winter. Depending on the performance of the culvert during the winter of 2010, additional work may be warranted.
- Install a staff gauge in the lower outfall section of the NVWID and establish a rating curve for this location, so that flow quantities can be measured.
- CONCLUSIONS:** Selected sections were inspected, including the Outfall Section at the access road, and no concerns were noted. Overall, the NVWID appears to be performing acceptably.
- In an attempt to reduce culvert icing, a wooden cover can be placed over the inlet and outlet ends of the culvert. This method has only met with limited success in the past

INTERMEDIATE DAM

- LOCATION:** Located at the west end of the Intermediate Pond, immediately east of the Polishing Pond (see Figure 2).
- FUNCTION:** Retain tailings solids, supernatant water and run-off water. Figures 14 to 17 provide photographs of the Intermediate Dam.
- LENGTH:** 650 m.
- MAX HEIGHT:** 32 m.
- CREST ELEVATION:** 1049.2 m; spillway elevation: 1047.7 m.
- CREST WIDTH AND CONDITION:** Crest width 6–7 m. The crest was repaired in 2003. The repairs consisted of the recommended crack filling and regrading which entailed the placement of about 250 mm of granular material on the crest. Cracking has not been evident in 2008 as it had been in previous years.
- Small shrubs and trees were removed from the crest in 2007. A small amount of re-growth has started to occur, but it is not currently of concern.
- SPILLWAY:** At the time of the inspections, the pond level in the Intermediate Reservoir was lower than the spillway inlet. The capacity of the spillway was calculated in 2006 (NHC 2006) based on survey information collected in 2004 and 2005. The calculated capacity of the spillway was 32 m³/sec (reservoir water level at top of dam core). The lower drop weir section of the spillway was re-graded in 2007; it is suggested that some repairs be undertaken in this area. It was observed that the riprap surface is not 'level' and under flow it appears that water would concentrate on the left side of the spillway. The surface of the riprap should be levelled to ensure that flow concentration would not occur if the emergency spillway is needed.
- RIPRAP:** The water elevation in the Intermediate Pond continues to be maintained below the elevation originally intended; this is done for water treatment purposes. Deformation and sloughing of the riprap was noted in 2006 and repairs were recommended. Repairs to the rip rap were undertaken in 2007. The repaired area appears to be performing satisfactorily. On the polishing pond side of the lower road there is evidence of wave erosion occurring where the rip rap has been disturbed. This area should be monitored by site staff during the regular visual inspections.. From a physical stability standpoint, the water level in the pond should be maintained such that the water level is within the zone protected by rip rap. If the pond is maintained lower than the area now protected by rip rap (for water treatment purposes),

INTERMEDIATE DAM CONTINUED

additional future maintenance or extension of the riprap will be required.

DOWNSTREAM SLOPE: 2:1 slope angle, 2.1:1 overall, including 20 m berm. The downstream slope of the dam was rehabilitated in 2003. The downstream face experienced fairly significant rilling erosion and some slumping. This type of behaviour has occurred on the face of the dam a number of times over the last four or five years, ever since some sand and gravel was applied to the face of the dam. The rill erosion and slumping is occurring within this surfacing material. In previous years this material has been used to re-surface the downstream face. This should not be undertaken. The rilling and minor surface slumping does not need to be repaired, if desired the erosion rills can be filled with a coarse angular gravel, but this is not strictly needed. The downstream face appears in 'rough' shape and more and more of the surface fill that is not part of the shell will be removed each year, this should not be cause for immediate concern, but the size and severity of the rills should be monitored and any changes noted. The development of any concentrated runoff within these rills should signal the need to conduct repairs. The crest of the dam should be graded slightly to direct runoff towards the upstream slope of the dam, which is protected by riprap.

The granular material collected on the road surface (eroded down the face of the dam in previous years) should be removed in order to expose the gravel drain.

SEEPAGE: Only minor signs of seepage are noted on the lower road level, most of this is evident in spring and is considered to be related to snowmelt that has infiltrated the downstream shell materials.

INSTRUMENTATION: Readings of the ID instruments for 2008 were obtained in June and September. Tabulated data and plotted records are presented in Appendix III and summarised in Table 12. The positions of these instruments are shown in the section in Figures 2 and 18.

PIEZOMETERS: The deep piezometer located in 91-ID3 indicated an increase in pore pressures in 2008, which went against the overall declining trend for the instrument. The 2009 readings return to the decreasing trend in pore pressures. This small increase in 2008 could be related to the higher canal elevations that were experienced. It is inferred that the piezometer data reflects abutment conditions dominated by drainage

INTERMEDIATE DAM CONTINUED

from upslope, not the level of the tailings pond upstream of the dam. That inference is supported by the sudden increase in piezometric level of 2 m recorded by both tips in June 1992, which would be coincident with the spring freshet in the adjacent diversion channel. Therefore, the previous decline in piezometric pressure recorded by 91-ID3 may be related to better drainage associated with ongoing loss of permafrost in the abutment downstream of the dam.

Additional general observations about the 2009 Intermediate Dam piezometric monitoring data include the following:

- Similar conditions to historical readings were observed in 96-2.
- Normal readings were observed in 96-ID3, 96-ID4, 96-ID6, 96-ID7, 96-1, 96-3, 96-4, 94-IDC-1, P01-03, and P01-04.
- The data from the pneumatic piezometer 91-ID4, 91-ID6 and P01-04 indicates the presence of a downward hydraulic gradient.
- Hydrostatic conditions exist within the nested standpipe piezometers located at P96-3, and P96-4.
- The piezometric information from P01-04 indicates pore pressures within the foundation of the dam and not the pore pressures within the dam itself.
- Piezometer BKS04-06 and 94-IDC-1 are dry.

MAINTENANCE

RECOMMENDATIONS: The following maintenance / monitoring requirements are recommended:

- Monitor the wave erosion occurring on the polishing pond side of the lower road.
- Monitor the erosion gullies that have formed on the downstream slope.
- Remove granular material that has collected on the road surface in order to expose the gravel drain.

CONCLUSIONS:

Overall, the Intermediate Dam appears to be performing in an acceptable manner. The piezometers and monitoring wells along the toe of the dam indicate a piezometric surface ranging between 2.2 and 4.3 m below ground surface (bgs). The piezometers and monitoring wells installed at the crest of the dam indicate a piezometric surface ranging from approximately 19 to 21 m bgs. The piezometer in the south abutment of the dam indicates drained conditions in the upper 7 m. The deep tip (15.2 m bgs) in the south abutment indicates pore pressures at depth are continuing a declining

INTERMEDIATE DAM CONTINUED

trend. It is recommended that monitoring of all functional piezometers and monitoring wells in the Intermediate Dam continue in 2010.

CROSS VALLEY DAM

- LOCATION:** Immediately west of the Polishing Pond, at the downstream (western) limit of the Rose Creek Tailings Area (see Figure 2).
- FUNCTION:** Designed to have capacity for 60-day retention of seepage/discharge water from the Intermediate Dam. Used as a polishing pond and later for treatment residue retention. Figures 19 through 21 provide photographs of the Cross Valley Dam (CVD).
- LENGTH:** 500 m.
- MAX HEIGHT:** 17 m.
- CREST ELEVATION:** 1033.1 m
- CREST WIDTH AND CONDITION:** 6–7 m. Tension cracks and a faint backscarp are evident on the upstream crest of the dam, in the soil material directly above the rip rap. These tension cracks are apparent on the crest of the dam near the old access road and are extending throughout the upstream surface of the dam. This is thought to be in response to damage to the rip rap. This area should be watched carefully, and if conditions worsen repairs may be needed. In 2007 when the vegetation was removed from the crest of the dam, a loss of crest width was evident in one location. This was noted in the 2009 BGC inspection and repaired later in July, see photo in Figure 20.
- The small trees and shrubs that were beginning to grow on the crest of the dam were removed during 2007. A small amount of re-growth has occurred, but is not presently of concern.
- SPILLWAY:** Elevation: 1031.7 m. During the site inspections, the upstream pond was lower than the inlet elevation of the spillway. During the inspections, no water was being transferred from the polishing pond. The inlet to both the spillway and pilot channel were in satisfactory condition, based on the visual inspection. The capacity of the spillway was calculated in 2006 (NHC 2006) based on survey information collected in 2004 and 2005. The calculated capacity of the spillway was 300 m³/s (reservoir water at the top of the dam core).
- RIPRAP:** During the spring of 2009, in order to create storage space for the expected spring inflow, the pond elevation was lowered when the ice was on the polishing pond. During this drawdown ice plucking of the rip rap occurred. This has lead to the movement of rip rap down the face of the dam, exposing in some cases the underlying sand and

CROSS VALLEY DAM CONTINUED

gravel and creating a scarp on the upstream face. This has led to movement of the rip rap above the ice plucking zone and minor sliding. Repairs to the rip rap should be completed within 2 years.

DOWNSTREAM SLOPE: 2:1 slope angle. The downstream face appears to be in satisfactory condition, with no seepage, cracking or deformation noted. The trees and shrubs that were growing on the downstream face of the dam and at the toe of the dam were removed in 2007. During the 2009 inspection it was observed that further vegetation removal is needed at the toe of the dam. The remaining vegetation should be removed, from the upstream portion of the spillway, the south abutment and the surface of the seepage blanket.

SEEPAGE: The 2009 data and the historic summary of weir flows are presented in Tables 13 and 14. Weir flows for 2009 are summarised on Figure 22. The Weir X13 quantity is slightly more than the combined flow volumes of X11, X12 and W3, but a difference exists between the calculated combined flow rates and the flow rate, as presented in Table 13. This difference is due to contributing surface run-off or from additional groundwater flow which comes to surface downstream of the seepage trench.

The north portion of the seepage collection trench, as measured by Weir X-11, produces the majority of the seepage water. Additionally, this area has artesian pressures at depth, which is consistent with past performance. It is thought that this area experiences high pressures and seepage since it is near the location of the creek prior to the construction of the dam.

The average 2009 flow rate at Weir X13 is 23.6 l/s, which is comparable to the 27.6 l/s average flow rate recorded in 2008. This continues the trend, seen in Figure 23 and detailed in Table 14, of decreasing average seepage over the years. There are three main potential causes for the long term reduction of seepage flows; lower pond levels, "fines" accumulation on the base of the Polishing Pond and clogging of the drains in the downstream toe. The upper plot on Figure 23 shows a comparison of the measured flow at X13 to the pond elevations. This shows the decreasing seepage flow trend, despite having similar pond elevations for the period 1988, 1999 and 2000. There has been no measured increase in the pore water pressures at the downstream toe and clogged drains would cause the pore water pressure to increase in this area. Therefore, the most

CROSS VALLEY DAM CONTINUED

probable explanation of the reduced seepage is that the fines and sludge that are pumped into the Polishing Pond are settling and decreasing the hydraulic conductivity along the seepage path. The rating curves for the four weirs should be checked again in 1 to 2 years. These weir rating curves must be checked for accuracy regularly because they are an important indicator of the performance of the Cross Valley Dam.

In 2009 higher than normal turbidity readings were encountered upstream of the X-13 weir. A summary of the results of turbidity readings is present in Appendix IV. A number of potential issues with the readings were highlighted in this memorandum, and ways to resolve these issues with accuracy of the readings were also identified. Increased turbidity of the levels as shown in the memo may be cause for concern, and should be carefully evaluated as to the source of the increases. It is recommended that TSS measurements begin, and a determination of the source of the turbidity be determined.

In the spring of 2009 lowering of the water levels was necessary to create room in the tailings area to store spring freshet water volumes. Recommendations for drawdown rates were made; a copy of those recommendations are included in Appendix V.

INSTRUMENTATION: Readings of the CVD instruments for 2009 were obtained in June and September. Tabulated data and plotted records are presented in Appendix II and summarised in Tables 15 and 16. The positions of these instruments are shown in section in Figures 2 and 24.

PIEZOMETERS: Low pore pressures within the foundation and cut-off trench of the dam are indicated by readings taken at instruments CVDC-4, CVDC-7 and CVDP-6. Slightly higher pore pressures are observed at instrument CVDC-9. Higher pore pressures recorded at CVDC-9 are likely related to the fact that the instrument is located in the approximate area of the former Rose Creek channel. Instruments CVDP-1, CVDP-3, CVDP-5, CVDT-1 and P01-11 along the dam toe indicate artesian or near artesian pressures, as observed in previous years' monitoring.

Additional general observations with regards to the 2009 Cross Valley Dam piezometric monitoring data include the following:

- Instrument 94CVDC-1 indicates the piezometric surface within the core of the dam is approximately 10 m below the crest surface of the dam. Similar to past performance.

CROSS VALLEY DAM CONTINUED

- Piezometer CVDP-2 has ceased to be operational and should be abandoned.
- Upward gradient conditions exist in the crest at the location of the nested standpipe piezometer CVDC-7. Similar to past performance.

THERMISTORS:

The 2009 readings indicate the ground temperatures at depth appear to be stable in Thermistors CVDC-6 and BH-88-4T. The thermistor beads at 21 and 29 m depth in CVDC-6 appear to be malfunctioning and therefore have been ignored.

Data collected in the spring from piezometer BH-88-4 indicates that winter frost penetration extended to a depth of approximately 4 m at this location.

MAINTENANCE

RECOMMENDATIONS: The following maintenance/monitoring requirements are recommended:

- Carefully monitor the cracking in the crest of the dam following spring thaw, and repair if conditions worsen.
- The water level in the pond should be maintained such that the water is within the zone protected by riprap. Continue monitoring for small scarps forming in the riprap.
- Vegetation should be removed from the upstream portion of the spillway, the south abutment and the surface of the seepage blanket.
- Careful determination of the source of the increase turbidity should be completed.

CONCLUSIONS:

The piezometric pressures recorded from the instrumentation in the Cross Valley Dam indicate that pore pressures remain consistent with previous years' readings. Instrument 94CVDC-1 indicates the piezometric surface within the core of the dam is approximately 10 m below the surface of the dam (approximately 1023.3).

Geothermal instrumentation within the Cross Valley Dam indicates that no permafrost is encountered within the foundation of the dam and winter frost penetration is observed to be approximately 3.5 to 4 m below the crest.

Overall, the dam is exhibiting acceptable performance which is consistent with the historical monitoring at this dam. Continued monitoring of the seepage weirs and functioning instruments in the Cross Valley Dam is recommended for 2010.

CROSS VALLEY DAM CONTINUED

Budgeting should start for repairs to the ice damaged rip rap in either 2010 or 2011.

NORTH FORK ROCK DRAIN (NFRD)

- LOCATION:** West of the waste rock piles, part of the haul road that extends to the Vangorda mining area (see Figure 1).
- FUNCTION:** The NFRD was designed to transmit the water flow of the North Fork Rose Creek through the haul road. Figures 25 and 26 provide photographs of the rock drain. Figure 29 provides the location of the NFRD and its instruments and monitoring locations.
- MAX HEIGHT:** 55 m +/-
- CREST ELEVATION:** 1143.9 m
- CREST WIDTH AND CONDITION:** 25 m +/-, no signs of cracking or settlement evident.
- UPSTREAM FACE:** Minor channelized erosion and related sloughing has occurred on the upstream side of the rock drain. Some woody debris and silty materials have collected at the base of the upstream face.
- DOWNSTREAM FACE:** Channelized erosion and related sloughing has occurred on the downstream side of the rock drain due to runoff from the crest haul road. The road protection berm has been breached and is now allowing run-off water to flow down the face, which has formed an erosion gully. So far this does not appear to significantly affect the performance of the drain, but this gap should be repaired. If an outlet for surface water is needed, the gap in the safety berm should be moved so that it is not directly above the drain outlet.
- SEEPAGE:** Head pond level was normal during the inspections and the drain appears to be passing the flows in a satisfactory manner.
- INSTRUMENTATION:** The pond data logger experienced problems in the winter of 2007 period (draining the battery) and a detailed check of the data logger was undertaken in the spring of 2008. No problems were encountered with the data logger. But during this inspection the battery was completely drained and non-functional. It appears that the problem is likely due to the instrument. A new vented pressure gauge is recommended for this location. A careful examination of the external batteries will be needed to ensure that these are useable.
- POND WATER LEVEL:** A sensor and datalogger are located in the pond to measure pond water elevations. The pressure gauge installed has failed, this should be replaced to re-institute monitoring of the pond elevation. A benchmark was established on the upstream side of the pond to allow regular pond elevation surveys as a check on the sensor readings. The

NORTH FORK ROCK DRAIN (NFRD) CONTINUED

measured pond water levels from 2009 (based on surveying of the pond level) and the toe discharge quantities are shown on Figure 27 and in Appendix II. By combining the pond water elevation on the upstream face, the elevation of water discharge on the downstream face, and the dimension of the drain, the hydraulic gradient through the drain can be estimated. Comparison of the hydraulic gradient in 2009 to the past few years (the period when data has been collected) indicates that the performance was similar, see Figure 28 and in Appendix II. This indicates that the capacity of the drain has not reduced in this time period. Further evaluation of the hydraulic gradient based on future monitoring is recommended to evaluate the possibility of the drain clogging.

The water level in the pond appears to have been increasing over the last few years for the same discharge and same water exit elevation. Upon detailed examination during the 2009 inspection this appears to be related to beaver activity on the face of the rock drain. The beavers are building a facing on the rockfill material which is raising the pond elevation, although this is not thought to cause a significant reduction in the maximum capacity of the drain, or reduce stability of the downstream toe, the beavers should be removed from the pond.

FLOW:

Two staff gauges and a sensor with datalogger are located near the main access road, at Station X2, to measure the discharge in the creek via a rating curve. The flow measurements from 2009 are presented on Figure 28.

MAINTENANCE

RECOMMENDATIONS: Beaver activity should be removed from the pond so that drainage can be returned to normal. The pond data logger also needs to be repaired so it is functional.

CONCLUSIONS:

The flow-through rock drain was observed during the site inspections. The discharge area was observed to be flowing clear water from the downstream side. There was also no evidence of significant instability on the slope above the discharge area. On this basis, it appeared that the downstream portion of the causeway section was functioning as intended, and that its performance is not deteriorating.

Monitoring via visual inspection and via the surveying at the pond level, downstream toe should be continued on a twice per month basis (weekly during freshet period). Similarly, the monitoring of the creek flows at X2 and NFRD23 staff gauges should be read once per week.

NORTH FORK ROCK DRAIN (NFRD) CONTINUED

Confirmation of the rating curve at the flow monitoring station used to convert staff gauge readings to flow should be undertaken in 2010. The sensor at the pond should be replaced, and pond level monitoring should be continued. Along with this, the dataloggers from the pond and creek should be downloaded once per month and the results sent to BGC.

FARO CREEK DIVERSION CHANNEL

- LOCATION:** Top of the east wall of the Faro Pit (see Figure 1).
- FUNCTION:** The channel transmits creek water, which previously flowed directly through the pit area, over to the North Fork Rose Creek upstream of the rock drain. Figures 30 through 32 provide photographs of the diversion channel. Figure 33 provides the locations of the instruments located on the Faro Creek Diversion Channel.
- LENGTH:** 1,500 m +/-, with an elevation loss of approximately 21 m.
- INSTRUMENTATION:** Four staff gauges were installed in 2007 to monitor the flow in the diversion. Initially, two staff gauges were installed; one near the inlet to the diversion and the second upstream of the transition to the steep gradient section. These staff gauges were installed by Laberge and a rating curve developed. Following recommendations made in 2007 two additional staff gauges were installed within the Faro Creek Diversion. Throughout 2009, each of these staff gauges was read thirty-one times.
- Data from the monitoring at the staff gauges is included in Appendix II. Flows could only be calculated for the two gauges that had previously had rating curves developed, FCD-1 and FCD-2. The 2009 average flow at FCD-1 was 387 L/s and the average at FCD-2 was 928 L/s. These average flows are lower than previous due to more readings (thirty-one in 2009 compared to eight in 2008) and taking readings later into the year. Rating curves need to be developed in 2010 for the newer staff gauges, FCD-3 and FCD-4.
- OBSERVATIONS:** In 2008, a number of slumps occurred in the slope above the diversion and also on the downstream side of the road. Repair of the major slump in the hill side at the corner appears to have been undertaken adequately. As part of this repair, rip rap has been placed on the hill side edge of the channel. This rip rap placement had restricted the flow in the channel, following the BGC inspection this was repaired to remove the restriction.
- The section of the channel repaired last year through the addition of bituminous liner and rip rap appears to be performing adequately. In this area there is no need to cover the bituminous liner. In one location, marked by a rock with flagging, the joint in the liner has come loose. This was repaired in 2009.
- RIPRAP:** Some minor rip rap movement has occurred in select locations, exposing the underlying geotextile. This was likely caused by ice action this past winter. The rip rap should be reinstated, in some

FARO CREEK DIVERSION CHANNEL (CONTINUED)

locations the damage has been extensive and a new section of geotextile should be placed in the area.

MAINTENANCE

RECOMMENDATIONS: A number of maintenance recommendations have been made for the Faro Creek Diversion channel, in both the Spring and Fall inspection memos, as well as the test pitting report. The riprap at the toe of the repaired slump zone should be adjusted so that the flow of the channel is not restricted. The exposed geotextile should be recovered with riprap in the select locations that were affected by ice action.

The recommendations for 2009 are:

- Test pitting locations on the dike should be monitored throughout the fall and spring as these areas were disturbed and may be subject to instability in the future (slumping, settlement, etc.).
- Continue monitoring the flow in the FCDC using the installed staff gauges.
- The FCDC should be either moved to a new position or repaired as a priority item within the next 2 or 3 years.

CONCLUSIONS:

The canal experienced a significant departure from its typical good behaviour in 2007. It is thought that the extreme cold of November 2006 along with the poor dike foundation condition, were responsible for the deterioration in the performance. The repairs made in 2008 appear to have been effective, as the canal performed in a satisfactory manner in 2009. Following the test pit investigation recommendations done in 2008, the canal dike should continue to be closely monitored throughout 2010. Although the canal performed adequately in 2009, there is still a high potential for another significant seepage or failure event to occur due to the poor soil and foundation conditions. A large scale repair effort of replacement of the structure should be investigated in the near future. More understanding of the behaviour of the seepage losses is also needed, so it is important that staff gauges be monitored and rating curves be developed for FCD-3 and FCD-4.

Monitoring of the performance of the pit wall continues, a copy of the 2009 report on the pit wall is included as Appendix VI. This monitoring should be continued.

SELECTED WASTE ROCK DUMPS

LOCATION: Southeast of the Faro Main Pit (see Figure 1), overlooking North Fork of Rose Creek.

MAX HEIGHT: Variable

INSTRUMENTATION: None.

MAINTENANCE

RECOMMENDATIONS: Structures were not inspected in 2009.

CONCLUSIONS: The review of these dumps is on a two year cycle. As a September inspection was not carried out this year, the dumps should be visually inspected again in 2010.

SECONDARY TAILINGS IMPOUNDMENT (EAST OF DIVERSION DAM)

LOCATION:	Located on the east side of the Down Valley project area. The east leg of the Secondary Tailings Dam is directly adjacent to either the North Fork of Rose Creek or the original portion of the RCDC. See Figure 3.
FUNCTION:	Retain tailings solids, supernatant water and run-off water from flowing into the Rose Creek Diversion Canal. Figures 34 and 35 provide photographs of the Secondary Dam and Tailings Impoundment.
LENGTH:	Approximately 1120 m.
MAX HEIGHT:	Approximately 28 m.
CREST ELEVATION:	Varies from 1060.2 m to 1063.3 m.
CREST WIDTH AND CONDITION:	Approximately 6 m, capped with a protective layer of sand and gravel fill. No concerns were noted with the crest of the road.
LOWER ROAD	No concerns were noted.
SPILLWAY:	N/A
BACKSLOPE:	2:1 slope angle.
SEEPAGE:	During this year's inspections, no signs of seepage were noted at the toe of the Secondary Dam.
INSTRUMENTATION:	Readings of the Secondary Tailings Impoundment instruments for 2009 were only obtained in September. Tabulated data and plotted records are presented in Appendix III and summarised in Table 17.
PIEZOMETERS:	<p>Readings were collected from the piezometers in the Secondary Dam and Secondary Impoundment Areas.</p> <p>Two of the piezometers within the Secondary Dam: P81-06 and P81-08, recorded dry conditions in 2008.</p> <p>The three piezometers within the tailings impoundment and near to the eastern portion of the secondary dam, P03-01, P03-02, and P03-03, indicated conditions at or near hydrostatic at an elevation of approximately 1054 m to 1055 m amsl, are shown on Figure 35.</p>
MAINTENANCE RECOMMENDATIONS:	Surface water appears to have been directed along the east toe of the dam this spring. The surface water traveled along the toe of the dam until near the pumping wells, where it travelled across the road causing erosion of the road surface. A small swale was created in the road surface to direct the water into the North Fork Rose Creek Diversion channel. The erosion location should be filled with sand

SECONDARY TAILINGS IMPOUNDMENT (EAST OF DIVERSION DAM) CONTINUED

and gravel fill, and the swale should be formalized, if the surface water will continue to be directed to this area.

CONCLUSIONS:

Based on the piezometric information available, the elevation of the water table in the secondary tailings impoundment ranges from approximately 1054.4 m to 1055.3 m, depending on seasonal variability. The elevation of Rose Creek in the Diversion Canal along the east arm of the Secondary Dam is approximately 1054.1 m. Under these conditions, and assuming a uniform head loss between the tailings and the water levels in the Diversion Canal, the piezometric levels in the Secondary Dam should be at an elevation of approximately 1054.3 m, but were dry since the piezometers terminate above this elevation. The geometry and piezometric assumptions mentioned above are conceptually illustrated on Figure 35.

The low piezometric levels in the secondary tailings impoundment is a result of the long term “drain down” in the tailings area and appears to be reflective of the overall tailings deposit piezometric conditions.

Overall, the Secondary Tailings Impoundment is performing in an acceptable manner. The piezometers and monitoring wells installed at the crest of the dam indicate dry, well drained conditions. It is recommended that monitoring of all functional piezometers and monitoring wells in the Secondary Tailings Impoundment continue in 2010.

K8 CREEK ROCK DRAIN

- LOCATION:** Approximately 2.5 km west of the North Fork Rock Drain, part of the haul road that extends to the Vangorda pit (see Figure 1).
- FUNCTION:** The K8 Creek Rock Drain was designed to transmit the water flow of the K8 Creek through the haul road. Figure 37 provides inspection photographs of the rock drain.
- MAX HEIGHT:** 55 m +/-.
- CREST ELEVATION:** Approximately 1155 m.
- CREST WIDTH AND CONDITION:** 25 m +/-, no concerns noted.
- UPSTREAM FACE:** Face appears to be in good condition, with no cracking or sloughing evident. Some woody debris and silty materials have collected at the base of the upstream face.
- DOWNSTREAM FACE:** Face appears to be in good condition.
- SEEPAGE:** Head pond level was normal during the inspections and the drain appears to be passing the flows in a satisfactory manner.
- In the upstream pond there are circular “holes” in the surface of the accumulated sediment. Rock is exposed at the base of the “holes” and flow into the rock drain is concentrated at these locations. It is speculated that sediment accumulates on the upstream surface, raising the water surface, until enough pressure builds up and then a “piping” event occurs, which washes the sediment through the rock fill structure. Further monitoring will be needed to confirm this assessment.
- INSTRUMENTATION:** None.
- POND WATER LEVEL:** Should be determined in 2010.
- FLOW:** Should be determined in 2010.
- MAINTENANCE RECOMMENDATIONS:** It is recommended that a sensor and a data logger be installed to measure the pond water elevations in 2010. Flow through the rock drain should also be determined by using staff gauges or other means at the K8 culvert (potentially a data logger).
- CONCLUSIONS:** The flow-through rock drain was observed during the site inspections. The discharge area was observed to be flowing clear water from the downstream side. There was also no evidence of significant instability on the slope above the discharge area. On this basis, it appeared that

K8 CREEK ROCK DRAIN CONTINUED

the downstream portion of the causeway section was functioning as intended.

5.0 INSTRUMENTATION, MONITORING AND ANNUAL REVIEW

5.1 Instrumentation Readings

The frequency of readings of the instrumentation has been greatly reduced from the initial practice of quarterly observations because confidence in the performance of the structures has been substantiated by accumulated data. Figure 38 provides a schedule of readings for 2010 for the major structures, broken down by month. As has been the case over the last several years, all instrumentation data collected by site staff should be forwarded to BGC for review.

If any rapid lowering of either reservoir in the Down Valley is expected, then BGC should be consulted and changes to the monitoring program may be made.

It is recommended that the pond levels on the upstream side of the flow-through causeway be measured and correlated to measured flow in the North Fork of Rose Creek. In the past few years, this has included monitoring by data loggers and manual readings. In 2010, the data loggers should continue to be used. Monitoring of the rock drain should be continued at the pond, downstream toe and at Station X2 using the existing staff gauges. A new sensor is needed at the pond on the upstream side of the North Fork Rock Drain.

It is recommended that new staff gauges be installed within the Rose Creek Diversion Canal in 2010. The purpose of the new staff gauges would be to monitor the amount of seepage loss in the different reaches of the canal, but particularly near the Intermediate Dam. The new staff gauges should be installed and rating curves developed for each of the new instruments. Given this program of staff gauge installation, a supplemental staff gauge should be installed in the flat section between the upper and lower weir sections.

It is recommended that two new piezometers be installed in the spoil pile above the seepage that is occurring into the Cross Valley dam pond.

A check of the rating curve for NFRC 23 is required. This involves collecting direct stream flow measurements and staff gauge readings. Between four and eight readings should be taken throughout the year to confirm the rating curve. This procedure should also be carried out for the Rose Creek rating curves as well.

Rating curves need to be developed for staff gauges FD-3 and FD-4, which were installed in the Faro Creek Diversion Channel in 2007.

A sensor is recommended to be installed in the upstream pond at the K8 Creek Rock Drain. Provision to measure flows near the K8 Creek culvert should be made.

A staff gauge is recommended to be installed in the NVWID outfall section. A rating curve needs to be established for this instrument.

5.2 Routine Inspections by On-Site Personnel

Any change in condition that is noted as a consequence of this program of routine inspection must be brought immediately to the attention of the inspector's superiors. BGC must also be notified so that the condition can be evaluated in light of the prior performance history of the structures, and to provide any necessary geotechnical advice related to the concern at hand. Photos of the changed condition should be taken and forwarded to BGC.

5.2.1 Rose Creek Diversion Canal

It is important that current site staff continue with their inspection program as described below, and that a log of observations be maintained:

1. To inspect the Rose Creek Diversion Channel before run-off to ensure any snow and/or ice blockages are removed.
2. To inspect, on a monthly basis, the 400 m reach of the Diversion Canal dike crest immediately upstream of the Intermediate Dam for evidence of cracking.
3. To view on a monthly basis, the opposite side of the Diversion Canal from the canal dike looking for change to the top profile of the gravelly backslope, possible narrowing of the flow channel, and other changes which might be attributed to sloughing of the backslope.
4. To inspect in June, just after spring runoff is completed, the top of the thermal liner on the backslope of the Diversion Canal at the location situated about 500 m upstream of the Intermediate Dam; such inspection to determine if new (sharp-edged) cracking has developed.
5. Visually monitor the sloughing of the Spoil Pile at the Polishing Pond shoreline.
6. Monitor the NFRD-4 (Rose Creek Staff Gauge) on a daily basis. Monitor the proposed staff gauges in the Rose Creek Diversion Canal according to the schedule shown in Figure 38.

5.2.2 Intermediate Dam

Weekly inspections should continue at the abutments of the Intermediate Dam for evidence of: changing conditions (sloughing of the embankment fill and/or the adjacent slopes); active crest cracking; sloughing of the riprap; and for evidence of changing seepage rates (especially the south abutment toe seepage) and locations.

The Intermediate Dam Pond levels should be noted and recorded on a weekly basis.

5.2.3 Cross Valley Dam

Weekly inspections should continue at the Cross Valley Dam's abutments and downstream toe berm culverts. The abutments should be inspected for evidence of: changing conditions (sloughing of the embankment fill and/or the adjacent slopes); sloughing of the riprap; active crest cracking; and for evidence of changing seepage rates and locations. The downstream toe berm culverts should be inspected for consistency of flow rate.

The Polishing Pond levels should be noted and recorded on a weekly basis.

The cause of the higher turbidity near weir X-13 should be thoroughly investigated.

5.2.4 North Fork Rose Creek Flow-Through Causeway

Additional data should be collected in 2010 as detailed in Section 5.1. This additional data should include pond levels, water levels at the downstream toe of the drain, and flow downstream of the drain. Data during periods of high flow is particularly important and, as a minimum, the head pond should be viewed and surveyed weekly in the late afternoon for the period from about April 15th until June 30th.

The upstream and downstream faces of the rock drain should also be inspected monthly for any signs of instability or sloughing.

Monitoring of the staff gauge at X2, and NFRC23 should be continued on a daily basis.

5.2.5 Faro Creek Diversion Canal

Continue with both visual and survey monitoring of the overburden ravelling proximal to the access road and diversion channel. Assess if the average ravelling rate noted by Golder (200) is appropriate or if conditions have changed following rehabilitation of the channel. The monitoring program recommended by Golder should be continued.

Visual inspection of the access road and channel sections for cracks and for overburden ravelling overlooking the Faro Pit should be undertaken monthly from May until October. Any signs of deformation should be forwarded to BGC for comment.

5.2.6 Faro Waste Rock Dumps

Continue visual monitoring of dump slopes by site staff.

5.2.7 Secondary Tailings Impoundments – East Leg

Continue visual monitoring of the crest and the toe of this dam on a weekly basis by site staff. Monitoring of the instrumentation within this structure should continue.

5.3 Annual Reviews

As has been noted in previous annual reports, the performance monitoring and annual inspections of facilities has served as a basis for:

- a. judging current performance of the facilities;
- b. providing some forewarning of any trends towards potentially troublesome performance;
- c. adjusting the frequency of observation of instrumentation;
- d. recommending the installation of additional instrumentation; and

e. undertaking maintenance work.

In keeping with the important nature of these facilities, and the inherent value of keeping a comprehensive performance record, it remains prudent to continue with the data acquisition. As such, Figure 38 provides a proposed schedule of instrumentation monitoring for 2010. The collection of current data is of both immediate and ongoing value, to review such data in relation to the existing database, complemented by annual inspection of the works for evidence of deteriorating or deficient performance.

Annual inspections in 2010 should be performed in May/June (near the freshet period) and early September, in keeping with the schedules held for previous inspections, and for the advantage of consistency of conditions.

6.0 CLOSURE

This report summarizes the physical conditions as observed by BGC and the instrumentation results as collected by site staff on various mine waste facilities and structures at Faro Mine. Thank you for the opportunity to be of service to Denison and Faro Mine. Should you have any questions on this report, please contact BGC at your convenience.

Respectfully submitted,
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TABLES

Table 1 Summary of Polishing Pond and Intermediate Pond Levels

DATE	Cross Valley Pond Elevation (m amsl)	Intermediate Dam Pond Elevation (m amsl)
January 22, 2009	1029.148	1047.020
February 26, 2009	1029.560	1047.145
March 24, 2009	1029.837	1047.223
March 27, 2009	1029.796	1047.151
March 28, 2009	1029.724	
March 30, 2009	1029.596	1047.111
April 2, 2009	1029.368	1047.091
April 6, 2009	1028.939	1047.123
April 8, 2009	1028.736	1047.135
April 13, 2009	1028.164	1047.146
April 16, 2009	1027.744	1047.100
April 20, 2009	1027.716	1047.097
April 23, 2009	1027.487	1047.090
April 27, 2009	1027.273	1047.022
April 30, 2009	1027.159	1047.031
May 4, 2009	1027.229	1047.271
May 7, 2009	1027.419	1047.328
May 11, 2009	1027.604	1047.241
May 13, 2009	1027.690	1047.191
May 15, 2009	1027.734	1047.109
May 16, 2009	1027.831	
May 19, 2009	1027.831	1046.937
May 24, 2009		1046.821
May 31, 2009	1028.163	1046.680
June 8, 2009	1028.338	1046.495
June 13, 2009	1028.266	1046.428
June 29, 2009	1027.668	1046.480
June 30, 2009	1027.704	1046.508
July 13, 2009	1028.033	1046.410
July 20, 2009	1027.826	1046.338
July 27, 2009	1027.711	1046.299
August 3, 2009	1027.985	1046.242
August 7, 2009	1027.966	1046.252
August 10, 2009	1028.034	1046.285
August 18, 2009	1028.026	1046.327
August 24, 2009	1028.317	1046.448
August 31, 2009	1028.281	1046.531

Continued on Next Page

Table 1 Summary of Polishing Pond and Intermediate Pond Levels (Continued)

DATE	Cross Valley Pond Elevation (m amsl)	Intermediate Dam Pond Elevation (m amsl)
September 3, 2009		1046.511
September 7, 2009	1028.280	1046.475
September 10, 2009		1046.348
September 14, 2009	1028.360	1046.259
September 19, 2009		1046.081
September 21, 2009	1028.587	1046.024
September 29, 2009	1028.852	1046.048
October 1, 2009	1028.980	1045.992
October 5, 2009	1028.938	1046.071
October 9, 2009	1028.668	1046.013
October 12, 2009	1028.428	1045.919
October 13, 2009	1028.338	
October 16, 2009	1028.393	
October 18, 2009		1045.942
October 19, 2009	1028.132	1045.907
October 20, 2009	1028.000	1045.903
October 21, 2009	1027.925	1045.891
October 22, 2009	1027.864	1045.890
October 23, 2009	1027.775	1045.890
October 24, 2009	1027.669	1045.881
October 25, 2009	1027.542	
October 26, 2009	1027.496	1045.854
October 27, 2009	1027.395	1045.826
October 28, 2009	1027.320	1045.814
October 29, 2009	1027.235	1045.799
October 30, 2009	1027.188	1045.782
October 31, 2009	1027.123	1045.766
November 1, 2009	1027.034	1045.755
November 2, 2009	1026.960	1045.738
November 9, 2009	1027.174	1045.786
November 16, 2009	1027.381	1045.896
November 23, 2009	1027.537	1045.944
November 30, 2009	1027.720	1046.029
December 7, 2009	1027.822	1046.089
December 14, 2009	1027.966	1046.143

Table 2 Total Monthly Precipitation (mm) At Faro Airport, Yukon

Year	Jan	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (mm)
1978	0.4	miss.	trace	4.1	11.6	27.0	38.1	41.6	7.8	32.4	20.2	19.0	
1979	8.9	18.3	20.2	6.7	10.5	68.2	55.4	13.8	13.4	46.7	12.4	34.4	273.8
1980	19.7	2.4	11.7	12.5	10.5	11.1	95.4	33.2	46.7	miss.	21.3	13.3	
1981	6.5	23.1	4.0	4.5	7.8	42.8	41.3	22.5	41.9	21.5	17.0	5.4	238.3
1982	10.2	18.0	9.5	4.1	18.2	14.3	58.3	47.3	47.2	42.3	11.8	13.6	294.8
1983	35.7	6.6	9.8	2.2	20.6	55.6	49.1	65.8	21.2	16.3	11.4	3.9	298.2
1984	27.6	24.1	5.9	2.4	38.8	49.0	16.6	64.9	5.5	10.8	10.7	22.5	278.8
1985	22.5	24.8	2.2	13.8	17.2	28.1	62.6	80.8	46.3	20.0	22.2	26.1	366.6
1986	8.4	4.7	34.6	12.9	35.1	12.8	81.8	77.4	44.4	22.7	15.9	5.6	356.3
1987	3.1	14.0	2.8	10	40.1	50.8	92.4	63.5	30.2	26.6	17.8	6.2	357.5
1988	7.0	10.4	17.2	8.2	38.0	37.3	97.2	25.5	43.8	29.0	17.9	16.5	348.0
1989	19.8	3.6	19.8	2.0	17.9	41.0	51.7	16.9	30.8	46.3	39.8	13.8	303.4
1990	14.4	25.8	5.0	7.0	23.4	45.4	30.0	64.4	66.2	22.7	25.4	24.8	354.5
1991	17.2	22.6	16.6	2.8	22.4	30.2	115.4	33.0	48.2	49.6	43.4	40.0	441.4
1992	22.8	24.6	7.6	15.8	14.4	11.4	66.1	34.4	47.8	13.8	18.8	13.0	290.5
1993	22.2	15.0	1.6	6.0	76.7	48.6	50.2	56.0	50.8	35.7	miss.	miss.	
1994	20.2	8.4	11.4	5.0	39.8	24.2	19.6	25.2	45.6	41.6	24.4	8.0	273.4
1995	8.4	7.8	18.4	5.2	10.9	33.9	73.4	63.4	28.8	12.2	22.3	15.4	300.1
1996	10.2	9.1	27.1	7.2	13.4	20.0	64.4	70.8	52.7	34.8	3.5	5.9	319.1
1997	6.6	8.7	1.4	14	16.5	39.3	86.4	33.2	trace	25.2	6.4	12.4	250.1
1998	7.0	2.8	4.8	4.2	14.4	29.6	19.2	24.2	23.4	24.0	4.6	8.2	166.4
1999	24.4	10.0	15.4	1.8	44.4	64.8	42.0	33.8	27.0	22.4	12.8	21.6	320.4
2000	12.2	2.0	trace	6.0	9.6	39.6	48.1	116.2	102.2	8.6	19.4	5.8	369.7
2001	7.4	3.0	4.0	14.6	30.8	35	58.4	14.2	44.6	28.6	12.2	15.4	268.2
2002	9.2	5.8	9.0	7.0	19.6	19.4	34.9	64.1	38.4	18.2	9.6	9.4	244.6
2003	22.4	8.0	16.0	0.4	7.6	45.2	63.2	30.4	30.8	12.8	32.8	19.9	289.5
2004	31.1	11.4	45.0	4.0	15.6	34.0	13.5	38.0	48.5	33.6	9.8	45.0	329.5
2005	26.7	12.4	2.6	19.5	58.6	41.0	83.8	38.6	36.6	13.0	30.0	10.8	373.6
2006	11.0	7.0	18.5	21.6	16.2	38.0	33.4	33.3	35.6	21.0	33.1	8.3	277.0
2007	16.4	16.4	14.4	3.6	11.4	52.0	43.5	33.5	41.1	39.6	13.4	28.0	313.3
2008	miss.	miss.	miss.	miss.	miss.	68.6	74.8	99.0	27.2	miss.	miss.	miss.	
2009	miss.	15.4	20.3	20.4	19.9	26.1	16.8	62.4	28.2	miss.	miss.	miss.	
Max	35.7	25.8	45	21.6	76.7	68.6	115.4	116.2	102.2	49.6	43.4	45.0	
Year	1983	1990	2004	2005	1993	2008	1991	2000	2000	1991	1991	2004	
Mean	15.3	12.2	13.0	8.0	23.6	37.0	55.5	47.5	38.8	25.4	18.6	16.3	307.3
Min	0.4	2	1.4	0.4	7.6	11.1	13.5	13.8	5.5	8.6	3.5	3.9	
Year	1978	2000	1978	2003	2003	1980	2004	1979	1997	2000	1996	1983	
St.Dev	8.9	7.6	10.3	5.9	16.0	15.7	26.4	24.8	18.0	11.4	9.9	10.6	

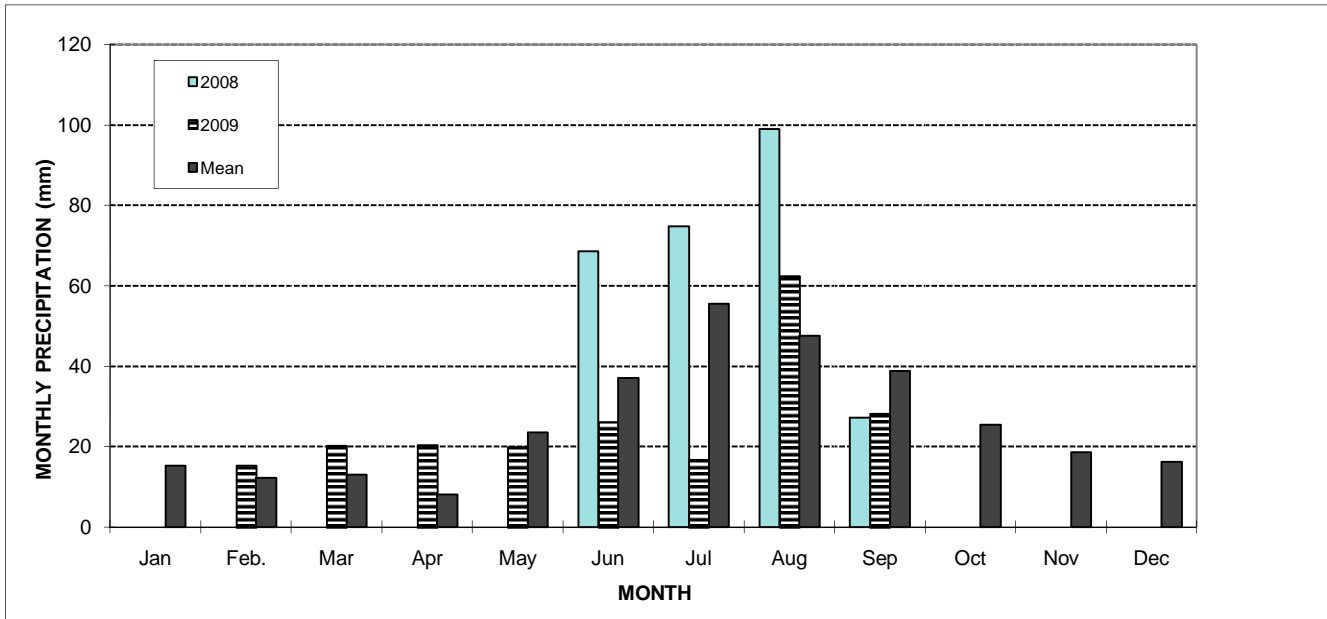


Table 3 Monthly Average Temperature (°C) At Faro Airport, Yukon

Year	Jan	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVE
1977	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	-30.5	
1978	-21.9	-13.9	-7.3	0.3	7.4	12.8	15.3	13.2	8.6	1.6	-15.7	-19.9	-1.6
1979	-26.7	-30.6	-5.1	-0.7	6.5	11.7	15.1	14.1	8.7	1.3	-8.2	-21.6	-3.0
1980	-26.6	-11.1	-8.6	2.6	8.6	14.5	14.4	11.3	5.1	2.6	-7.6	-34.6	-2.5
1981	-8.9	-15.8	-4.0	-3.3	10.0	11.0	14.8	12.8	5.5	-1.2	-8.8	-24.7	-1.1
1982	-37.3	-21.2	-13.4	-2.0	5.6	13.9	15.9	11.7	7.6	-3.8	-17.6	-19.0	-5.0
1983	-22.7	-15.8	-10.0	1.4	7.7	13.3	14.6	11.0	3.7	-1.9	-14.7	-32.0	-3.8
1984	-18.6	-9.7	-3.1	2.4	6.8	11.7	13.7	11.5	5.9	-3.6	-16.6	-24.0	-2.0
1985	-9.0	-21.2	-8.5	-1.9	6.2	10.6	14.4	10.4	5.9	-3.9	-24.2	-12.5	-2.8
1986	-12.1	-15.6	-8.2	-4.9	5.7	12.3	15.5	10.8	6.4	0.6	-18.6	-12.9	-1.8
1987	-14.4	-11.5	-12.4	0.5	7.2	12.1	15.2	12.2	6.4	1.9	-8.4	-14.5	-0.5
1988	-21.5	-12.0	-4.4	1.8	8.3	13.3	14.0	12.2	6.0	-1.8	-11.7	-16.1	-1.0
1989	-26.4	-19.3	-14.6	1.5	8.9	13.7	16.4	15.0	7.2	-2.6	miss.	-13.1	
1990	-20.8	-24.0	-6.0	1.6	8.8	12.8	15.6	13.5	8.2	-3.1	-23.8	-23.1	-3.4
1991	-20.0	-11.2	-9.2	1.8	8.5	13.3	14.2	11.0	7.7	-4.6	-13.2	-16.5	-1.5
1992	-13.3	-13.8	-5.6	-0.7	5.0	13.0	15.3	12.1	1.4	-4.2	-9.0	miss.	
1993	-21.3	-16.1	-7.2	2.6	8.8	13.3	14.4	12.0	6.9	0.4	-11.6	-14.2	-1.0
1994	-23.9	-25.6	-4.4	2.9	7.2	13.1	16.2	16.1	5.5	0.1	-17.3	-20.0	-2.5
1995	-20.1	-14.8	-11.1	3.5	10.0	14.4	14.6	11.3	9.9	-0.9	-17.2	-21.2	-1.8
1996	-34.8	-15.0	-11.8	-1.2	5.7	12.2	14.7	10.5	5.7	-6.4	-18.9	-23.9	-5.3
1997	-25.6	-10.7	-12.7	1.2	7.5	13.5	16.0	13.0	8.3	-5.9	-10.4	-11.7	-1.5
1998	-25.2	-10.8	-8.1	2.6	9.5	14.1	15.7	11.9	6.3	-1.3	-14.3	-19.8	-1.6
1999	-23.3	-17.7	-7.7	1.1	5.7	14.2	14.0	14.1	7.4	0.1	-13.1	-12.6	-1.5
2000	-18.7	-10.2	-4.8	-1.1	5.7	13.6	14.1	10.6	5.1	-1.4	-10.3	miss.	
2001	-10.8	-16.4	-8.6	0.9	5.6	13.3	14.7	14.0	7.5	-2.0	-13.9	-21.2	-1.4
2002	-17.8	-14.8	-14.4	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	-14.9	
2003	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	miss.	
2004	-9.2	-8.7	1.6	8.4	17.1	15.9	13.7	4.5	-1.9	miss.	miss.	miss.	
2005	-22.4	-15.8	-3.3	2.0	11.1	14.8	14.5	13.7	7.4	-0.1	-9.3	-13.6	-0.1
2006	-20.1	-14.1	-11.8	0.5	7.7	15.0	16.4	12.5	7.8	-1.4	-26.4	-14.7	-2.4
2007	-16.2	-22.0	-14.6	0.3	7.6	14.0	15.8	14.4	6.0	-2.2	-11.4	-21.6	-2.5
2008	-24.1	-18.9	-8.0	0.4	9.2	12.8	13.3	11.7	6.4	-1.8	-10.9	-26.0	-3.0
2009	-23.4	-20.3	-13.2	0.1	9.0	15.1	17.3	13.0	7.8	-2.1	-12.9	-17.6	-2.3
Max	-8.9	-8.7	1.6	8.4	17.1	15.9	17.3	16.1	9.9	2.6	-7.6	-11.7	
Year	1981	2004	2004	2004	2004	2004	2009	1994	1995	1980	1980	1997	
Mean	-20.6	-16.1	-8.4	0.8	7.9	13.3	15.0	12.2	6.3	-1.6	-14.1	-19.6	-2.2
Min	-37.3	-30.6	-14.6	-4.9	5.0	10.6	13.3	4.5	-1.9	-6.4	-26.4	-34.6	
Year	1982	1979	1989	1986	1992	1985	2008	2004	2004	1996	2006	1996	
St.Dev	7.0	5.1	3.9	2.5	2.4	1.2	0.8	2.1	2.4	2.4	5.2	6.3	

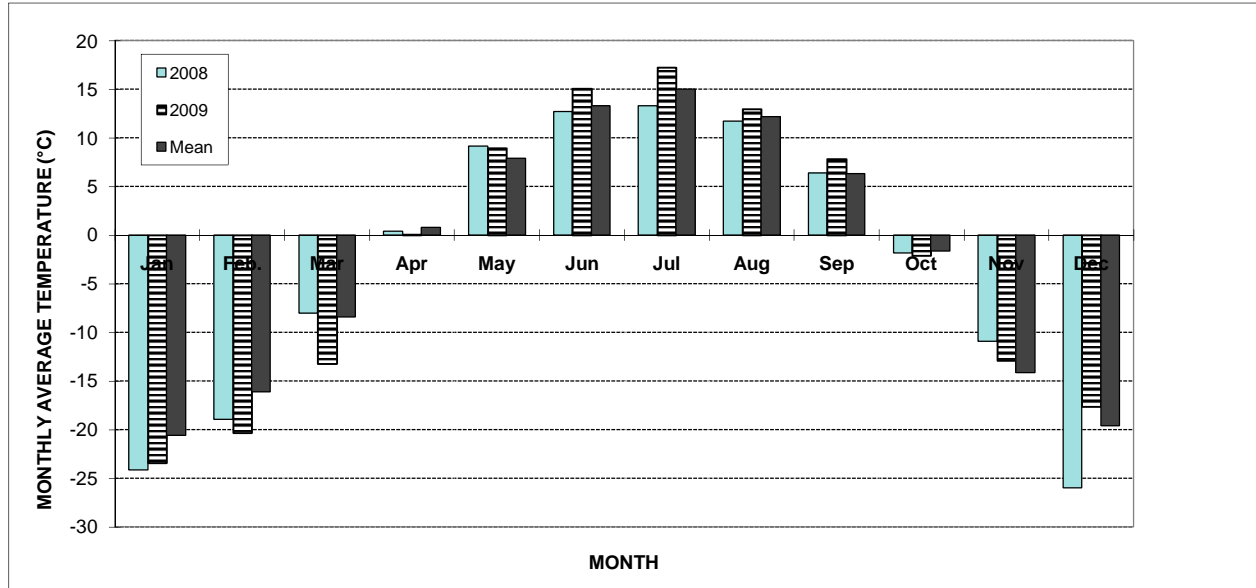


Table 4 Diversion Canal - Canal Dike - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2009	Ground Elevation (m amsl)	Tip Elev. (m amsl)	Historic Low Reading/ Date	Historic High Reading/ Date	2009 Low / Reading Date (Compared to 2008 Low)	2009 High / Reading Date (Compared to 2008 High)	Comments
CD-10	1981	P	2	1056.4	1045.3	1045.97/ Mar 1982	1050.48/ Sep 1992	1049.50/ Sep 17 (-0.21)	1049.57/ Jun 30 (-0.84)	Readings decreasing in comparison to 2008 data. Corresponds to lower water levels in the canal.
CD-13	1981	P	2	1055.2	1048.7/ 1044.7	1049.05/ Sep 1995 1047.57/ May 1982	1051.64/ Jun 2000, Jun 2001 1051.35/ Jun 2007	10501.08 / Jun 30 (+0.14) 1050.58/ Sep 29 (-0.14)	1051.50 / Sep 29 (+0.18) 1050.58/ Jun 30 (-0.21)	Shallow piezometer appears to be functioning properly again in 2009. Downward gradient.
CD-15	1981	P	2	1054.9	1048.10/ 1043.30	dry/Sep 2007 1043.31/ Dec, 1981	1051.25/ Oct 1985 1050.96/ Sep 2000	1048.66 / Sep 17 (-0.14) 1048.90/ Sep 17 (+5.46)	1049.29 Jun 30 (+0.35) 1049.67/ Jun 30 (-0.49)	Normally an upward hydraulic gradient. Sub-zero temperatures at depth (thermistor CD-15) correlate with variable pressures at depth.
CD-21	1981	P	2	1053.45	1047.50/ 1042.00	1047.92/ Apr 1991 1042.28/ Nov 1988, May 1982 to Sep 1983	1052.26/ Jun 1992 1047.51/ Jun 1992	1048.20 / Jun 30 (-0.70)	1048.69 / Sep 17 (-0.35)	Historically downward gradient, likely free drainage at depth. Pressures dropped in shallow piezometer from 1999 to 2003, stable from 2003 to 2005. Deep tip piezometer destroyed in 2005.
CD-26	1981	P	2	1053.1	1048.2/ 1042.0	1048.2/ Sep 1995, Sep 2007 1042.0/ Sep 1995	1049.81/ Jul 1988 1043.61/ Jul 1988	1048.55 / Jun 30 1042.42 / Jun 30	1048.62 / Sep 29 1042.56 / Sep 29	Downward gradient, likely free drainage at depth. Readings have been very consistent since 2001. Instrument was not read in 2008.
BGC05-03 BGC05-02	2005	P	2 / 1	1054.68 1054.1	1050.64 1044.65	1050.64 /Sep 2007 1045.21 / Sep 2007	1050.99 /Oct 2006, Jun 2007, Sep 2008 1046.75 / Sep 2008	1050.85 /Jun 30 (-0.07) 1045.91 / Sep 17 (-0.49)	1050.85 / Sep 17 (-0.14) 1045.91 / Sep 17 (-0.84)	Replaced former piezometer CD-19. Downward gradient, likely free draining at depth. Deep tip at historic high elevation in 2008.
BGC05-06	2005	P	2	1050.31	1046.78 1041.50	1046.78/ Sep 2007 1041.50/ Sep 2007	1046.99/ Jun 2007 1041.78/ Jun 2007	1046.85 / Jun 30 (-0.14) 1041.64 / Jun 30 (0.00)	1046.99/ Sep 17 (0.00) 1041.71 / Sep 17 (+0.07)	Downward gradient, likely free drainage at depth to dry condition. Replaced former piezometers 88-11. Shallow tip recording similar conditions to historic high.

Note: Bold values correspond to deep tip readings.

Table 5 Diversion Canal - Canal Dike - Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2009	Depth to Permafrost 2008 (depth below ground surface (m))	Depth to Permafrost 2009 (depth below ground surface (m))	Comments
CD-10	1981	10	1	Not observed within 9.9 m of ground surface.	Not observed within 9.9 m of ground surface.	Warming trend indicated at depth, readings appear to be highly inconsistent.
CD-15	1981	10	1	Not observed within 9 m of ground surface.	Not observed within 9 m of ground surface.	Data from a node at 3m depth was not included in the analysis. General cooling observed at this location.
CD-21	1981	13	2	Not observed within 13.0 m of ground surface.	Not observed within 13.0 m of ground surface.	Warming trend indicated at depth.
CD-26	1981	10	2	No readings available.	Not observed within upper 9.6 m of ground surface.	Temperatures are stable.
BGC01-02	2001	13.9	0	No readings available.	No readings available.	Previous readings indicate a warming trend at depth and no permafrost present within 13 m of surface.
BGC05-04	2005	11.9	2	Not observed within 11.9 m of ground surface.	Not observed within 11.9 m of ground surface.	Only two nodes functioning. More readings must be taken in order to determine any temperature trends. Replaced thermistor CD-19.
BGC05-07	2005	11.4	0	Not observed within 13.9 m of ground surface.	No readings available.	No readings taken in 2009. More readings are needed to develop trends. Replaced thermistor 88-11.

Table 6 Diversion Canal - Canal Dike - Slope Indicators

Installation	Date Installed	Length of Casing (m)	# of Readings in 2009	Comments
CD-10	1981	10	2	No movement in 2009. Movement previously detected between 4 and 5 m depth appears to have ceased.
CD-15	1981	10	2	Negligible subsurface movement since 1996. No substantial movement detected in 2009.
91CD-1	1991	11	2	Negligible movement since 1996.
CD-19	1981	10	2	Some movement was detected in readings prior to 1998. This movement has previously been attributed to settlement of the dike and settlement of the SI casing in the borehole.
CD-21	1981	10	2	Some movement was detected in readings prior to 1998. This movement has been attributed to settlement of the dike and settlement of the SI casing in the borehole. Indications of settlement have been observed at surface during the annual inspection since 1991. Minor surficial movement in upper 2 m.
BGC01-01 (88-10 replacement)	2001	11	0	Original depth of casing was 14 m bgs, frozen to 11.8 m in 2004. Frozen to 10 m in 2006. Makes interpretation difficult. Only minor movements in casing. No readings in 2009.
94CD-1	1994	14	2	Negligible subsurface movement since 1996. Minor surficial movements in upper 2 m.
BGC05-05	2005	11.5	2	Negligible movement in 2009.
BGC05-08	2005	12.5	2	Negligible surface movement in 2009.

Table 7 Diversion Canal - Spoil Piles - Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2009	Depth to Permafrost 2008 (m below surface)	Depth to Permafrost 2009 (m below surface)	Comments
SP-2	1981	10	0	Not observed with 10 m of ground surface	N/A	Warming trend at depth
SP-3	1981	10	1	Not observed with 10 m of ground surface	Not observed with 10 m of ground surface	Readings appear inconsistent from year to year.
SP-5	1981	10	1	Not observed with 10 m of ground surface	Not observed with 10 m of ground surface	Previously, permafrost was noted at 9 m depth, but now is not present

Table 8 Diversion Canal - Spoil Piles - Slope Inclinometers

Installation	Date Installed	Length of Casing (m)	# of Readings in 2009	Comments
SP-2	1981	7.5	1	Some settlement in the vicinity of SP-2, based on the distinctive shape of the deflection versus depth curves. Also some negligible downslope movement noted in upper 2 m.
SP-5	1981	10	1	Minor surface displacements have been occurring in the upper 2 m since September 2000. Minor movement at 6.7 m depth.

Table 9 Canal Backslope Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2009	Ground Elevation (m amsl)	Tip Elev. (m amsl)	Historic Low Reading/ Date	Historic High Reading/ Date	2009 Low Reading/ Date (Compared to 2008 Low)	2009 High Reading/ Date (Compared to 2008 High)	Comments
BS-5	1981	P	2	1060.2	1053.0	1053.28/ Sep 2006	1057.69/ May 1994	1054.33/ Jul 9 (-1.05)	1055.24/ Sep 9 (-0.14)	Slightly higher than average in 2009.
BS-9	1981	P	2	1056.3	1045.0	1047.73/ May 1982	1051.65/ Oct 1986, Oct 1990	1049.76/ Sep 23 (-1.19)	1051.02/ Jul 16 (+0.07)	

Table 10 Canal Backslope Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2009	Depth to Permafrost 2008 (m below surface)	Depth to Permafrost 2009 (m below surface)	Comments
BS-5	1981	10	2	N/A	7.5	Poor readings again in 2009, September results appear to show permafrost at 7.5 m depth.
BS-10	1981	10	2	8	8	Depth to permafrost steady at approximately 7 to 8 m from 2002 to 2009. Some cooling at depth.
BS-12	1981	10	2	N/A	N/A	Appears to be cooling at depth, negative temperatures seen below 5 m. Does not appear to be cool enough to indicate permafrost.

Table 11 Canal Backslope - Slope Inclinometers

Installation	Date Installed	Length of Casing (m)	# of Readings in 2009	Comments
BS-5	1981	10	1	No movements since 2004
BS-9	1981	10	1	No movements since 2004
BS-10	1981	10	1	Poor 2009 reading

Table 12 Intermediate Dam - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2009	Ground Elevation (m amsl)	Tip Elev. (m amsl)	Historic Low Reading/ Date	Historic High Reading/ Date	2009 Low Reading/ Date (Compared to 2008)	2009 High Reading/ Date (Compared to 2009)	Comments
BH91-ID3	1991	P	2	1043.82	1036.82/ 1028.62	1036.82/ Sep 95, Dec 98, Sep 00, Sep 02, Sep 03, May 05, Sep 05, May 07 1030.93/ Mar 2006	1039.23/ Jun 1992 1038.04/ Jun 1992	1036.89/ Jun 29 (0.00) 1032.33/ Sep 30 (-0.56)	1036.96/ Sep 30 (+0.07) 1032.61/ Jun 29 (-0.28)	Shallow tip readings dry or almost dry in 2009. Deep tip indicates declining pore pressures with high seasonal fluctuation. Downward gradient.
BH91-ID4	1991	P	2	1031.8	1024.22/ 1017.08	1028.28/ Sep 2007 1027.23/ Mar 2006	1034.58/ Jun 1992 1031.85/ Sep 1992	1028.91/ Jun 29 (-0.84) 1027.72/ Jun 29 (-0.84)	1030.31/ Sep 30 (-0.35) 1029.91/ Sep 30 (+0.58)	Downward gradient.
BH91-ID5	1991	P	0	1031.64	1024.3/ 1017.08			N/A N/A	N/A N/A	Both tips are leaking, making the instrument inoperable. Pore pressure has been increasing for the last few years.
BH91-ID6	1991	P	3	1031.36	1024.8/ 1016.9	1026.83/ May 1997 1028.17/ Mar 2006	1031.74/ Jun 1992 1034.96/ Jun 1992	1027.53/ Jun 29 (-0.91) 1028.52/ Jun 25 (-0.91)	1028.65/ Sep 30 (-0.42) 1029.85/ Sep 30 (-0.28)	Downward gradient.
BH91-ID7	1991	P	3	1032.42	1025.95	1029.17/ Mar 2006	1032.20/ Feb 1992	1029.66/ Jun 29 (-0.77)	1030.50/ Sep 30 (-0.56)	Pore pressures have been increasing over the past few years previous to 2009 where a drop occurred.
BH94-IDC-1	1994	S	2	1049.21	1035.1 (approx)					Has recorded dry conditions since initial monitoring in 1994
BH96-1	1996	S	2	1049.15	1027.35	1027.85/ Oct 2006	1031.65/ Jun 1999	1029.24/ Sep 30 (+0.38)	1029.24/ Sep 30 (+0.38)	Piezometric Elev. Approx. 20 - 22 m bgs. The first 2009 reading was affected by frozen water in the casing.
BH96-2	1996	S	2	1049.22	1028.87	1028.27/ May 10, 2004	1031.94/ Jun 1999	1028.44/ Jun 29 (-0.92)	1029.70/ Sep 30 (-0.36)	Piezometric Elev. Approx. 18 - 20 m bgs.
BH96-3	1996	S	2	1031.48	1022.43/ 1012.23	1027.37/ Mar 2006 1027.48/ Mar 2006	1031.38/ Jun 1999 1031.45/ Jun 1999	1027.96/ Jun 29 (-0.81) 1028.03/ Jun 29 (-0.79)	1029.20/ Sep 30 (-0.41) 1029.20/ Sep 30 (-0.39)	Piezometric Elev. Approx. 3.0 - 5.0 m bgs.
BH96-4	1996	S	2	1032.16	1025.68 1020.86 1015.69 1003.82	1027.61/ Mar 2006 1028.39/ Jun 2009 1027.74/ Mar 2006 1027.73/ Mar 2006	1032.04/ Jun 2002 1032.08/ Jun 2002 1031.64/ Jun 1999 1031.75/ Jun 1999	1028.08/ Jun 29 (-0.80) 1028.39/ Jun 29 (-0.02) 1028.14/ Jun 29 (-0.78) 1028.24/ Jun 29 (-0.79)	1029.26/ Sep 30 (-0.62) 1028.39/ Sep 30 (-0.40) 1029.30/ Sep 30 (-0.38) 1030.39/ Sep 30 (-0.05)	Piezometric Elev. Approx. 2.5 - 4.5 m bgs. Historic low in B piezometer in 2009. Occasionally shows upwards gradients.
P01-03	2001	S	2	1031.52	1022.35	1027.75/ Mar 2006	1030.63/ Sep 2001	1028.21/ Jun 29 (-0.81)	1029.37/ Sep 30 (-0.91)	Piezometric Elev. Approx. 2.5 - 3.5 m bgs.
P01-04	2001	S	2	1032.32	998.17/ 978.89	1029.55/ Sep 2003 1029.06/ Mar 2006	1032.24/ May 2005 1032.17/ May 2005	1030.33/ Jun 29 (-0.80) 1029.73/ Jun 29 (-0.78)	1031.41/ Sep 30 (-0.68) 1030.93/ Sep 30 (-0.28)	Piezometric Elev. Approx. 0 - 3.0 m bgs. Gradient small downward
BKS04-06	2004	S	2	1049.1	1036	1036.46/ Sep 2005	1036.60/ May 2005	1036.34/ Sep 30 (-0.09)	1036.44/ Jun 29 (-0.01)	Dry
BKS04-07	2004	S	1	1049.2	1037.3	1036.55/ Mar 2006	1037.72/ Sep 2005	1037.66/ Sep 30 (-0.35)	1037.66/ Sep 30 (-0.35)	Dry, one 2009 reading was not obtained due to a blockage, likely ice.

Note: Bold values correspond to deep piezometer tips

Table 13 Cross Valley Dam 2009 Weir Flows

DATE	X13 (comb.) FLOW* (Lps)	X11 (North) FLOW* (Lps)	X12 (South) FLOW* (Lps)	W3 (Central) FLOW* (Lps)	X13-(X11+X12+W3) FLOW (Lps)
5-Mar-09	29.79	13.80	0.97	5.62	9
12-Mar-09	30.45	14.02	0.97	5.62	10
19-Mar-09	30.45	14.46	0.97	5.88	9
26-Mar-09	30.45	15.60	0.97	6.14	8
2-Apr-09	28.49	15.14	0.97	6.97	5
8-Apr-09	27.20	13.16	0.97	7.12	6
18-Apr-09	22.27	8.03	0.97	6.83	6
23-Apr-09	18.79	6.83	0.97	6.14	5
30-Apr-09	20.50	7.56	0.97	3.33	9
7-May-09	21.08	9.34	0.97	3.33	7
14-May-09	21.67	11.93	0.97	3.33	5
21-May-09	24.69	11.34	0.97	3.81	9
28-May-09	25.94	12.95	0.97	4.01	8
5-Jun-09	24.08	11.54	0.97	3.33	8
13-Jun-09	25.94	11.54	0.97	3.33	10
20-Jun-09	29.14	11.73	0.52	3.33	14
28-Jun-09	24.69	10.04	0.62	3.33	11
5-Jul-09	24.69	9.34	0.62	3.33	11
12-Jul-09	24.08	8.34	0.66	3.33	12
18-Jul-09	24.69	8.34	0.77	3.33	12
25-Jul-09	23.47	8.18	0.66	3.33	11
1-Aug-09	24.69	8.34	0.77	3.33	12
8-Aug-09	21.67	7.12	0.31	1.71	13
15-Aug-09	21.67	7.26	0.34	2.40	12
22-Aug-09	21.67	8.18	0.31	2.64	11
29-Aug-09	21.67	8.34	0.34	2.56	10
5-Sep-09	22.27	9.00	0.34	2.48	10
12-Sep-09	22.87	8.67	0.36	2.48	11
19-Sep-09	23.47	9.17	0.36	2.48	11
25-Sep-09	24.08	10.04	0.41	2.80	11
4-Oct-09	24.69	12.74	0.44	2.88	9
9-Oct-09	24.69	11.93	0.44	2.88	9
15-Oct-09	24.69	9.86	0.44	2.48	12
25-Oct-09	24.69	8.03	0.44	2.48	14
31-Oct-09	21.67	6.55	0.36	2.33	12
5-Nov-09	21.08	6.14	0.29	2.33	12
12-Nov-09	16.58	9.86	0.23	5.25	1
19-Nov-09		9.86	0.21	4.78	X13 Frozen
26-Nov-09		10.22	0.21	4.66	X13 Frozen

Continued on next page

Table 13 Cross Valley Dam 2007 Weir Flows (Continued)

DATE	X13 (comb.) FLOW* (Lps)	X11 (North) FLOW* (Lps)	X12 (South) FLOW* (Lps)	W3 (Central) FLOW* (Lps)	X13-(X11+X12+W3) FLOW (Lps)
3-Dec-09	19.35	12.13	0.21	5.25	2
10-Dec-09	18.79	6.14	0.21	2.48	10
17-Dec-09	18.79	7.26	0.31	2.48	9
23-Dec-09	18.79	7.12	0.31	2.48	9
29-Dec-09	18.79	7.12	0.31	2.48	9
*Flows calculated from standard weir formulas and applied to staff gauge levels. Staff levels prior to September 2, 2005 corrected according to Laberge Environmental Services (2005). The difference of flow at X13 less (X11+X12+W3) is due additional seepage discharge beyond the other three weirs					
Average	23.55	9.87	0.60	3.70	9
Max	30.45	15.60	0.97	7.12	14
Min	16.58	6.14	0.21	1.71	1

Table 14 Cross Valley Dam Seepage Flows - Weir X13 (1982 - 2009)

YEAR	MEAN POND ELEVATION (m amsl)	MINIMUM FLOW RATE (month recorded) (L/s)	MAXIMUM FLOW RATE (month recorded) (L/s)	AVERAGE YEARLY FLOW RATE (L/s)
1982	1026.25	75.9 (Sept)	277.6 (June)	115.3
1984	1027.55	67.8 (Oct)	84.9 (Dec)	76.3
1985	1029.69	83.9 (Sept - Dec)	113.6 (Jul)	93.2
1986	1030.9	79.8 (May)	113.2 (Sept)	93.8
1987	~1030.9	77.0 (May)	106.1 (Aug - Sept)	94.4
1988	~1030.9	78.9 (Jun)	110.4 (Aug)	95.5
1989	~1030.9	72.3 (Mar)	97.9 (Aug)	85.7
1990	~1030.9	64.9 (Mar)	102.9 (Sept)	82.8
1991	~1030.9	66.6 (Oct)	91.0 (Jun)	81.6
1992	N/A	53.8 (Nov)	90.8	68.4
1995	1031.2	29.1 (Dec)	52.8 (Jun)	50.2
1996	1029.9 (Sep)	15.8 (Apr)	58.3 (Sep)	34.8
1997	N/A	30.0 (Apr)	109.9 (Sep)	28.6
1998	1030.5	49.0 (Dec)	119.0 (Sep)	52.7
1999	1030.7	44.0 (Feb - Sep)	82.0 (July)	53.6
2000	1031.5	35.0 (Nov)	78.0 (June 26)	48.7
2001	N/A	35.0 (Jan - Feb)	49 (Jun to Sep)	48.0
2002	N/A	38 (Oct - Nov)	49 (May to Sep)	46.4
2003	1029.7	28 (Sept - Oct)	46 (Jan to Mar)	38.1
2004	1029.8	31.6 (Apr, Sep to Dec)	49.5 (June)	35.3
2005	1028.0	16.0 (Mar - Apr)	49.2 (May)	27.3
2006	1027.8	18.8 (Mar)	44.61 (May)	26.0
2007	1028.7	21.7 (Sept-Oct)	34.5 (June)	26.4
2008	1029.7	22.9 (Nov)	35.2 (June)	27.6
2009	1028.1	16.6 (Nov)	30.5 (Mar)	23.6

- Notes:
1. For locations of weirs see Figure 2.
 2. Flows for 1983, 1984 and 1985 based on records for period June to December and flow for 1991 based on records for period January to November.
 3. High flow through Weir 3 in June, 1982 due to siphon discharge above weir.
 4. Weir 3 was replaced by X13 as a consequence of the seepage filter construction conducted in the summer of 1991.
 5. Drainage from west of south abutment road crossed to berm drainage collector during 1995 and perhaps in 1996; therefore some readings may higher than expected.
 6. Insufficient data for average pond level in 2001 - 2002 as water level was below staff gauge.
 7. Weir plates at X-11 and X-13 were replaced in August 2003.
 8. Weir maintenance and calibrations conducted in 2005, survey check in 2008 to confirm equations.
 9. Mean pond elevation data from 1982-2003 converted from m advd to m amsl.

Table 15 Cross Valley Dam - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2009	Ground Elevation (m amsl)	Tip Elev. (m amsl)	Historic Low Reading/ Date	Historic High Reading/ Date	2009 Low Reading/ Date (Compared to 2008 Low)	2009 High Reading/ Date (Compared to 2008 High)	Comments
CVDC-4	1981	S	11	1033.30	1007.9/ 999.7	1016.68/ Apr 1984 1016.72/ Apr 1984	1018.44/ Oct 1986 1019.05/ Jun 1992	N/A 1018.38/ May 5 (-0.36)	N/A 1018.84/ Mar 31 (+0.05)	Shallow piezometer blocked 7.6 m below top of pipe since 1987. Deep piezometer has been very consistent since 1992.
CVDC-7	1981	S	11	1033.24	1007.80/ 1002.90	1015.14/ Mar 2006 1017.17/ Mar 2006	1016.30/ Sep 1992 1019.21/ Jun 1992	1015.23/ Apr 30 (-0.17) 1017.19/ Apr 30 (-0.52)	1015.44/ Jun 29 (-0.11) 1017.77/ Mar 31 (-0.15)	Very consistent readings in both piezometers. Slight upward gradient.
CVDC-9	1981	S	11	1033.28	1007.70/ 1000.70	1019.91/ Aug 1983 1021.18/ Jun 1984	1024.74/ Aug 1982 1025.61/ Jun 1992	1020.16/ Apr 30 (-0.90) 1022.63/ Apr 30 (-1.09)	1021.17/ Mar 31 (-0.28) 1023.97/ Mar 31 (-0.32)	Moderately higher pore pressures than in other parts of the dam. Upward gradient.
CVDP-1	1982	P	11	1016.86	1014.51	1017.38/ Aug 1983	1019.55/ Sep 1992	1018.01/ Apr 27 (-0.42)	1018.57/ Mar 31 (-0.14)	Minor seasonal fluctuations, artesian conditions, drains into downstream blanket.
CVDP-2	1982	P	11	1016.86	1014.51	1015.07/ Jun 2009	1019.44/ Oct 1986	1015.07/ Jun 29 (N/A)	1015.77/ Mar 31 (N/A)	Piezometer functioning intermittently in 2009, no return readings were obtained in 2008.
CVDP-3	1982	P	11	1016.86	1014.71	1014.99/ Sep 1992	1018.07/ May 1991	1016.25/ May 5 (-0.28)	1016.32/ May 19 (-0.35)	Piezometer functioning intermittently in 2009, pore pressures just below grade.
CVDP-5	1982	P	11	1019.18	1014.28	1018.13/ Aug 1983	1021.21/ Sep 1992	1019.95/ Apr 27 (-0.63)	1020.93/ Mar 31 (+0.00)	Artesian conditions
CVDP-6	1982	P	11	1019.18	1014.37	1016.99/ May 1998	1018.99/ Sep 1992	1017.52/ Apr 27 (-0.28)	1017.94/ Mar 31 (+0.00)	Stable seasonally, Low pore pressures in the shallow foundation area.
CVDT-1	1994	S	11	1018.30	1007.9	1017.13/ May 1994	1018.32/ Aug 2004	1017.78/ Apr 27 (-0.04)	1017.89/ Mar 31 (+0.05)	Minor seasonal fluctuation. Pressure slightly below grade.
CVDT-2	1994	S	11	1019.50	1006.2	1015.33/ Mar 2006	1016.49/ Oct 2000	1015.43/ Apr 27 (-0.18)	1015.69/ Jun 29 (-0.13)	Minor seasonal fluctuation, 3.5 m below grade.
94CVDC-1	1994	S	11	1033.38	1020.4	1022.73/ Mar 2006	1024.58/ Sep 1995	1022.75/ Apr 30 (-0.58)	1023.14/ Sep 15 (-0.78)	Minor seasonal fluctuation. Near the lowest elevations on record.
P01-11	2001	S	11	1017.21	1006.61	1016.71/ Mar 2006	1017.83/ Jul 2003	1016.82/ May 19 (-0.13)	1016.92/ Mar 31 (-0.29)	Piezometric elevation located just below ground surface. Minor seasonal fluctuation. Frozen until May 2009.

Note: Bold values correspond to deep tip readings

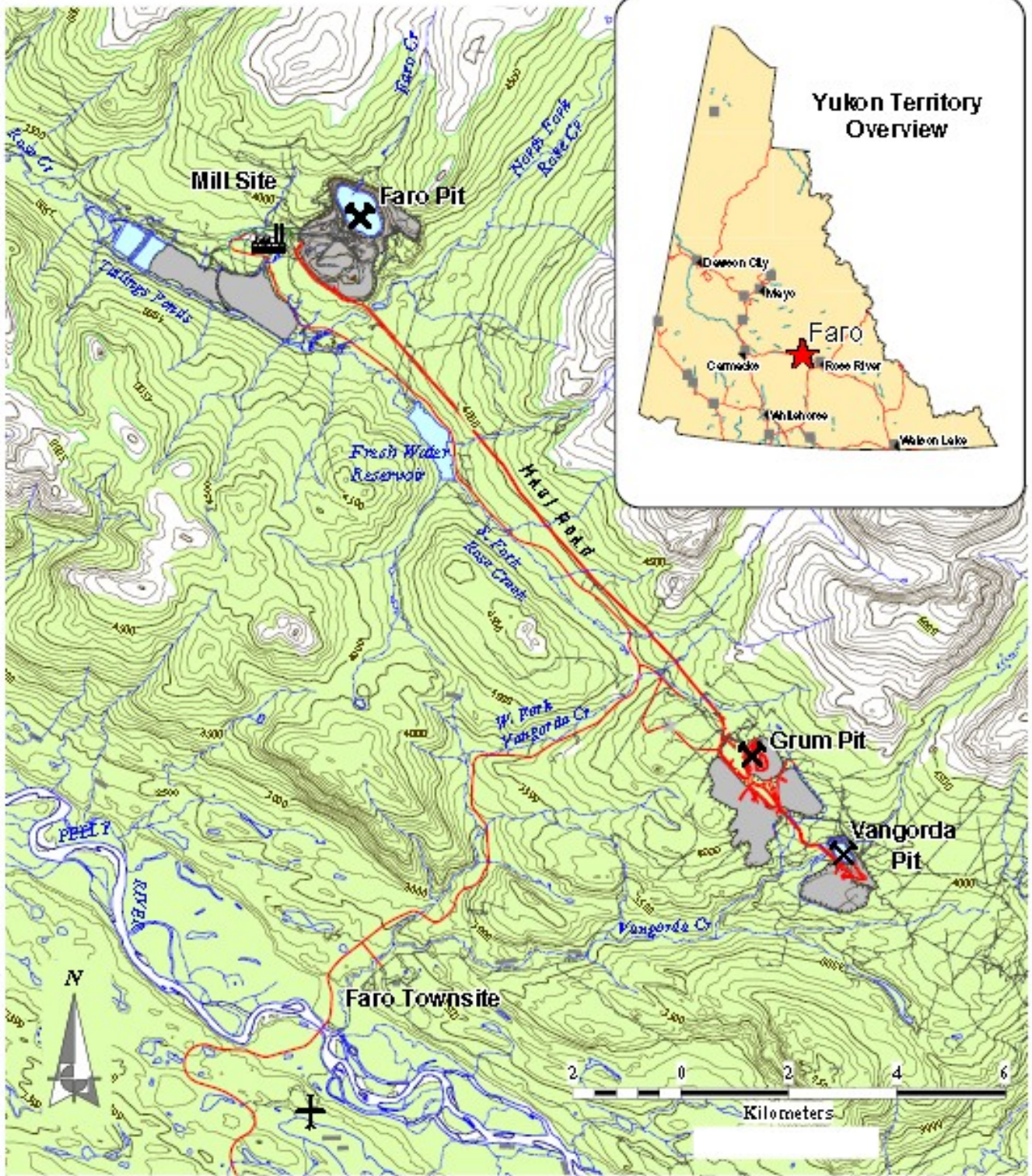
Table 16 Cross Valley Dam - Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2009	Depth to Permafrost 2008 (m below ground surface)	Depth to Permafrost 2009 (m below ground surface)	Comments
CVDC-6	1981	29	8	N/A	N/A	Readings at 21 and 29 m are unavailable. Temperatures in the whole profile have been between 2 and 3°C since 1995
88-4-4T	1988	4.2	7	N/A	N/A	Depth of winter frost extends to approximately 4 m.

Table 17 Secondary Dam - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2009	Ground Elevation (m amsl)	Tip Elev. (m amsl)	Historic Low Reading/ Date	Historic High Reading/ Date	2009 Low Reading/ Date (Compared to 2008)	2009 High Reading/ Date (Compared to 2008)	Comments
P03-01	2003	S	1	1060.58	9 Tips, Variable Depths	1054.54/ Sep 2007	1055.06/ Jun 2005	1055.25/ Sep 30 (+0.42)	1055.25/ Sep 30 (+0.35)	Gartner Lee monitoring well, 9 tips at varying elevations. Hydrostatic conditions.
P03-02	2003	S	1	1059.91	9 Tips, Variable Depths	1054.72/ Oct 2006	1058.35/ Jun 2007	1053.73/ Sep 30 (-0.98)	1053.72/ Sep 30 (-1.12)	Gartner Lee monitoring well, 9 tips at varying elevations. Hydrostatic conditions.
P03-03	2003	S	1	1060.67	9 Tips, Variable Depths	1054.62/ Sep 2009	1060.27/ Jun & Sep 2007	1054.62/ Sep 30 (+0.08)	1054.62/ Sep 30 (-1.4)	Gartner Lee monitoring well, 9 tips at varying elevations. Hydrostatic conditions. Historic low reading in 2009.
P03-04	2003	S	0	1060.43	N/A	1055.70/ Sep 2008	1059.55/ Jun 2005	N/A	N/A	No readings taken in 2009.
P81-06	1981	S	1	1060.74	1054.71	1054.71/ Aug 2005	1054.74/ Jun & Sep 2007	1054.72/ Sep 30 (-0.01)	1054.72/ Sep 30 (-0.02)	Piezometric levels near bottom of standpipe or dry.
P81-07	1981	S	1	1063.31	1057.17	1057.17/ 2005, 2006, 2007, & Sep 2008	1057.18/ Sep 2007 & Jun 2008	1057.17/ Sep 30 (0.00)	1057.17/ Sep 30 (-0.01)	Piezometer dry.
P81-08	1981	S	1	1063.26	1055.8	1055.80/ Aug 2005, Jun & Sep 2007	1055.81/ 2005 and 2006	1055.81/ Sep 30 (0.00)	1055.81/ Sep 30 (0.00)	Piezometric levels near bottom of standpipe or dry.

FIGURES



Note: Base map figure provided by Gartner Lee Limited.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW

TITLE: SITE LOCATION PLAN

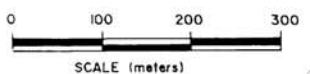
CLIENT:		PROJECT No.:	0762-002-05	FIGURE No.:	1	REV.:	0
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LEGEND

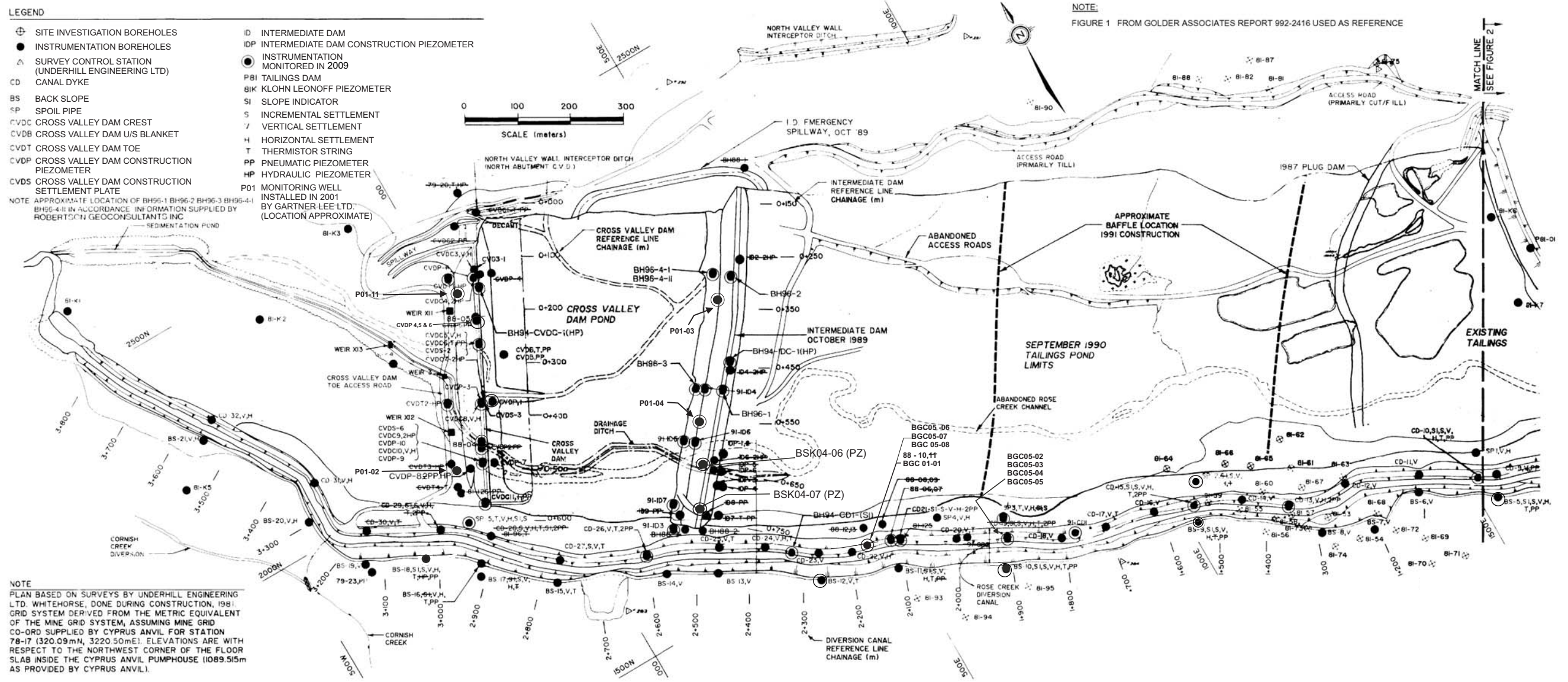
- ⊕ SITE INVESTIGATION BOREHOLES
- INSTRUMENTATION BOREHOLES
- △ SURVEY CONTROL STATION (UNDERHILL ENGINEERING LTD)
- CD CANAL DYKE
- BS BACK SLOPE
- SP SPOIL PIPE
- CVDC CROSS VALLEY DAM CREST
- CVDB CROSS VALLEY DAM U/S BLANKET
- CVDT CROSS VALLEY DAM TOE
- CVDP CROSS VALLEY DAM CONSTRUCTION PIEZOMETER
- CVDS CROSS VALLEY DAM CONSTRUCTION SETTLEMENT PLATE
- ID INTERMEDIATE DAM
- IDP INTERMEDIATE DAM CONSTRUCTION PIEZOMETER
- INSTRUMENTATION MONITORED IN 2009
- PBI TAILINGS DAM
- BKI KLOHN LEONOFF PIEZOMETER
- SI SLOPE INDICATOR
- S INCREMENTAL SETTLEMENT
- V VERTICAL SETTLEMENT
- H HORIZONTAL SETTLEMENT
- T THERMISTOR STRING
- PP PNEUMATIC PIEZOMETER
- HP HYDRAULIC PIEZOMETER
- P01 MONITORING WELL INSTALLED IN 2001 BY GARTNER LEE LTD. (LOCATION APPROXIMATE)

NOTE: APPROXIMATE LOCATION OF BH95-1, BH96-2, BH96-3, BH96-4-I, BH96-4-II IN ACCORDANCE WITH INFORMATION SUPPLIED BY ROBERTSON GEOCONSULTANTS INC.

NOTE: PLAN BASED ON SURVEYS BY UNDERHILL ENGINEERING LTD. WHITEHORSE, DONE DURING CONSTRUCTION, 1981. GRID SYSTEM DERIVED FROM THE METRIC EQUIVALENT OF THE MINE GRID SYSTEM, ASSUMING MINE GRID CO-ORD SUPPLIED BY CYPRUS ANVIL FOR STATION 78-17 (320.09mN, 3220.50mE). ELEVATIONS ARE WITH RESPECT TO THE NORTHWEST CORNER OF THE FLOOR SLAB INSIDE THE CYPRUS ANVIL PUMPHOUSE (1089.515m AS PROVIDED BY CYPRUS ANVIL).



NOTE: FIGURE 1 FROM GOLDER ASSOCIATES REPORT 992-2416 USED AS REFERENCE



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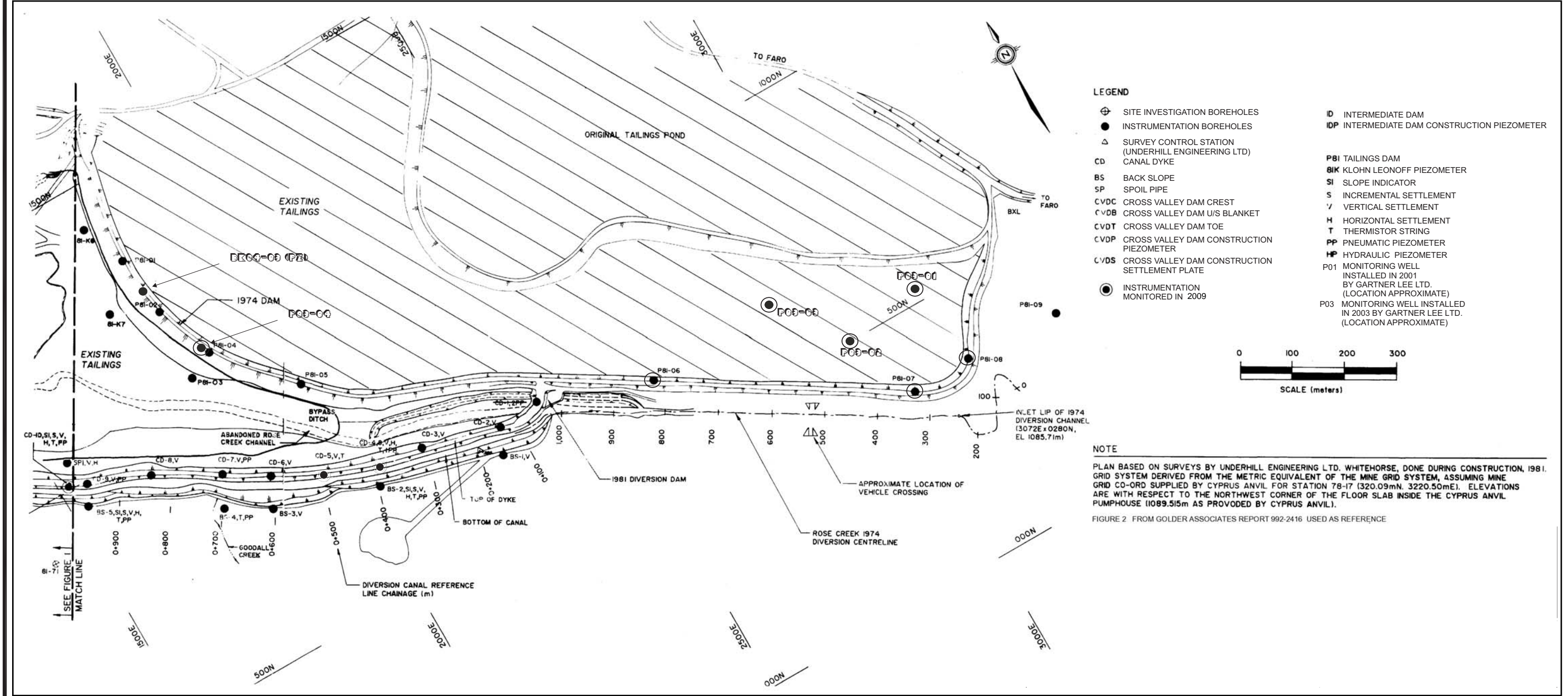
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CLIENT:

PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: DOWN VALLEY TAILINGS CONTAINMENT INSTRUMENT LOCATION 1 OF 2		
PROJECT No.: 0762-002-05	FIGURE No.: 2	REV.: 0



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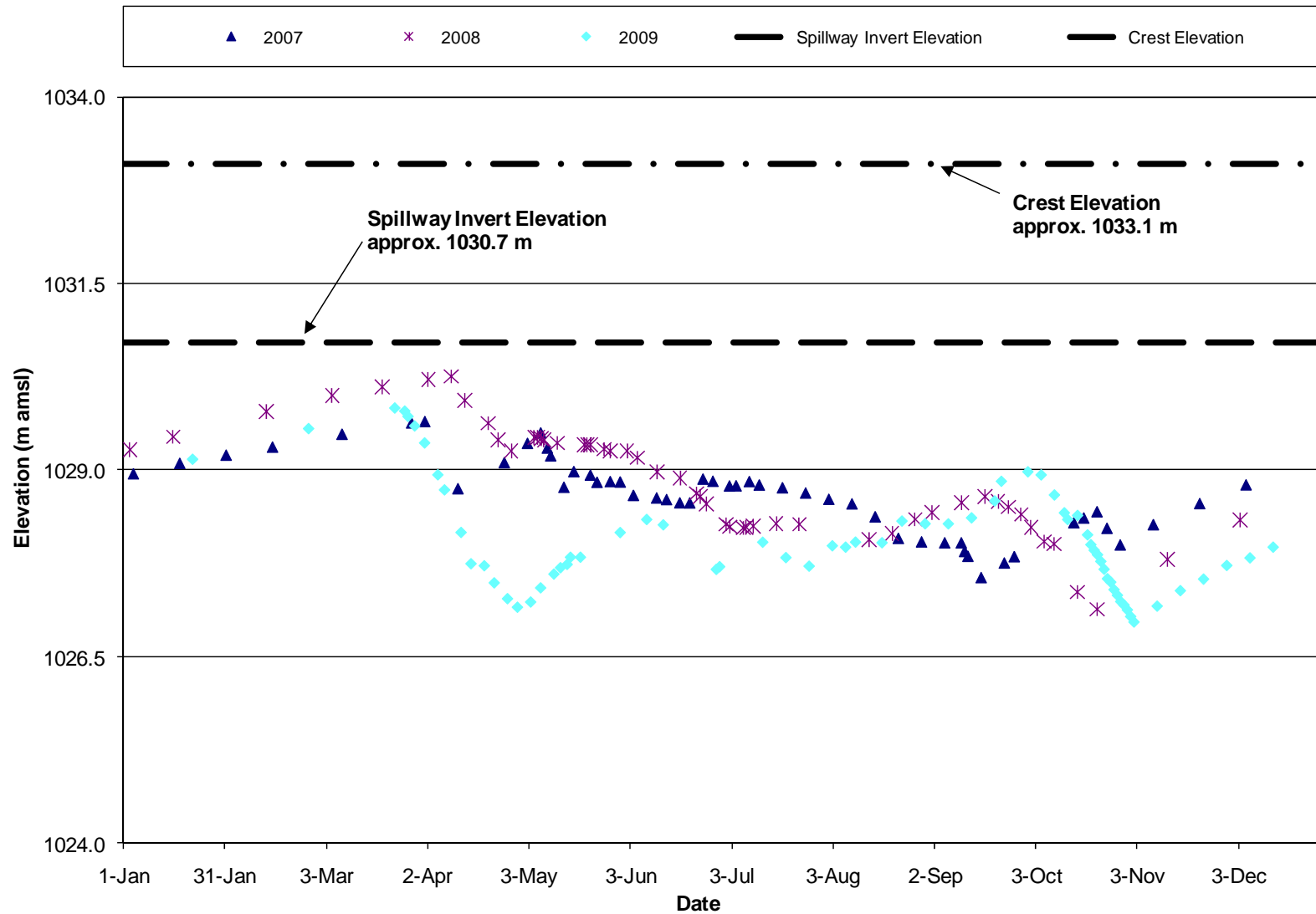
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PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE:	DOWN VALLEY TAILINGS CONTAINMENT INSTRUMENT LOCATION 2 OF 2		
PROJECT No.:	0762-002-05	FIGURE No.:	3
REV.:			0



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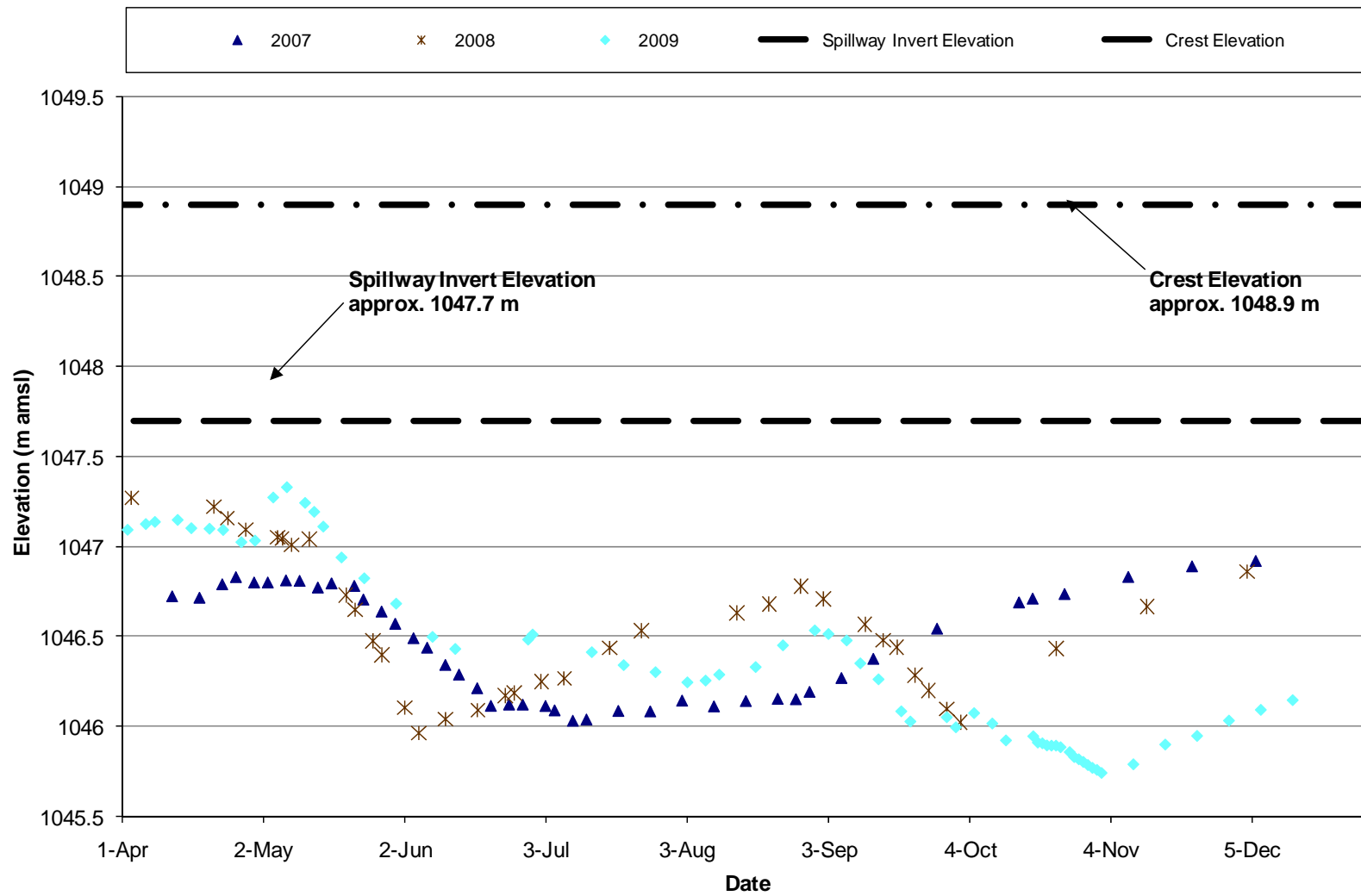
PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE:	CROSS VALLEY DAM POND ELEVATIONS (2007-2009)		

CLIENT:



PROJECT No.:	FIGURE No.:	REV.:
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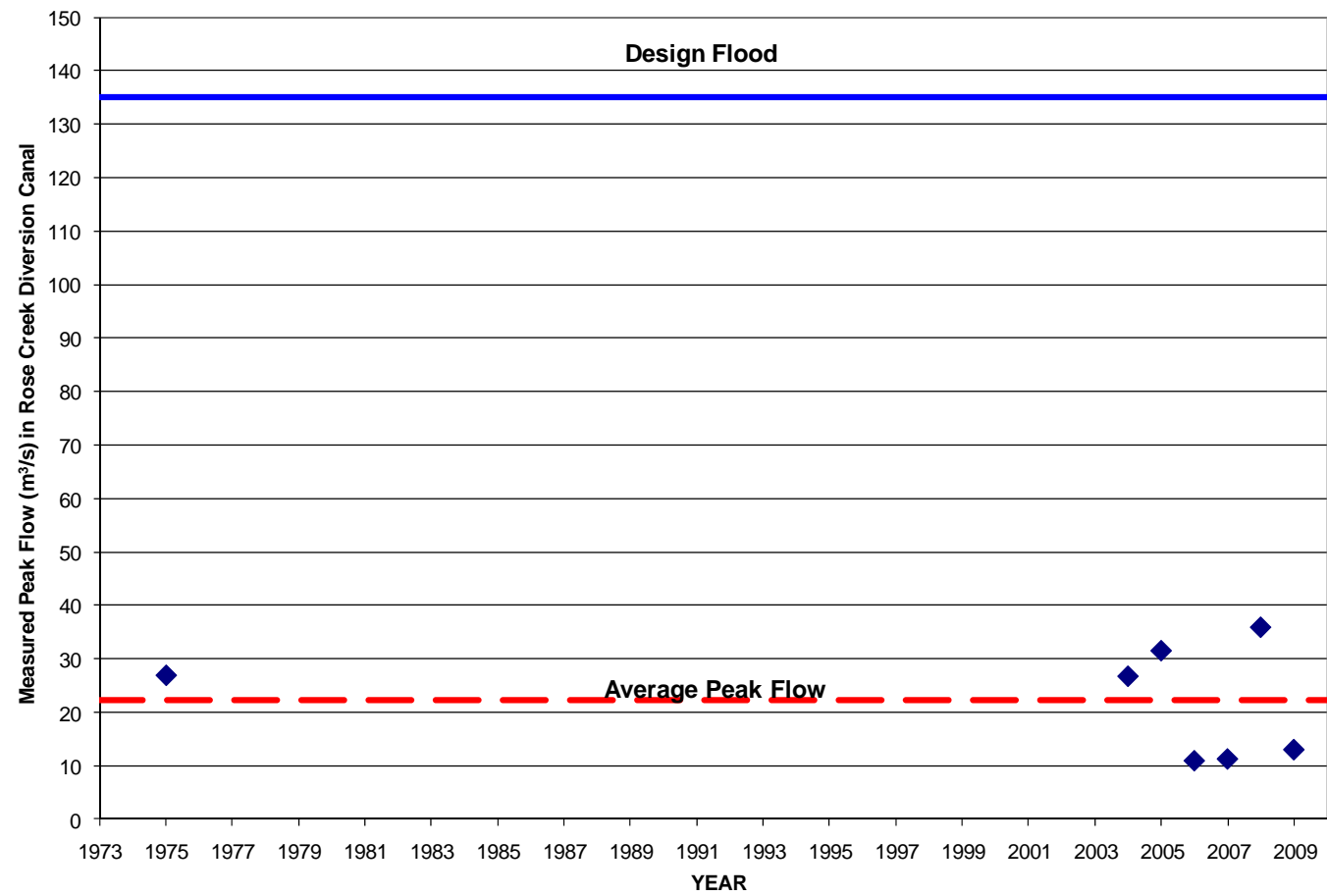
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TITLE:	INTERMEDIATE DAM POND ELEVATIONS (2007-2009)		

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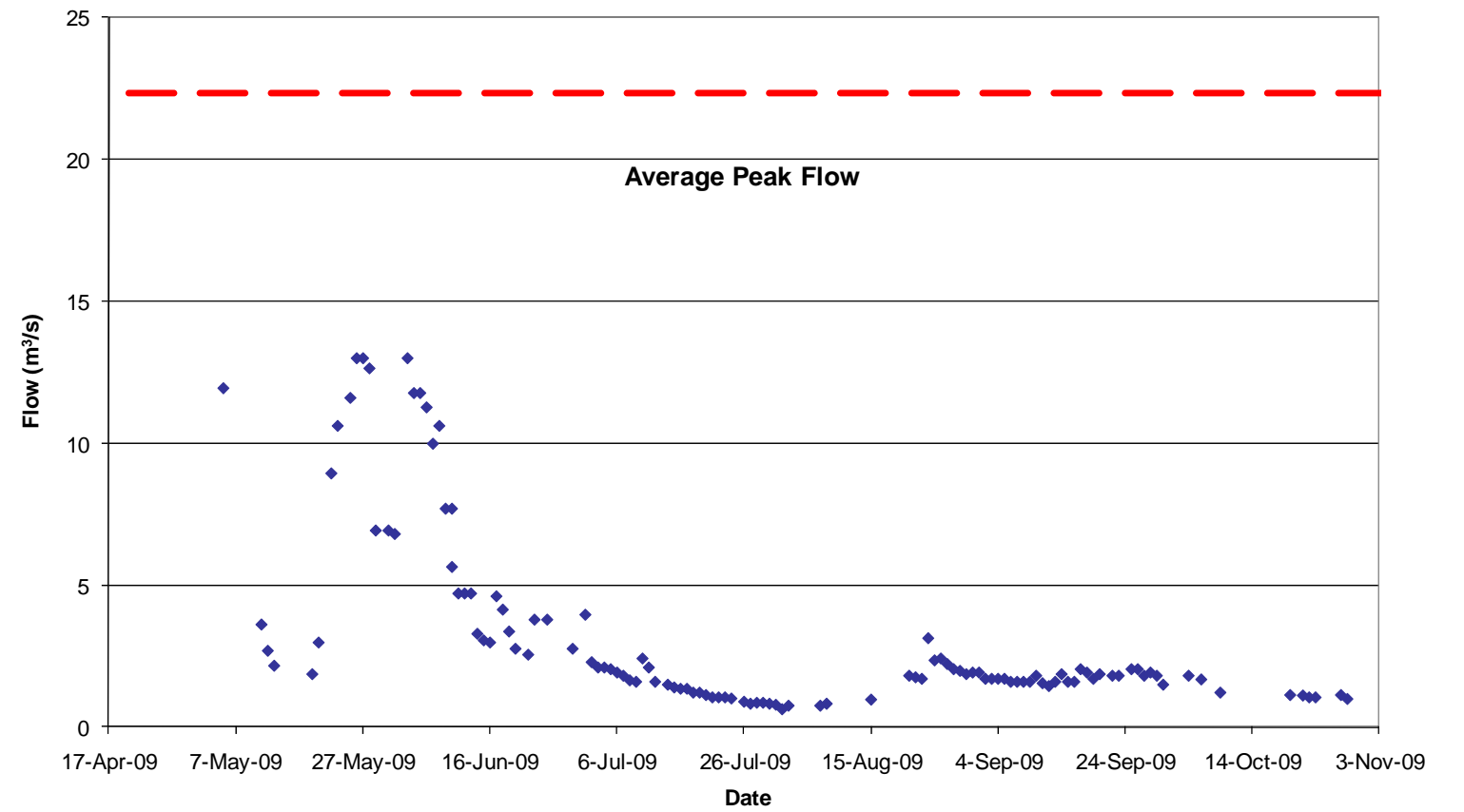


PROJECT No.:	0762-002-05	FIGURE No.:	5	REV.:	0
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Rose Creek Diversion Canal
2009 Measured Flows (Based on staff guage reading)



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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: ROSE CREEK DIVERSION FLOW		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	6	0



July: shows the water flowing in the channel section.



July: shows a view of the slump in the backslope of the Diversion Channel.



July: shows Goodall Creek discharge into the canal.



July: a view of the Diversion looking downstream. Note the bedrock outcrop on the right bank.

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CLIENT:  Denison Environmental Services

PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: DIVERSION CANAL DIKE INSPECTION PHOTOS		
PROJECT No.: 0762-002-05	FIGURE No.: 7	REV.: 0



July: shows minor erosion occurring on road edge. Repairs not needed, but should be monitored.



July: shows an upstream view of the upper weir section of the canal, looking towards Cornish Creek.



July: shows a slump area that has had some advancement over the past year. Repair is not yet needed.



July: shows a view of some erosion gullies in the backslope of the canal.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: DIVERSION CANAL DIKE INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	8	0



July: view of the lower weir section, this is where Severin Creek enters the Diversion Canal.



July: view of the upper weir section, looking upstream at the point where Cornish Creek flows into the canal.



July: shows the start of the upper weir section, looking upstream



July: a view looking upstream from the lower end of the upper weir section.

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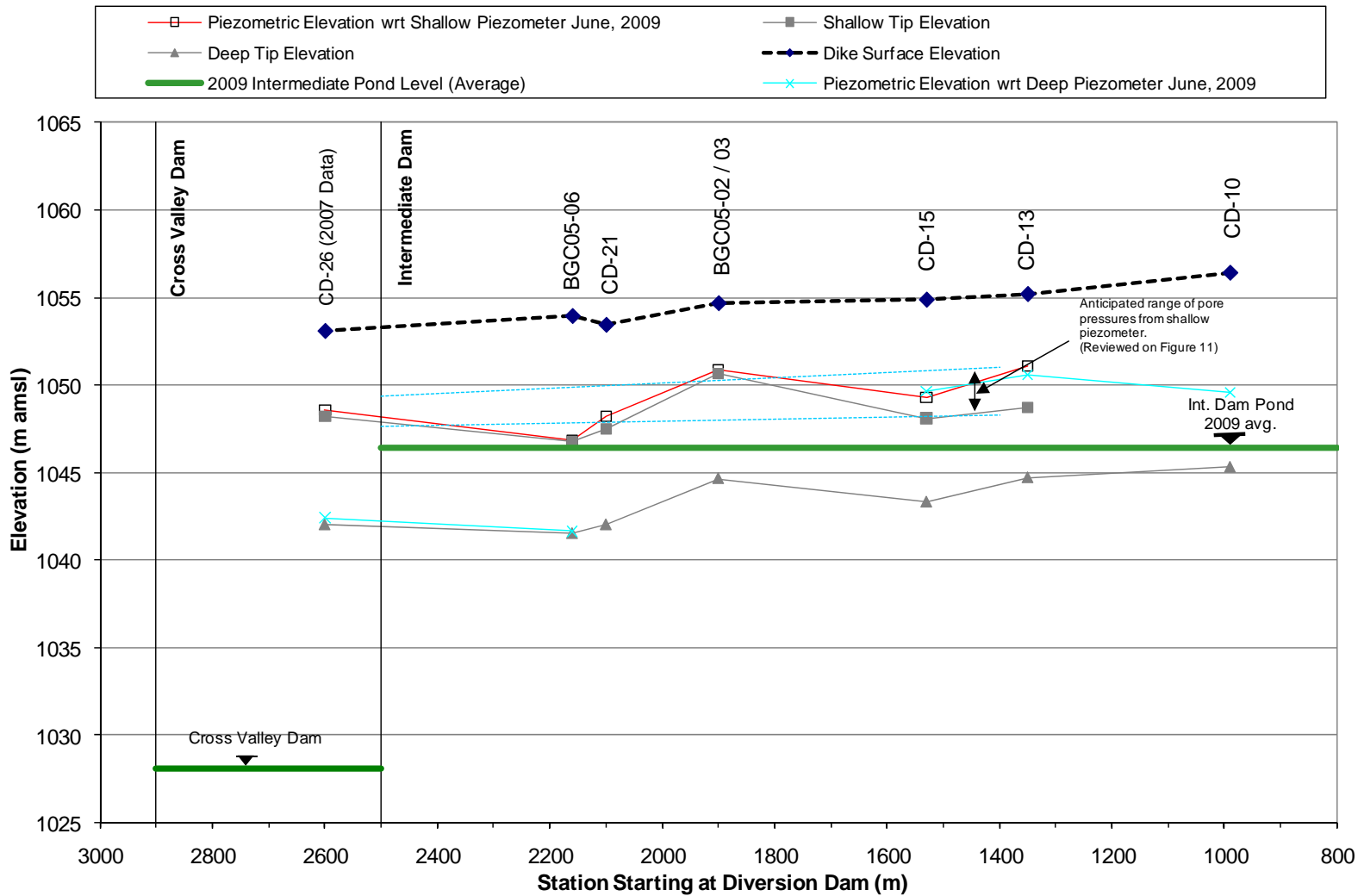
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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: DIVERSION CANAL INSPECTION PHOTOS-WEIR SECTIONS		
PROJECT No.: 0762-002-05	FIGURE No.: 9	REV.: 0



SCALE:	N/A	DESIGNED:	TMW
DATE:	FEB 2010	CHECKED:	HHH
DRAWN:	TMW	APPROVED:	GWF



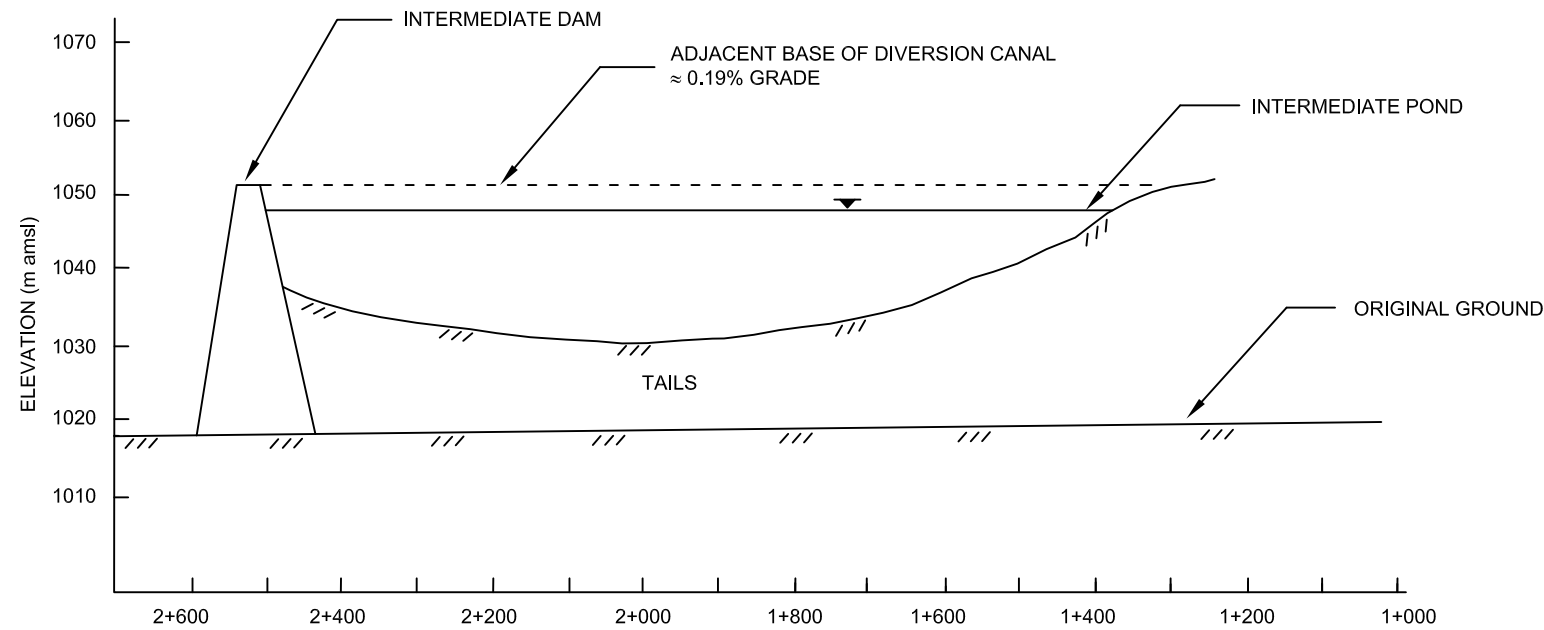
PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE:	CANAL DIKE, CURRENT PIEZOMETRIC CONDITIONS		

CLIENT:



PROJECT No.:	0762-002-05	FIGURE No.:	10	REV.:	0
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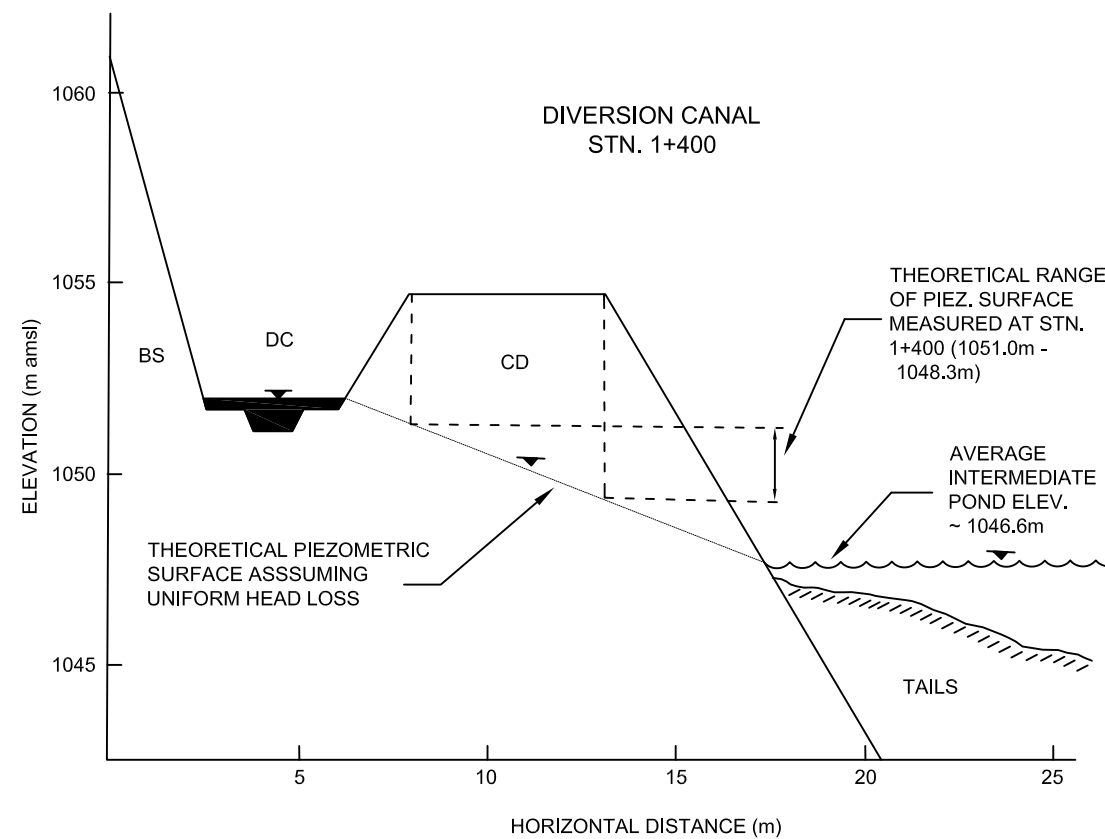
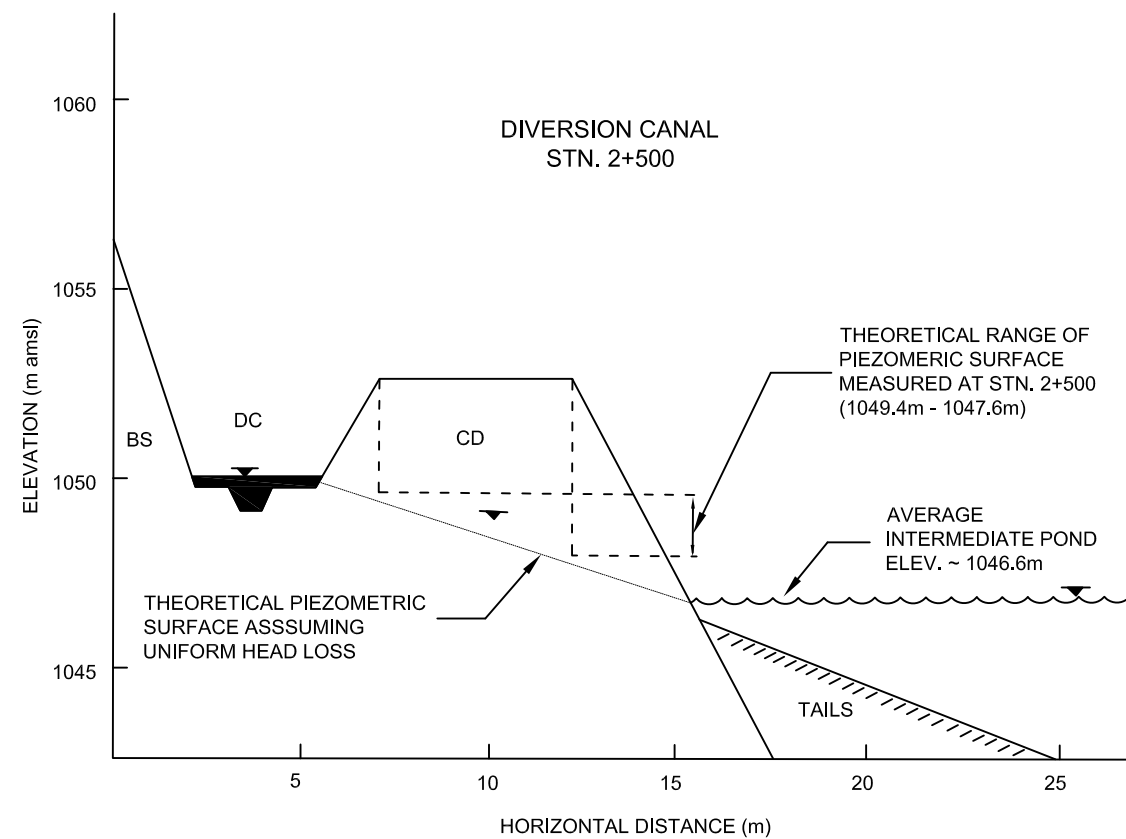
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- NOTES: 1) DRAWING IS A SCHEMATIC, CONSTRUCTED FOR ILLUSTRATIVE PURPOSES ONLY.
- 2) ALL ELEVATIONS ARE APPROXIMATE AND ARE BASED ON AVAILABLE INFORMATION.
- 3) LOCATION OF TAILINGS IN THE INTERMEDIATE POND IS APPROXIMATE. NO BATHYMETRIC INFORMATION IS AVAILABLE.

LEGEND	
BS	BACK SLOPE
DC	DIVERSION CANAL
CD	CANAL DIKE

NOTE: 10X VERTICAL EXAGGERATION



K:\Projects\0762_Denison_Environmental\02_2009_Annual_Inspection_Report\05_Reporting\Graphics\Workspaces\0762-002-05_Fig_11.dwg Layout: Figure 11 Plot Date Feb 4 10 Times: 9:49 AM

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: CANAL DIKE / INTERMEDIATE POND HYDRAULIC CONNECTIVITY		
PROJECT No.: 0762-002-05	FIGURE No.: 11	REV.: 0



July: a view of the toe of the spoil pile. The pond level is lower than usual, as shown by the high water marks.



July: view of one of the larger seepage points in the spoil toe.



July: view of the polishing pond shoreline, which is formed by the spoil pile base. Note that this is an area of slumping and seepage.



July: shows ice plucking damage to shoreline.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: SPOIL PILE INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	12	0



July: shows the start of the North Valley Interceptor Ditch just uphill from the guard house gate. This is the area the dike was repaired before and the riprap is present in the photo. After inspection of this section, it appears that the channel is flowing well with no signs of erosion or blockages.



July: a downstream view of the North Valley Interceptor Ditch, looking at the culvert.



July: shows a new crossing that has been made over the North Valley Interceptor Ditch. Culverts were installed to allow water to flow though.



July: a downstream view of the North Valley Interceptor Ditch downstream of the culvert.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: NORTH VALLEY INTERCEPTOR DITCH INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	13	0



July: shows a view of the riprap near the spillway.



July: a view looking south along the crest of the dam.



July: shows a view of the upstream face which was repaired in July 2007. Appears to be in good condition with no wave erosion occurring.



July: shows the shoreline of the pond from the left abutment. Canal Dike is on the extreme right of this photo.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: INTERMEDIATE DAM INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	14	0



July: showing a view looking south along the downstream dam face.



July: a view of the North Abutment contact.



July: looking downstream in the spillway.



July: a view of the downstream face of the Intermediate Dam Note the appearance of the erosion rills on the face.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: INTERMEDIATE DAM INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	15	0



July: shows a view of erosion on the downstream face. This area should be repaired by removing the eroded sand and silt from the gravel drain outlet.



July: shows the intersection of the downstream face with the north abutment. Vegetation was removed and the area was graded for construction access in 2007.



July: shows a view of the toe of the dam at the lower road. Note slough material at the toe.



July: a view of the edge of the polishing pond, note some ice plucking damage to the riprap.

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TITLE: INTERMEDIATE DAM INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	16	0



July: a view of minor cracking occurring at the edge of the polishing pond. Note that cracking has historically been seen in this area.



July: shows a view of the edge of the polishing pond. Note that some rilling and wave erosion is evident.



July: shows some minor slumping that is occurring on the face of the downstream side of the dam.



July: a view of the downstream face with the left abutment on the Intermediate Dam in the background.

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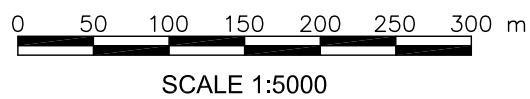
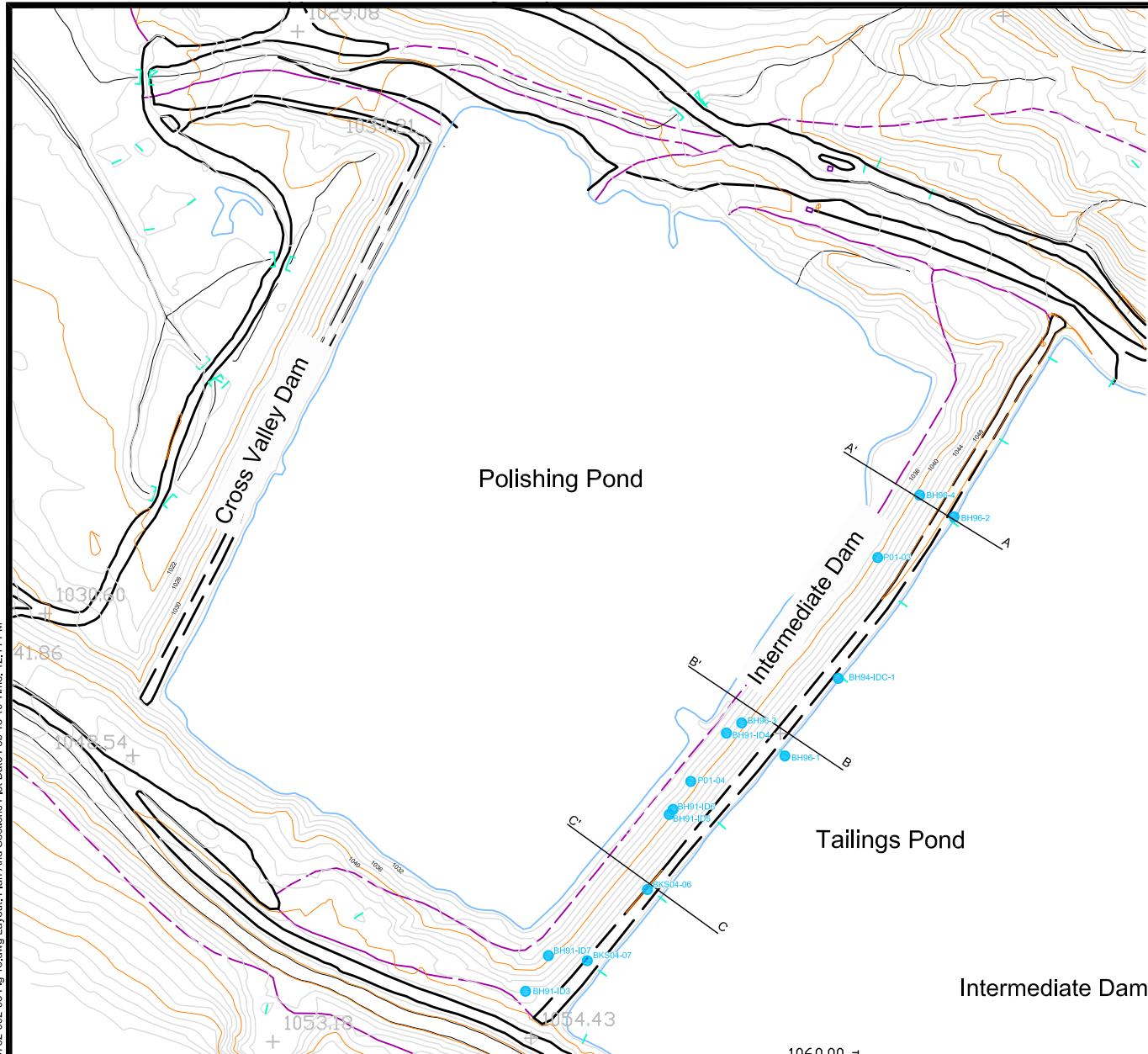
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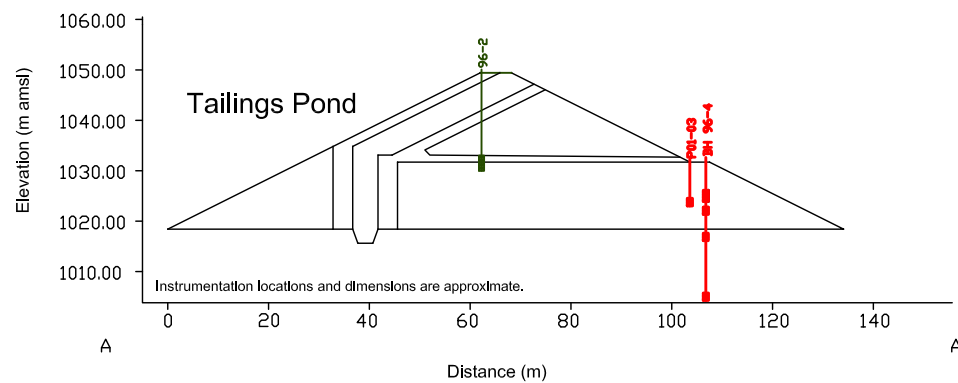


PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: INTERMEDIATE DAM INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	17	0

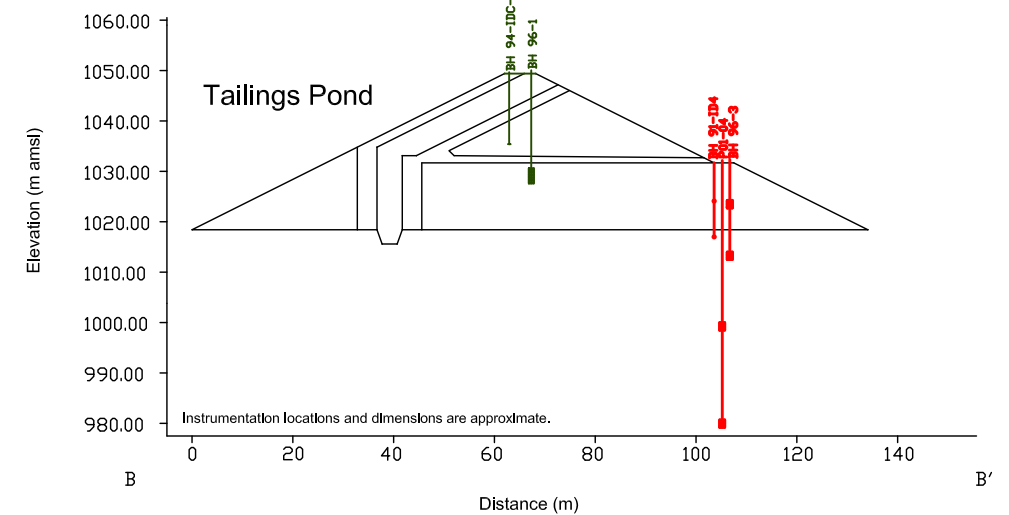


- Screened Intervals of Standpipe Piezometers
- ▬ Bottom of Standpipe Piezometers
- Pneumatic Piezometer Tips
- Crest Piezometers
- Downstream Toe Piezometers

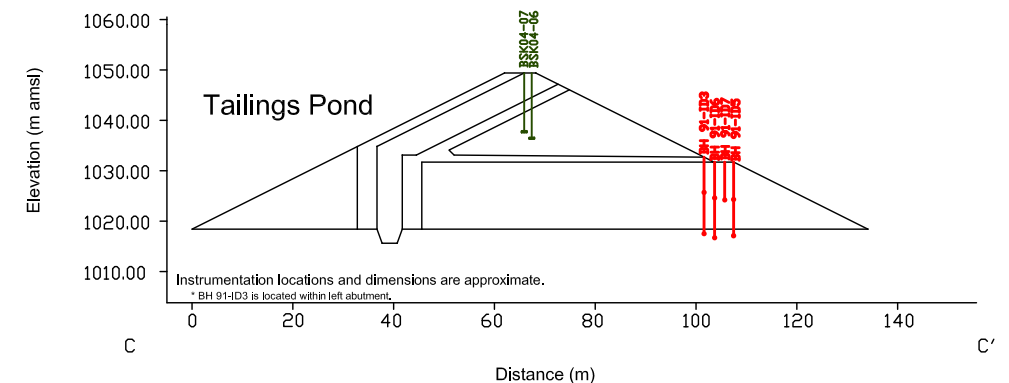
Intermediate Dam - Cross-Section A - A'



Intermediate Dam - Cross-Section B - B'



Intermediate Dam - Cross-Section C - C'



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CLIENT:

PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: SECTION VIEW OF INTERMEDIATE DAM		
PROJECT No.: 0762-002-05	FIGURE No.: 18	REV.: 0

K:\Projects\0762 Denison Environmental\02 2009 Annual Inspection And Report\05 Reporting\Graphics\Workspace\0762-002-05 Fig 18.dwg Layout: Plan And Sections Plot Date Feb 18 10 Time: 12:11 PM



July: shows the upstream face of the Cross Valley Dam.



July: shows a view of the crest of the dam.



July: looking along the upstream face of the dam at the riprap. Note the water level is lower than the historic high water marks. Some ice plucking damage was noted in 2009, and should be monitored regularly in 2010.



July: view of cracking in the upstream edge of the dam crest. This is likely due to frost action and should be graded and compacted.

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CLIENT:



PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW

TITLE: CROSS VALLEY DAM INSPECTION PHOTOS

PROJECT No.: 0762-002-05

FIGURE No.: 19

REV.: 0



July: shows a view of the downstream shell of the Cross Valley Dam.



Site Staff Photo, July: shows the crest of the dam after the crack has been repaired.



July: shows a crack in the crest of the dam. This is due to frost action and the area should be graded and compacted.



Site Staff Photo, July: shows a view of the crest and downstream face with re-graded compacted surface.

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CLIENT:  Denison Environmental Services

PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: CROSS VALLEY DAM INSPECTION PHOTOS		
PROJECT No.: 0762-002-05	FIGURE No.: 20	REV.: 0



July: shows a view of the downstream toe. Note the concentration of vegetation at the toe. This should be removed.



July: view of the wet location located on the right side of the dam toe.



July: Overview of the downstream toe area of the dam.



July: shows the seepage discharge weir and staff gauge.

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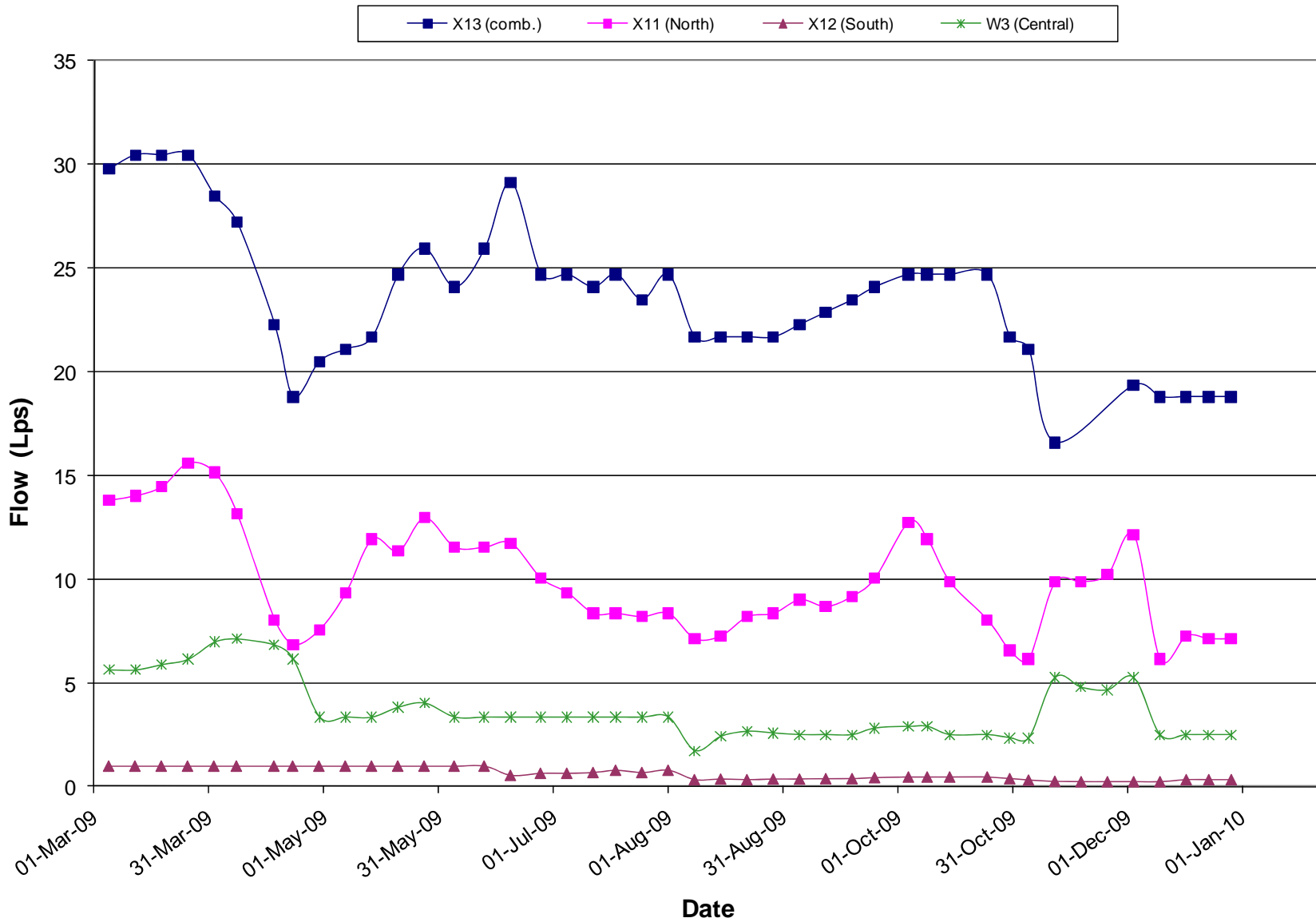
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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: CROSS VALLEY DAM INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	21	0



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PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE:	CROSS VALLEY DAM 2009 WEIR FLOWS		

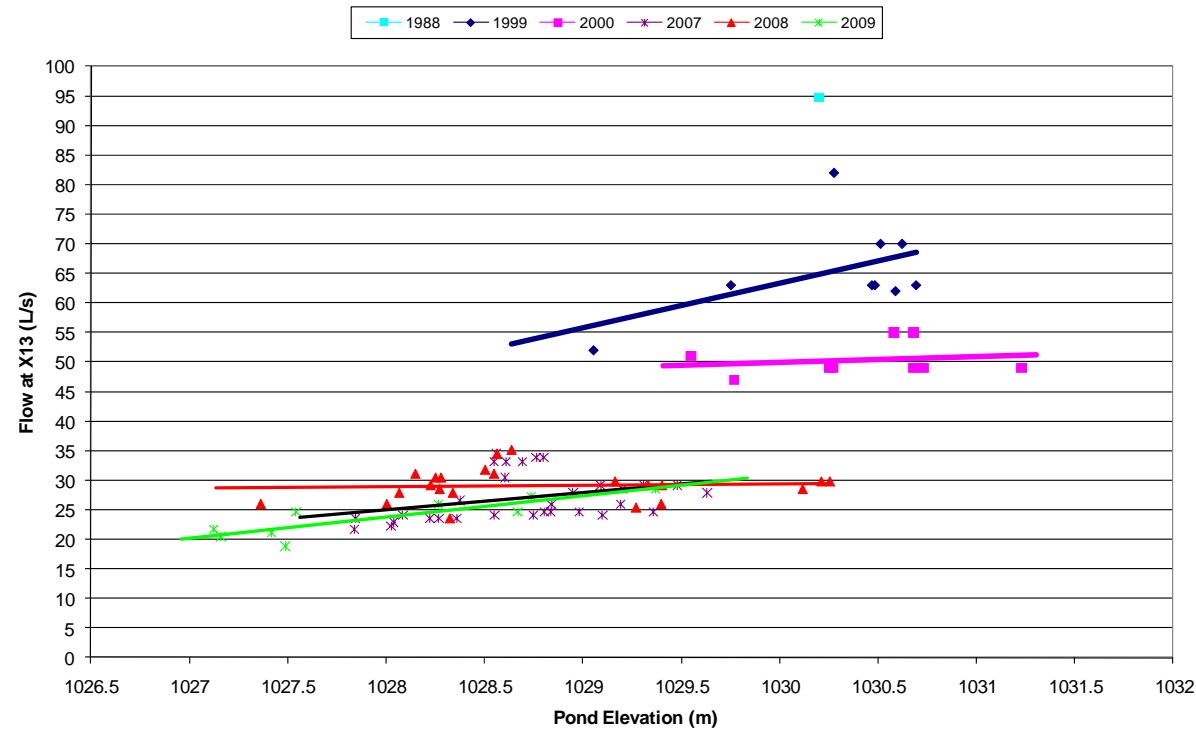
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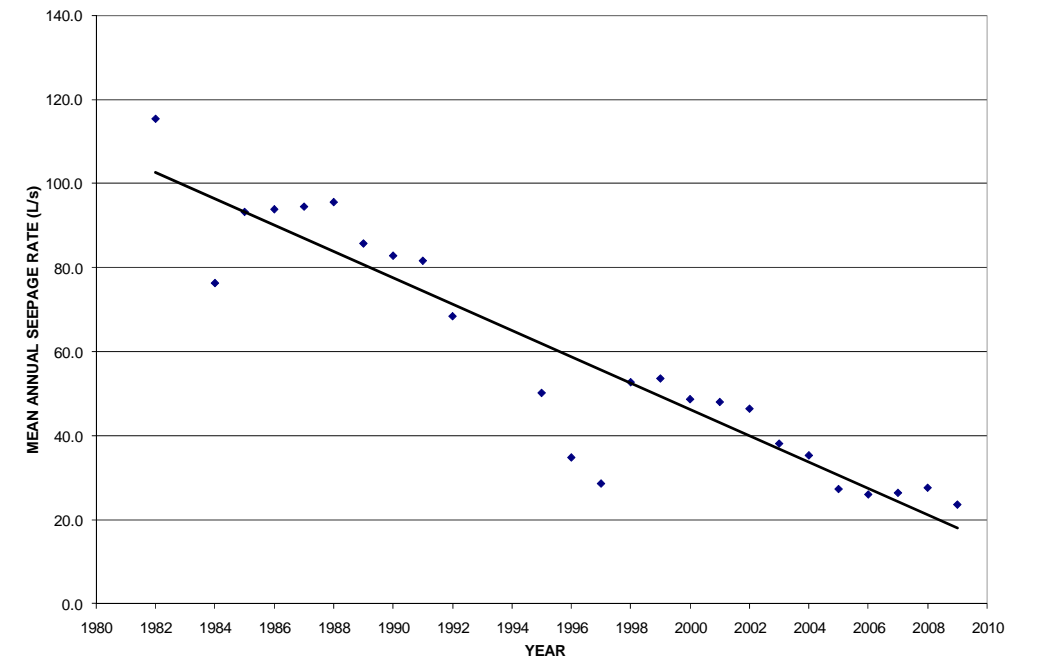
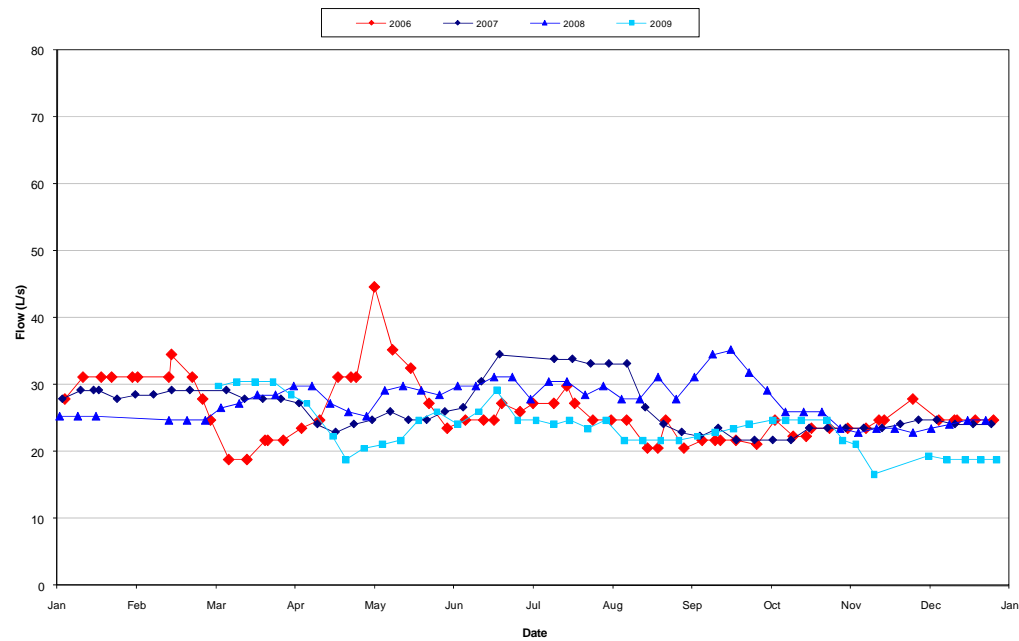
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Cross Valley Pond Elevation vs. Flow Rate at X13



MEASURED FLOW RATES AT X13 (L/s)



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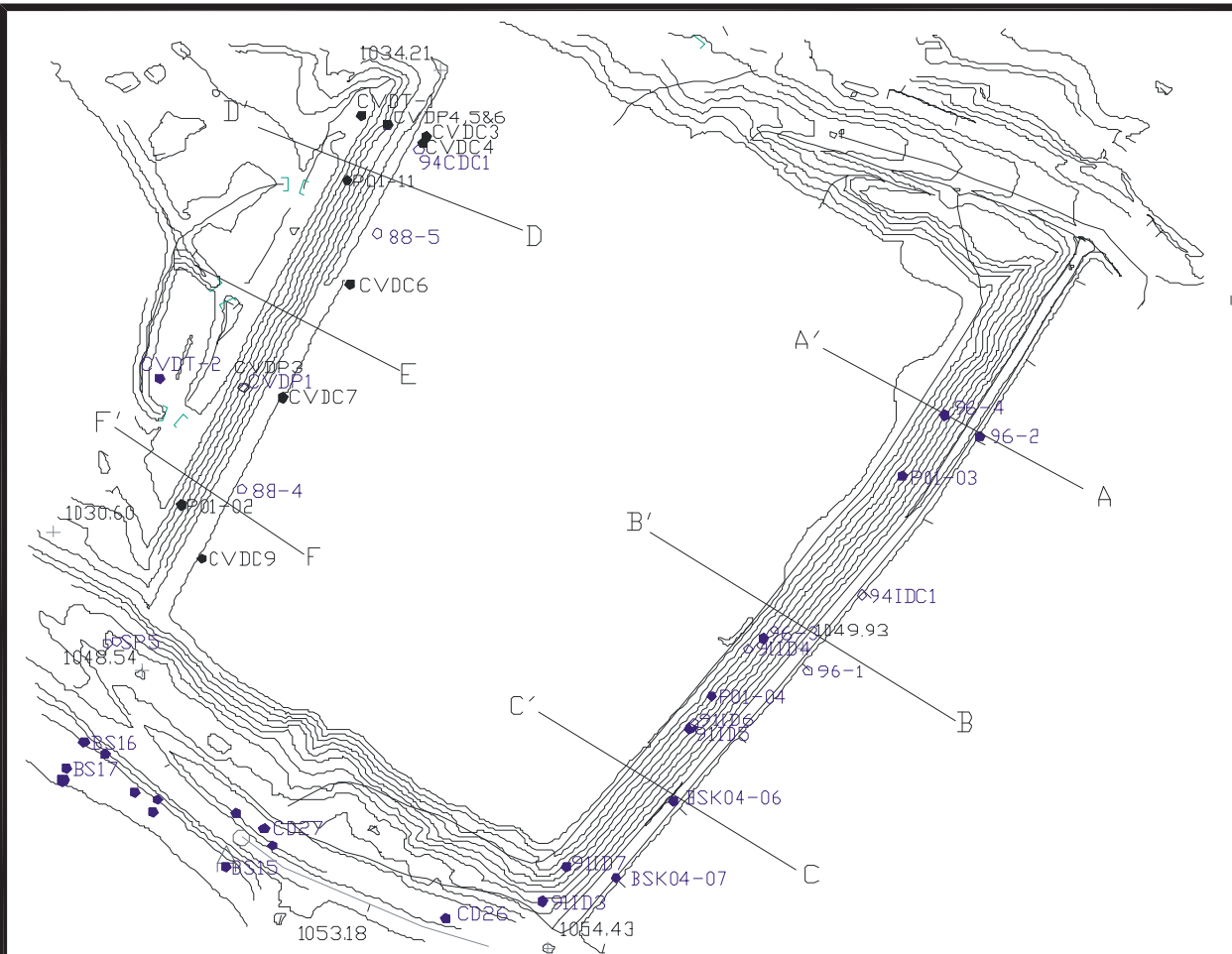
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2009 ANNUAL GEOTECHNICAL
EVALUATION AND INSTRUMENTATION REVIEW

TITLE:
CROSS VALLEY DAM MEASURED
FLOW RATES AT X13

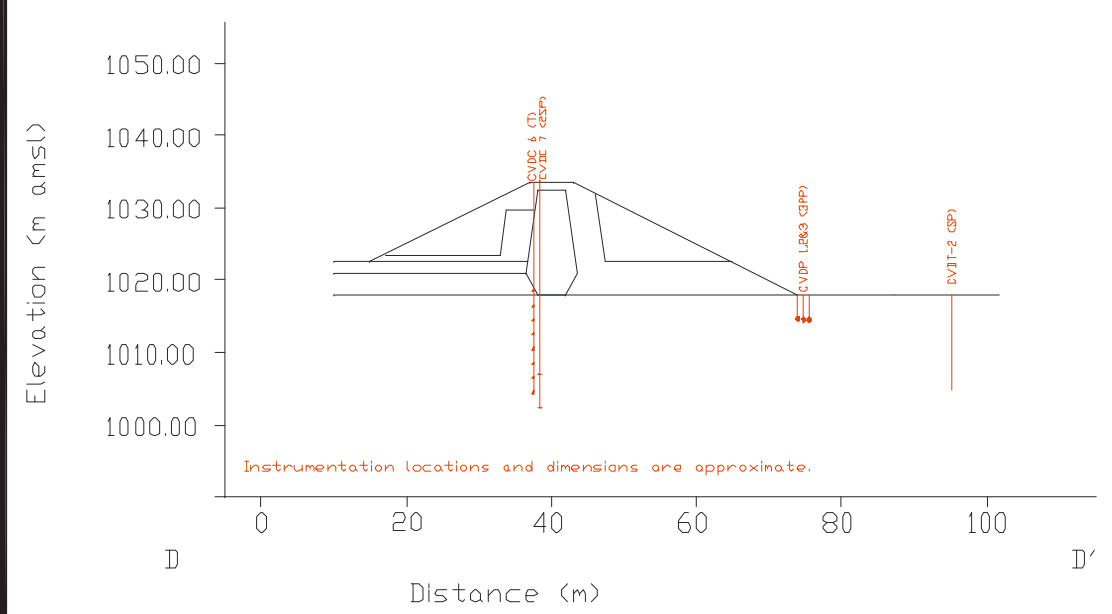
PROJECT No.:
0762-002-05

FIGURE No.:
23

REV.:
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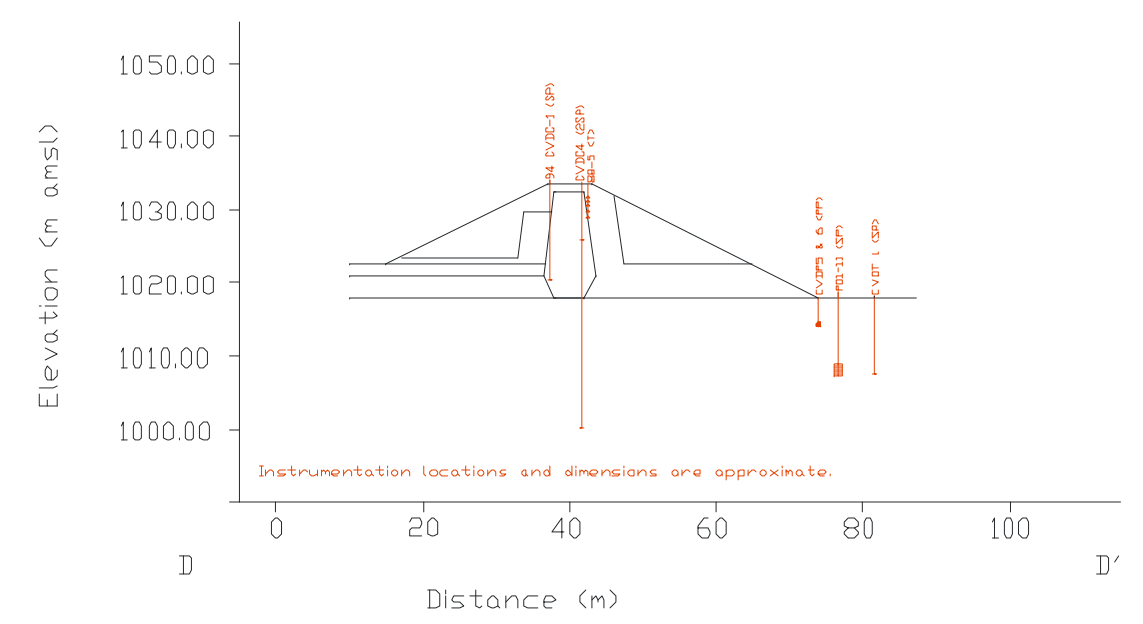


Cross Valley Dam - Cross-Section E - E'

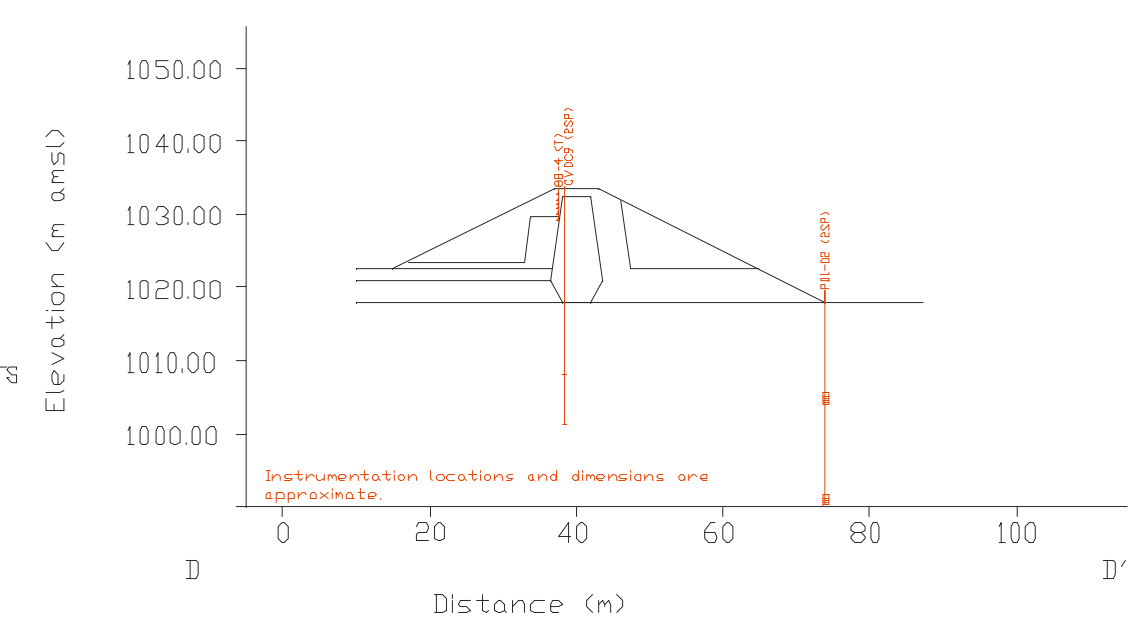


- SP Standpipe Piezometers
- PP Pneumatic Piezometers
- T Thermistor Cables
- Screened Intervals of Standpipe Piezometers
- └ Bottom of Standpipe Piezometers
- Pneumatic Piezometer Tips
- △ Thermistor Nodes

Cross Valley Dam - Cross-Section D - D'



Cross Valley Dam - Cross-Section F - F'



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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: SECTION VIEW OF CROSS VALLEY DAM		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	24	0



June: shows a view of the upstream head pond of the North Fork Rock Drain. Note that the pond level is higher than for the same flow 4 years ago. This appears to be due to beaver activity on the upstream face of the rock drain.



June: shows a panorama view of the upstream side of the North Fork Rock Drain

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SCALE:	N/A
DATE:	FEB 2010
DRAWN:	TMW
DESIGNED:	TMW
CHECKED:	HHH
APPROVED:	GWF

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CLIENT:



PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: NORTH FORK ROCK DRAIN INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	25	0



July: shows an overview of the downstream side of the North Fork Rock Drain. Note the erosion gully on the face.



July: looking towards the east limit of the upstream pond. Note that the water level is approximately 3 m below the high water mark that is indicated by debris deposited on the face of the drain.



July: a panorama view looking down from the crest of the Rock Drain.



July: Looking at the downstream drain from the crest.

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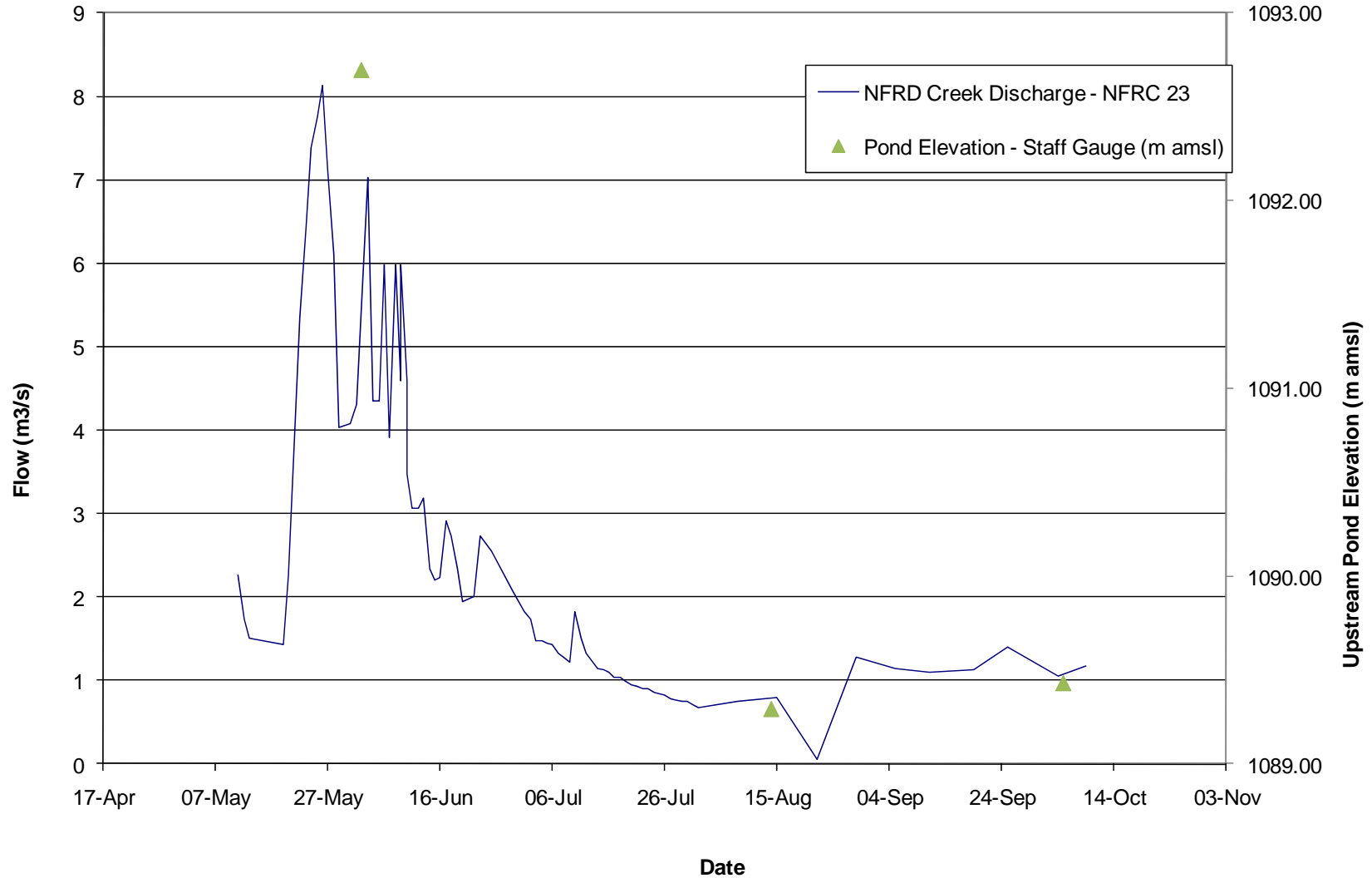
SCALE:	N/A
DATE:	FEB 2010
DRAWN:	TMW
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APPROVED:	GWF

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CLIENT: 

PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: NORTH FORK ROCK DRAIN INSPECTION PHOTOS		
PROJECT No.: 0762-002-05	FIGURE No.: 26	REV.: 0



SCALE:	N/A	DESIGNED:	TMW
DATE:	FEB 2010	CHECKED:	HHH
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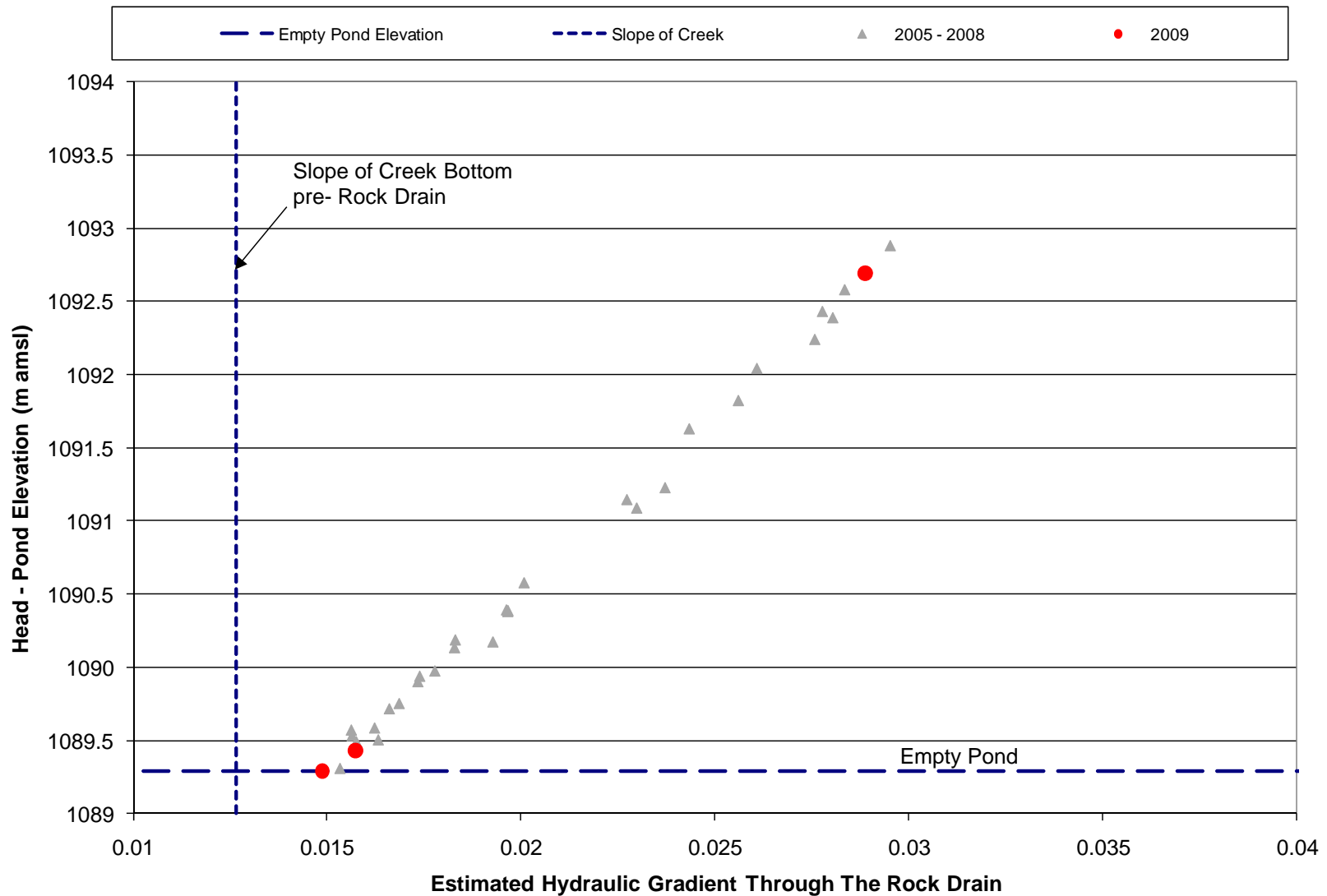
PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE:	NORTH FORK ROCK DRAIN MEASURED POND ELEVATION AND CREEK DISCHARGE		

CLIENT:



PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	27	0

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PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE:	NORTH FORK ROCK DRAIN FLOW THROUGH PERFORMANCE		

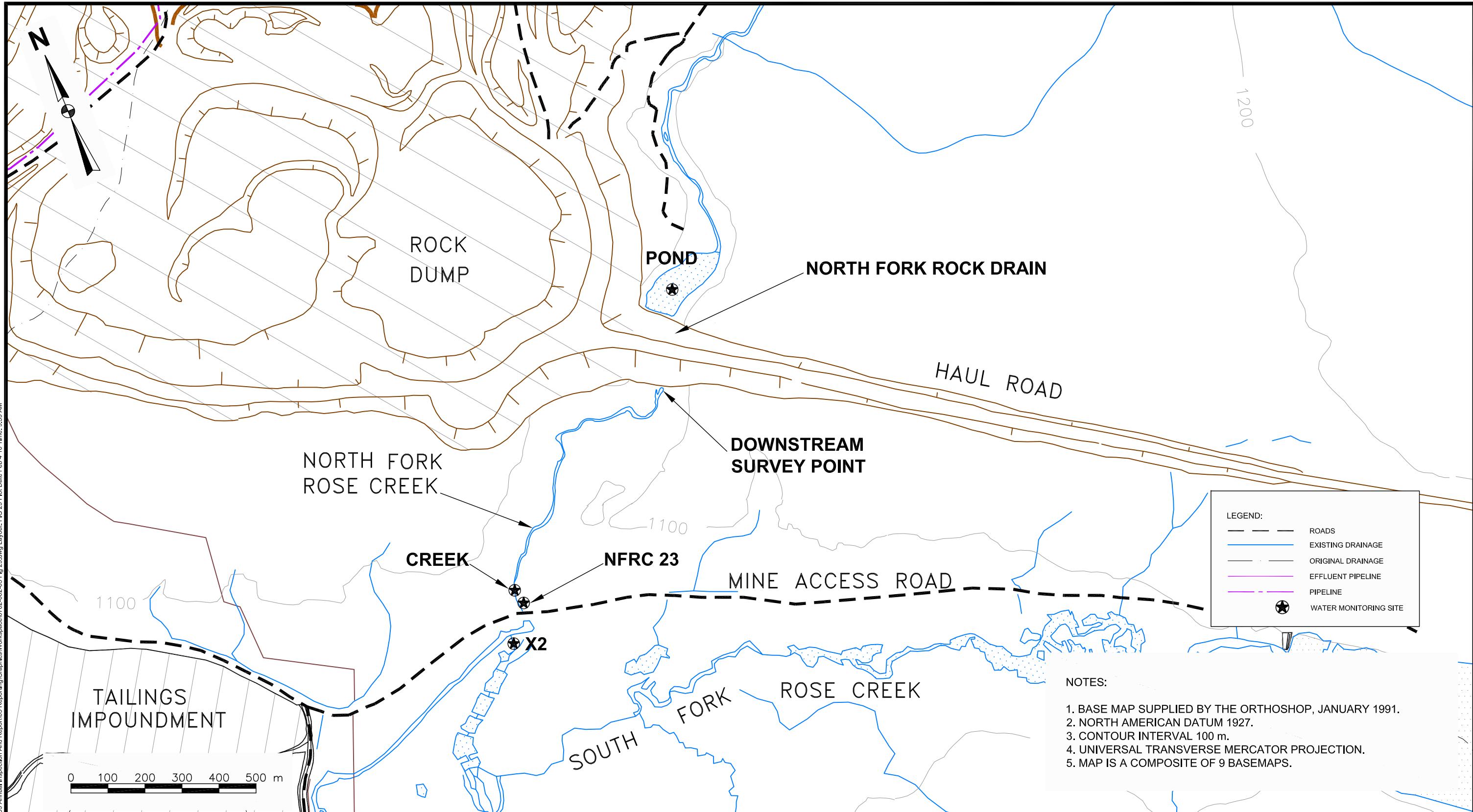
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PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	28	0

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: NORTH FORK ROCK DRAIN INSTRUMENT & MONITORING LOCATIONS		
PROJECT No.: 0762-002-05	FIGURE No.: 29	REV.: 0



June: an upstream view of the starting area of the diversion.



June: shows a view of an area with geotextile exposure.



June: shows an downstream view of the area that was repaired in 2007. Note that some of the fill is soft and cracking.



June: an upstream view of the channel, banks appear to be in good condition.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: FARO CREEK DIVERSION CHANNEL INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	30	0



June: shows a view of Faro Creek Diversion Channel looking downstream.



June: shows a downstream view of the canal and road.



June: shows the slope stability repair zone in the backslope. Note the slumping of the disturbed ground.



June: shows a view of the lower end of riprap placement in the Faro Creek Diversion. Riprap has been moved downstream and geotextile is exposed. No repairs needed.

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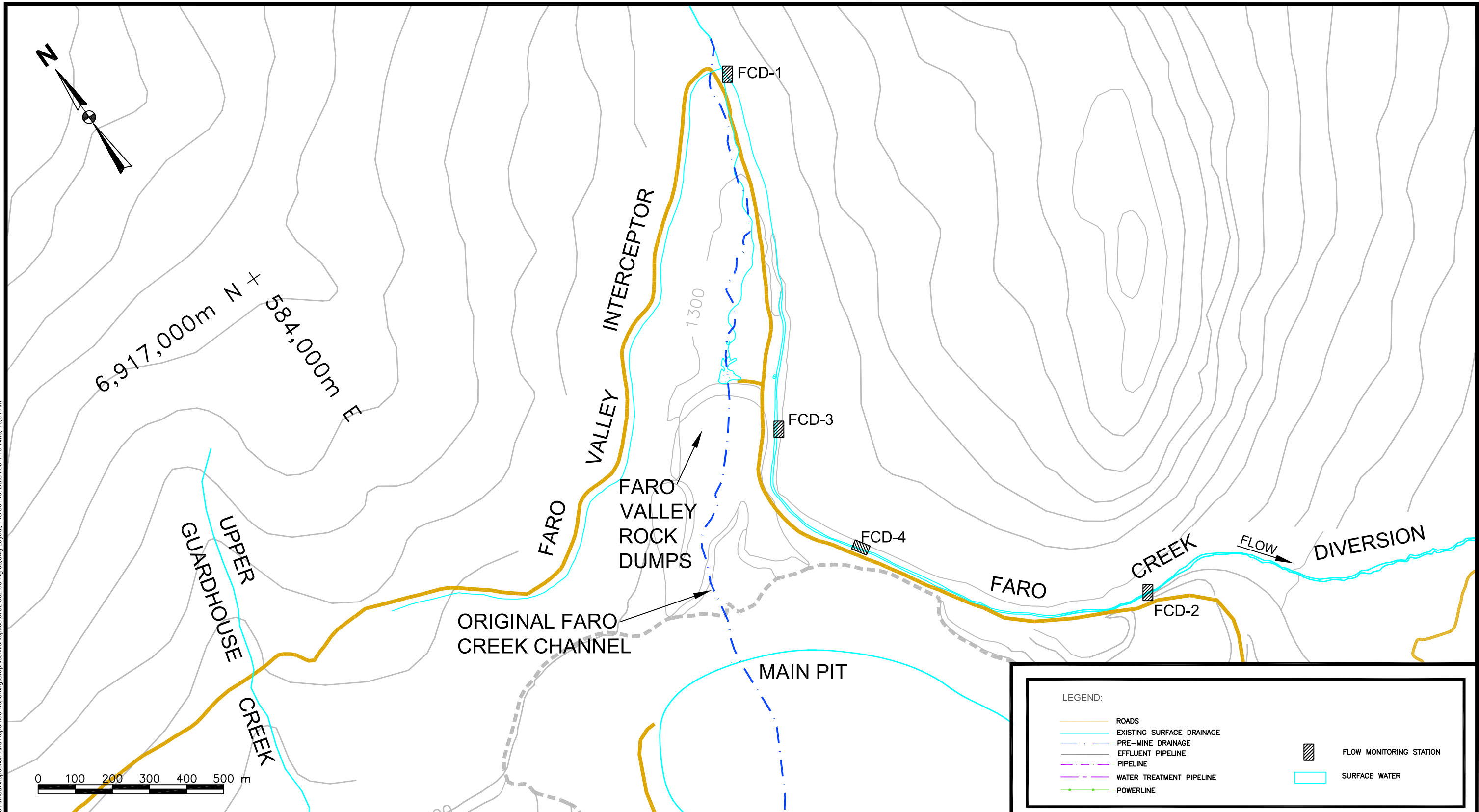
PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: FARO DIVERSION CHANNEL INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	31	0



June: a view of the repaired slough area which was caused partially by over steepened banks. The area is still restricting the flow through the channel. Repaired in July 2009 by site staff.

SCALE:	N/A	DESIGNED:	TMW		PROJECT:	2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW			
DATE:	FEB 2010	CHECKED:	HHH		TITLE:	FARO CREEK DIVERSION CHANNEL INSPECTION PHOTO			
DRAWN:	TMW	APPROVED:	GWF		PROJECT No.:	0762-002-05	FIGURE No.:	32	REV.:
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K:\Projects\0762 Denison Environmental\02 2009 Annual Inspection And Report\05 Reporting\Graphics\Workspace\0762-002-05 Fig 33.dwg Layout: Fig 33 Plot Date: Feb 4 10:04 AM



LEGEND:

- ROADS
- EXISTING SURFACE DRAINAGE
- - - PRE-MINE DRAINAGE
- EFFLUENT PIPELINE
- - - PIPELINE
- - - WATER TREATMENT PIPELINE
- - - POWERLINE
- FLOW MONITORING STATION
- SURFACE WATER

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: FARO CREEK DIVERSION MONITORING STATIONS		
PROJECT No.: 0762-002-05	FIGURE No.: 33	REV.: 0



July: shows a view looking South down the crest of the Secondary Dam.



July: a view of the downstream face of the dam with the diversion channel on the left side of the photo.



July: shows a view of erosion that is occurring on the lower road at the toe of the dam. This should be repaired by creating a channel to divert run-off.



July: looking down the upstream face from the crest of the dam.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVEIW		
TITLE: SECONDARY DAM INSPECTION PHOTOS		
PROJECT No.: 0762-002-05	FIGURE No.: 34	REV.: 0



July: shows the downstream side of the Secondary Dam. Note the pond at the Diversion Dam in the background.



July: shows the crest of the Secondary Dam.



July: A faint crack in the crest of the dam on the tailings side. Monitor the area in 2010 for deterioration.



July: shows the downstream face of the Secondary Dam.

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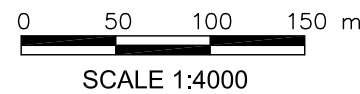
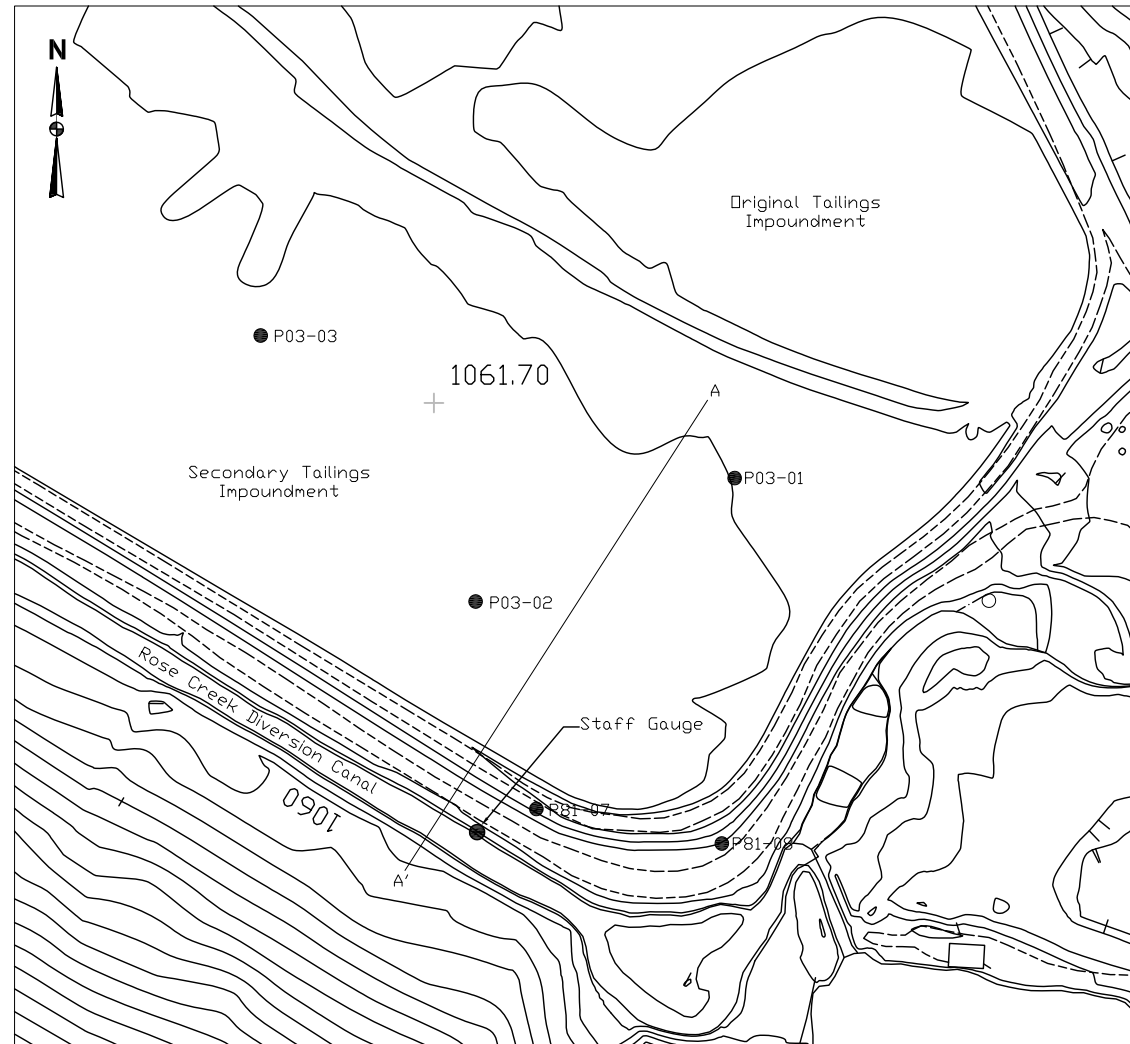
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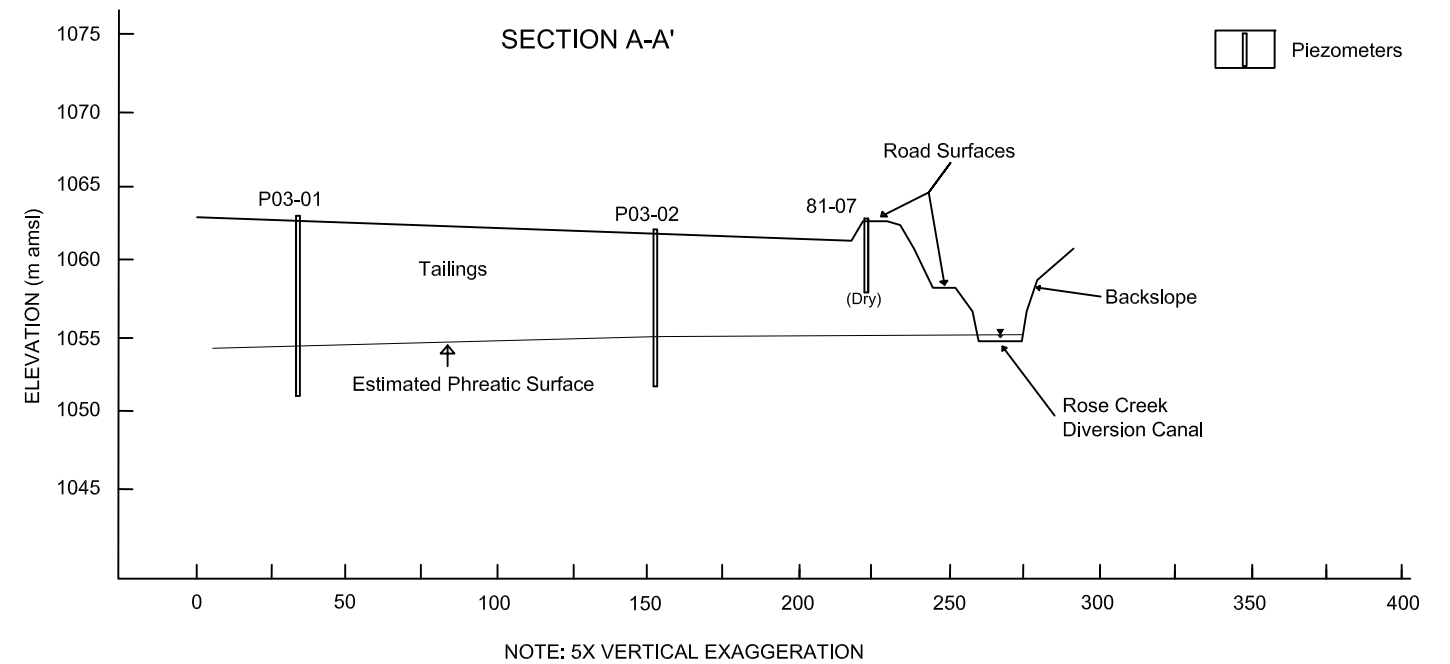


PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: SECONDARY DAM INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	35	0

K:\Projects\0762 Denison Environmental\2009 Annual Inspection And Report\05 Reporting\Graphics\Workspaces\0762-002-05 Fig. 36.dwg Layout: Figure 36 Plot Date Mar. 1 10 Times: 11:29 AM



NOTES: 1) DRAWING IS A SCHEMATIC, CONSTRUCTED FOR ILLUSTRATIVE PURPOSES ONLY.
2) ALL ELEVATIONS ARE APPROXIMATE.



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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW

TITLE: SECONDARY DAM CURRENT PIEZOMETRIC CONDITIONS

PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	36	0



June: shows the face of the upstream side of the rock drain



June: a view of the sediment and grass that is present on the upstream face of the rock drain.



June: a view looking down the upstream face of the rock drain at the upstream pond.



June: shows the downstream face of the rock drain with water flowing clearly from the toe.

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PROJECT: 2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENTATION REVIEW		
TITLE: K8 CREEK ROCK DRAIN INSPECTION PHOTOS		
PROJECT No.:	FIGURE No.:	REV.:
0762-002-05	37	0

2010 INSTRUMENTATION READINGS SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	10	10	10	10	10	10	10	10	10	10	10	10
1. Diversion Canal												
THERMISTORS												
- Canal Dyke: CD-15, CD-21, BGC05-04, BGC05-07, CD-26					***	***			***			
- Spoil Pile: SP-3, SP-5						***						
Backslope: BS-5, BS-9, BS-10, BS-12	* Not read in 2010											
SLOPE INDICATORS												
- Canal Dike: CD-10, CD-15, CD-19, CD-21, BH94CD-1, BH91-CD1, BGC05-05, BGC05-08					***				***			
- Spoil Pile: SP-2, SP-5						***						
Backslope: BS-5, BS-9, BS-10	* Not read in 2010											
PIEZOMETERS												
- Canal Dyke: CD-13, CD-15, CD-21 BGC05-02, BGC05-03, BGC05-06, CD-26					***	***			***			
Backslope: BS-5, BS-9	* Not read in 2010											
STAFF GAUGE: RCDC-4, New Staff Gauges⁵				daily	daily	daily	daily	daily	daily			
2. Cross Valley Dam												
THERMISTORS - CVDC-6, BH88-4					***	***			***			
PIEZOMETERS: CVDC-4, CVDC-7, CVDC-9, CVDT-1, CVDT-2, CVDP-1, CVDP-3, CVDP-5, CVDP-6, 94 CVDC-1, P01-11²					***	***			***			
WEIR FLOWS¹: X-11, X-12, W3³	***	***	***	***	***	***	***	***	***	***	***	***
WEIR FLOWS¹: X-13	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
POLISHING POND WATER LEVEL	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
3. Intermediate Dam												
PIEZOMETERS: 91ID-4, 91-ID-6, 91-ID-7, 94-IDC-1, 96-1, 96-2, 96-3, 96-4, P01-03², P01-04², BKS04-06, BKS04-07					***	***			***			
91-ID3 (with seepage observations near south abutment)					***	***		***	***			
RETAINED POND WATER LEVEL	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
4. Secondary Tailings Dam												
PIEZOMETERS: P81-6, P81-7, P81-8; P03-01⁴, P03-02⁴, P03-03⁴					***	***			***			
5. North Fork Rock Drain												
DATALOGGERS (automatic): Need to re-install.												
STAFF GAUGES¹: NFRD23 and X2				daily	daily	daily	weekly	weekly	weekly	weekly		
Survey or Staff Gauge: Pond, Toe of drain					weekly	weekly	weekly	bi-weekly	bi-weekly			
6. Faro Creek Diversion Channel												
STAFF GAUGES: FCD-1, FCD-2, FD-3 ⁶ , FD-4 ⁶				bi-weekly	bi-weekly	bi-weekly	bi-weekly	bi-weekly	bi-weekly	bi-weekly		

NOTES:

- 1 Confirm accuracy of monitoring techniques.
- 2 Before monitoring P01 series monitoring wells, confirm with AECOM staff in Whitehorse that it is alright to do so.
- 3 Monitor Instrumentation twice per month
- 4 Monitored as part of Environmental Monitoring Program, provide elevation data to BGC
- 5 Scheduled for installation in 2010, need to develop rating curves for new instruments.
- 6 Need to establish rating curve for these staff gauges.

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TITLE:	2010 MONITORING SCHEDULE		
PROJECT No.:	0762-002-05	FIGURE No.:	38
REV.:	0		



DENISON ENVIRONMENTAL SERVICES

2009 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENT REVIEW

VOLUME 2 OF 2

VARIOUS FACILITIES AT FARO MINE, YUKON

FINAL

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**APPENDIX I
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(JULY)**

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APPENDIX IV
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