BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

DELOITTE & TOUCHE INC.

2004 ANNUAL REPORT

FRESH WATER SUPPLY DAM BREACH PROJECT
FARO MINE, YUKON

FINAL

PROJECT NO.: 0257-024-03
DATE: FEBRUARY 23, 2005

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Project No. 0257-024-03
February 23, 2005

Mr. Doug Sedgwick
Deloitte & Touche Inc., as Interim Receiver for Anvil Range Mining Corporation
Suite 1900, TD Centre
79 Wellington Street West
Toronto, ON
M5K 1B9

Re: 2004 Annual Report
Fresh Water Supply Dam Breach Project, Faro Mine, Yukon

Dear Mr. Sedgwick:

Please find attached our Annual Report for the Fresh Water Supply Dam Breach Project (FWSB) at Faro Mine. This report has been prepared to comply with the terms of Water Licence QZ03-058. This report contains the assessment of the physical performance of the breach, the success of the re-vegetation activities and a report on the aquatic environment. Copies of this report have been issued in accordance with the distribution list noted on the cover.

If there are any questions regarding this report, or if you require any other services, please contact the undersigned at your convenience.

Yours truly,
BGC Engineering Inc.
per:

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

encl.: Final report
GWF/sf

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LIMITATIONS OF REPORT

This report was prepared by BGC Engineering Inc. (BGC) for the account of Deloitte & Touche Inc. The material in it reflects the judgement 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 Engineering Inc. 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 and authorization for use and/or publication of data, statements, conclusions or abstracts from or regarding our reports and drawings is reserved pending written approval by BGC.

1.0 INTRODUCTION

1.1 Background

The Fresh Water Supply Dam Breach Project (FWSB) was undertaken in November/December 2003, in accordance with the terms and conditions provide in the Yukon Water Board Licence Number QZ03-058 (the Licence). This licence is in effect until December 31, 2008 and provides details on reporting, effluent quality standards, monitoring and surveillance required for this specific project.

The 2004 Annual Report provided herein has been prepared in accordance with the provisions of Part A, Sections 13 and 14 of the Licence. This report provides a summary of the performance of the breached FWS Dam at the Faro Mine site. In addition to commentary related to the physical performance of the engineered breach section, this report provides details regarding the re-vegetation of the reservoir and the aquatic life in the creek channel, tributaries and channel downstream. Deloitte & Touche Inc. (Deloitte) is the Interim Receiver for Anvil Range Mining Corporation (ARMC) and they currently manage the site activities. This report was prepared by BGC Engineering Inc. (BGC) based on information collected by BGC staff, ARMC site staff, White Mountain Consulting (WM) and Arctic Alpine Seeds (Arctic Alpine).

This report presents water quality monitoring results as indicated in Part C, Section 25 and Part D, Section 33 of the Licence. The field information presented in this report was gathered by ARMC staff. The physical monitoring program described in Part C, Section 33 of the Licence was performed by BGC and is presented in this report. An As-Built Report on the construction of the breach (SRK & BGC 2004) was prepared which described the activities undertaken as part of the construction of the breach section through the Fresh Water Supply Dam. The As-Built Report was required by Part C, Section 31 of the Licence and was submitted along with last year's annual report.

The annual inspection and assessment of the re-vegetation of the former reservoir area and the breach area, required in Part C, Section 34, were performed by Arctic Alpine and is attached to this report. The attached 2004 re-vegetation report combines a description of the re-vegetation efforts of 2003/2004 and then provides a summary of the performance of the re-vegetation only for the areas planted in 2003.

An assessment of the riparian conditions, availability of spawning and rearing habitat and fish sampling to determine densities (performed by WM) is attached in a separate appendix to this report. This assessment was committed to in the original design report (SRK et al. 2003) and the Environmental Management Plan (EMP) prepared as part of the Water Licence application.

1.2 Scope of Services

BGC provided a proposal (No. 05-056) for the preparation of this Annual Report. The scope of work described in the proposal was to:

1. Provide input, review and interpretation of monitoring data collected by site staff at the FWSB project site. Prepare and submit monthly reports on the monitoring activities to the Water Board (as per Part A, Section 15 of the Licence).
2. Perform a May site visit to examine site conditions at the FWSB and K8 Creek project sites following the spring freshet, as detailed in the EMP.
3. Perform a September site visit to examine conditions near the end of the open water season.
4. Prepare and submit Annual Report for the FWSB project. This will include the annual inspection of physical conditions to be performed by BGC as well as the reports prepared with respect to the re-vegetation and aquatic requirements.

Authorization to proceed with the work was provided by Mr. Doug Sedgwick of Deloitte.

2.0 FACILITY OVERVIEW

Faro Mine is located in the central Yukon, approximately 200 km north-northeast of Whitehorse. The mine site is situated approximately 22 km north of the town of Faro, as shown in Figure 1. The former FWS Dam and reservoir are located south of the main access road to the Faro Mine, approximately 5 km from the mine guard house.

The FWS Dam was constructed in 1968 on the south fork of Rose Creek. The FWS Dam was a zoned earth fill dam that was used to store fresh water for mine-processing operations during the operational life of the mine. The FWS Dam was approximately 410 m long, 20.5 m high at its highest point and 6 to 7 m wide at the crest. The slope of the downstream face of the dam was approximately 2H:1V and the slope of the upstream face of the dam was approximately 2.6H:1V. A 30 m wide, 3.2 m deep concrete spillway is still located at the north abutment of the breached dam. The crest of the FWS Dam is at a nominal elevation of 1099.3 m above mean sea level (amsl), based on the geodetic survey conducted in 2002.

The FWS Dam was breached in a controlled manner in November/December 2003, in accordance with a design and regulatory requirements prepared for this project. Design for the breach of the dam was presented in a Final Design Report (SRK et al. 2003). Information related to the construction activities during the breach was presented in an As-Built Construction Report (SRK & BGC 2004).

The dam breach design included an engineered breach through the body of the dam along the approximate alignment of the original creek channel and re-establishment of the pre-construction creek through the reservoir (SRK et al. 2003). The design approach included the concept of adaptive management for the work required in the former reservoir and in the channel downstream of the actual construction area. Adaptive management in this case meant that continuing reviews of the re-forming channel in the former reservoir and the remaining portion of Fresh Water channel would not be engineered per se as part of the breach work, but evaluated and remediated on an as-needed basis.

The breach and channel construction completed consists of a 315 m long section through the former footprint of the dam, as shown in Figures 2. The main components of the breach works are; the floodplain (20 m wide), the channel (8 m wide), the erosion protection along the edge of the floodplain, the inlet structure and the five riffles within the channel.

SRK et al. 2003 noted, that given the winter construction period, some frozen material may be incorporated in the construction zone. If this occurred, settlement of some of the areas could be expected in the summer months. Therefore, as part of the overall construction plan, repairs due to this phenomenon would be evaluated in 2004 and repairs would be performed in the Fall of 2004. Such settlement did occur at Riffle 3 and repairs were undertaken, as detailed in Section 4.

Another component of the project was the rehabilitation of a tributary creek, K8, into the reservoir, as shown on Figure 1. This creek experienced down cutting of the channel base due to scour erosion where the creek entered the former reservoir footprint. This area was repaired in early 2004, prior to the onset of spring freshet. A description of the work performed to rehabilitate the creek bed and banks, where the creek entered the former reservoir, was described in another As-Built Report (BGC 2004).

3.0 MONITORING RESULTS

As noted in Section 1, monitoring of the flow quantity and total suspended solids (TSS) is required as part of the licence. Two sampling points are specified in the licence: FWSB 1 is located at the gun club bridge approximately 1.5 km upstream of the limit of the reservoir and FWSB 5 is located downstream of the limits of the 2003 construction area, as shown on Figure 1. These sample points were monitored twice per month during the period April through August. The results were submitted in monthly reports to the Yukon Water Board; copies of these reports are included in Appendix I.

A summary of the results obtained for FWSB 1 is contained in Table 1. Flow measurements were not collected during the initial part of 2004 due to ice cover and dangerous conditions in the creek for the in-stream measurements during the high flow period. This data is also plotted in Figure 3, showing a high TSS values during the high flow periods and no/minimal TSS during low flow periods. The results for FWSB 5 are contained in Table 2 and are plotted in Figure 4. Similar to the results for FWSB1, the high TSS values correspond to the high flow period.

A comparison of the TSS measurements at these two stations is contained in Figure 5. This shows that TSS is generally higher downstream of the former reservoir (maximum TSS of 96 mg/L) and breach works than upstream (maximum TSS of 26 mg/L). This result confirms the expectation in design, given that the south fork of Rose Creek is finding its original channel through the former reservoir. The highest TSS measured at FWSB 5 was 96 mg/L during the spring freshet period compares well with the predicted range of 80 to 330 mg/L (SRK et al. 2003) for peak TSS from the former reservoir. Previous TSS measurements at locations upstream of mine disturbance have ranged from 4 to 698 mg/L (SRK et al. 2003), indicating that such TSS are within the typical range experienced in the region.

A comparison of the flow measured (litres per second or LPS) at the two stations is provided in Figure 6. The last three flow measurements generally represent base flow conditions and indicate that the flow in the South Fork of Rose Creek does not increase in the 3.5 km reach between the monitoring locations. This result is despite the two tributaries that join the South Fork of Rose Creek between the stations and is thought to be due to seepage out of the creek into the ground. A more typical result for higher flow periods is represented in the first data point, where the flow downstream is about 100 LPS greater than upstream.

The chemical testing results for water collected at FWSB 6, the run-off from the potentially acid generating (PAG) spoil area (Figure 1), are shown in Table 3. Included on this table are the maximum discharge criteria provided in the Licence. Based on the grab sample tested, the water did not exceed any of the License criteria.

4.0 GEOTECHNICAL INSPECTION

BGC staff members were on-site twice during 2004 to undertake visual inspections of the completed construction works at the FWS Dam breach and K8 locations. Mr. G. Ferris, P.Eng. visited the Faro Mine site during the period May 26 to 28, 2004. The purpose of this May visit was to inspect the performance of the constructed works, the creek and tributaries during the first spring freshet period. Mr. J. Cassie, P.Eng. visited Faro Mine during the period September 28 to 30, 2004. This inspection corresponded to the annual inspection visit for other facilities at the Faro Mine and documented the conditions at the end of the first summer since construction.

The facilities were inspected during a walking tour. A camera and Dictaphone were used to record conditions and observations. The photographs, along with recorded observations, are compiled into a Field Record Summary that is kept in BGC's files. The observations made during the May and September site visits are summarized within this section of the report. The observations of the more recent September visit took precedent over observations made in May. In addition to these two main inspection visits, BGC personnel were onsite during the rehabilitation of the K8 creek site (BGC 2004) and during repairs to Riffle 3 undertaken in September 2004, as detailed later in this section of the report.

The purpose of the site inspections was to examine the facilities in detail for evidence of deficient performance and possible maintenance, to provide a basis for possible adjustment to the frequency of monitoring and to review points of immediate concern and maintenance with site representatives. Upon return to the office, a Field Memo was prepared that outlined the status of the various structures inspected, highlighted items of concern and items requiring immediate attention. These inspection memos are attached in Appendix II.

Two different views of the FWSB project area are shown in Figure 7. Included on the aerial view are the locations of the slump, tension cracks, erosion gullies and Riffle 3. The location of these feature, except the erosion gullies, are shown on the view from the north limit of the breach.

In general, the channel section through the breach worked as designed. The majority of the creek flow was concentrated in the channel section, even during the highest flow period of 2004, as shown in Figure 8. During the high flow period, erosion of some of the soil placed on top of the riffles and inlet structure occurred, as shown in Figure 9. Additionally, some erosion occurred along the edges of the channel; this level of erosion was expected and was allowed as part of the adaptive management scheme for this project.

Once the flow volume decreased in the summer, the extent of the erosion at the riffles and channel edge was revealed, as shown in Figures 8 and 9. Except for Riffle 3, the amount of erosion occurring was within the original expectations and therefore did not require repairs. At Riffle 3, it was estimated that between 10 and 15% of the total water flow was bypassing the main channel on the left side of the floodplain, as shown on Figure 10. This bypassing flow appeared to be due to settlement of the riffle crest. As outlined in SRK et al. 2003, this occurrence was predicted and allowed for in the project plan. Repairs to Riffle 3 were undertaken in September 2004. The repair involved placement of additional rip rap on the left side of the riffle, thereby bringing the crest elevation of the riffle on the left side equal to the elevation on the right side. Detailed photos of the repair are shown in Figure 11. The repair required the placement of approximately 8 m^3 of rip rap. The source for this rip rap was a small stockpile left over from the original construction of the breach.

In addition to the riffle repair, some cracks and slumping were evident above the upper limit of the erosion protection. This slumping appeared to be related to the steep nature of the excavations made to install the erosion protection. One larger-scale tension crack was encountered on the south bank of the excavation section between Riffle 2 and Riffle 3, as shown on Figure 11.

A significant slough developed on the south valley wall, just upstream from the south abutment of the breached dam. A view of the development of this slough is shown in Figure 11. The slough appears to be driven by seepage from the valley wall. It is expected that the slough will continue to grow in size as additional seepage occurs. It may be necessary to backfill the toe of the slough area with coarse gravel or rock to prevent the enlargement of the slough. Drainage of water from this seepage exit point to the breach will continue occur following repairs. Visual monitoring should be undertaken to ensure that seepage water does not carry any sediment into the nearby creek.

During the May inspection the berm placed around the PAG stockpile was full of water. This water was sampled (FWSB 6) and tested. The results of this testing was reported in Section 2 and summarized on Table 3.

The recent repair at the K8 Creek (Northeast Tributary) appears to have stopped the scour erosion of the creek base. Some re-channelization is occurring as the creek exits the former borrow pit. Views of the repaired section are shown under freshet flows and normal flow conditions in Figure 12. There are no signs of additional erosion were the rip rap was installed. Development of a fan deposit continues below the repaired section of the channel.

5.0 RE-VEGETATION

The re-vegetation monitoring program described in Part E of the license was performed in 2004 by Arctic Alpine; their full report is included as Appendix III. The Arctic Alpine report covers two aspects:

1. An evaluation of the success of the re-vegetation of the reservoir performed prior to the breaching of the dam in 2003.
2. A description of the activities related to the re-vegetation efforts undertaken in 2003 and 2004.

The evaluation of the re-vegetation success was undertaken for two different phases of planting. Phase I planting occurred between Elevations 1096 and 1090 m amsl in June 2003. In September 2004, this area had an overall vegetative cover of 95%. Phase II planting occurred between Elevations 1090 and 1086 m amsl in September 2003. In September 2004 this area had an overall vegetative cover of 80%, with the majority of the non-vegetated area due to standing water on the former reservoir base.

In addition to the above mentioned seeding, in 2003, a number of trial sites for riparian vegetation (willow and tree) were established to prove the planting methodology for the planned species. Evaluation of these sites in early 2004 indicated the successfulness of the methodology for the species planted. Therefore, based on this successful trial, the riparian area was planted in 2004, except for a small portion of the northeast tributary where the final channel location was not yet established. This area should be evaluated in 2005 to determine where the final channel position is established and then the riparian vegetation program should be completed in 2006.

During 2004 seeding of the remaining areas within the former reservoir, the breach and the spoil piles were completed.

6.0 AQUATIC ENVIRONMENT

An evaluation of the aquatic environment, as described in SRK et al. 2003 and the EMP for the project, was completed by WM. Their full report is attached in Appendix IV.

WH presented information related to fish species and habitat conditions within the five reaches covering the former reservoir, the breach section and a reach downstream from the breach construction area. This study also covered a short reach of Rose Creek downstream from the lower limit of the diversion canal to Station X14. A full description of the reaches, including justification for the reach breaks, is contained in the WM report.

The study made the following conclusion concerning habitat and fish utilization in the study areas:

- Reach 1 has excellent fast water cover for small fish in the form of deep spacing between boulders and turbulent flows. Nineteen Arctic greying, 7 Burbot and 10 Slimy Sculpins were encountered during electro-fishing (maximum from two passes).
- Reach 2 has very limited cover. Five Arctic greying, no Burbot and 69 Slimy Sculpins were encountered during electro-fishing (maximum from two passes).
- Reach 3 has limited amounts of cover occur in the upper parts of the reach, but the cover increases from undercut banks and increased depth in the portion of this reach. Several areas of the reach may provide possible Arctic grayling spawning areas. Four Arctic greying, 7 Burbot and 21 Slimy Sculpins were encountered during electro-fishing (maximum from two passes).
- In Reach 4, the newly created channel provides good fish habitats. Fish cover amongst the cobbles and boulders is enhanced by the depth and the adjacent riffles. Nineteen Arctic greying, 6 Burbot and 13 Slimy Sculpins were encountered during electro-fishing (maximum from two passes).
- In Reach 5, boulders and cobbles are clear of fines and provide good interstitial spacing. Well established riparian vegetation exists through the reach. Twenty one Arctic greying, 5 Burbot and 6 Slimy Sculpins were encountered during electro-fishing (single pass).

- In location X-14 (Rose Creek downstream of the Rose Creek Diversion Canal), the native channel below the diversion channel provides a mix of habitat types with long glide areas, deep flowing pools, side pools and shallow gravel riffles. Cover is provided by large woody debris, root wads and submerged willows. Erosion and deposition occurs in a natural pattern with deep cut banks opposite and upstream from deposition areas. Excellent cover for larger fish occurs in this reach. Two Arctic greying, 2 Burbot and 124 Slimy Sculpins were encountered during electro-fishing (single pass). In addition, the 14 minnow traps captured 23 juvenile Chinook salmon. Prior to this study, only unconfirmed reports of salmon within the RCDC had been made.

The conclusions of the fish utilization study were:

- Slimy sculpin adults were well dispersed throughout the study area, sculpin fry (0+ years) were common in Reach #2, uncommon in Reach #3 and absent from the rest of the reservoir basin. Single pass electro-fishing at X-14 indicated a large numbers of slimy sculpin adults were recorded; possibly a remnant population from fish released from the reservoir basin during fish salvage operations in 2003.
- Arctic grayling juveniles were common in Reach #1 and #4 and occasional in Reach #2 and #3. Numerous adult grayling were taken in Reach #5; the only other adult taken in the former Reservoir Basin was in Reach #3. Two Arctic grayling adults were electro-fished at X-14 and several were observed. General visual observations relating to Arctic grayling distribution through all reaches of the reservoir basin indicated that adult and sub adult were well dispersed through Reaches #3 and # 4 and occasional in #2 and #5. The densest aggregations of grayling near the reservoir basin occurred in the deep water areas immediately upstream of the old coffer dam. Numerous Arctic grayling adults were observed and angled at X-14. Arctic grayling were observed surface feeding and were easily angled at this site. The site has easy access and has been a popular angling location for locals. These grayling may be remnants from salvage releases, migrants unable or unwilling to pass into the diversion channel or resident fish.
- Minnow traps set at X-14 captured numerous juvenile chinook salmon. Juvenile chinook salmon were not recorded at any of the other sampling locations during this investigation.
- A single Arctic grayling with a tag was observed in Reach #3 on August 10, 2004 and an unconfirmed report of a tagged grayling being angled in the same reach in July was reported.

The recommendation resulting from this study was that some minor modifications be made at the inlet structure to ensure fish passage during low flow periods. This would most likely consist of the addition of some more rip rap on one portion of the structure.

7.0 RECOMMENDATIONS

The following section provides summary recommendations with respect to routine inspections, monitoring, maintenance and annual inspections for 2005.

7.1 Routine Inspections and Monitoring

The following routine inspection and monitoring should be performed by site staff, as part of good practice and in order to comply with the Licence:

- Monitor the flow quantity and TSS at FWSB 1 and FWSB 5 twice per month between April and August (inclusive).
- Monitor and sample the run-off from FWSB 6 for acidity and metals, once per year.
- Perform weekly visual inspections of the performance of the sideslopes and constructed creek elements. The three areas of concentration should be the slough near the south abutment of the dam, the erosion gullies near the inlet on the north side of the breach and the tension crack between Riffle 2 and 3 on the south side of the breach channel.
- Perform weekly visual inspection of the portion of the fresh water channel that was not modified as part of the breach construction (part of the adaptive management).
- Perform monthly visual inspection of South Fork of Rose Creek and tributaries through the former reservoir area, checking for channel blockage.

This data should be collected and reviewed as part of the annual review of the performance of the breach and to validate the adaptive management approach taken.

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 should also be notified so that the condition can be evaluated and to provide any necessary geotechnical advice related to the concern at hand. Photos of the changed condition should be taken.

7.2 Annual Reviews

The purpose of annual reviews is to provide a record of the performance of the facilities. The annual inspection of the physical performance of the breach and K8 creek area should be performed in May and September of 2005. The annual inspection of the re-vegetation and aquatic life/habitat should be performed in July / August 2005.

7.3 Recommendations for Remedial Actions

The following recommendations for remedial actions are made:

- The slough area located near the south abutment should be backfilled with coarse drain rock (gravel sized particles or larger) to both support the eroding area and permit the drainage of the seepage water.
- Repairs to the inlet structure to allow fish passage in low flow period, consisting of the hand placement of a small amount of additional rip-rap (likely performed in conjunction with the 2005 aquatic life/habitat study).
- Review the portion of K8 creek (northeast tributary) that has not, to date, established its final position. In 2006 the final position is established, complete the riparian re-vegetation efforts in this area.

8.0 CLOSURE

This report summarizes the physical conditions as observed by BGC, Arctic Alpine and WM and the water testing results as collected by site staff. Thank you for the opportunity to be of service to Deloitte & Touche and Faro Mine. Should you have any questions on this report, please contact BGC at your convenience.

Respectfully submitted,
BGC Engineering Inc.
per:

for Gerry Ferris, M.Sc., P.Eng. (AB)
Geotechnical Engineer

PROFESSIONAL ENGINEER YUKON TERRITORY J.W. CASSIE

James W. Cassie, M.Sc., P.Eng.
Specialist Geotechnical Engineer

PERMIT TO PRACTICE
Signature
Date 05-FEB-23.
PERMIT NUMBER: PP092
Association of Professional Engineers of Yukon

REFERENCES

BGC Engineering Inc. 2004 K8 Creek Construction, As-built Report. Report prepared for Deloitte & Touche Inc., June 2004.

SRK Consulting Inc., BGC Engineering Inc. and Gartner Lee Ltd. 2003. Final Breach Design, Fresh Water Supply Dan, Faro Mine. Report prepared for Deloitte and Touche Inc., April 2003

SRK Consulting Inc. and BGC Engineering Inc. 2004. As-built Construction Report, Fresh Water Supply Dam Breach, Faro Mine. Report submitted to Deloitte and Touche Inc., February 2004

TABLES

Table 1 - Monitoring Results for FWSB 1

Date	TSS	Flow (LPS)	Comments
April 13, 2004	<1		Creek was ice covered, refer to note1
April 30, 2004	1		Freshet started, creek unsafe to enter
May 11, 2004	1		refer to note2
May 25, 2004	26		refer to note2
June 14, 2004	8		refer to note2
June 22, 2004	<1		refer to note2
July 6, 2004	<1		Flow measured on July 8, 2004
July 8, 2004		464	
July 12, 2004	<1		Flow measured on July 15, 2004
July 15, 2004		384	
August 18, 2004	<1	245	
August 30, 2004	<1	400	

Note1: The creek was ice covered and collection of reliable flow data was not possible.
Note2: The creek was flowing near full and conditions were unsafe to collect flow data.

Table 2 - Monitoring Results for FWSB 5

Date	TSS	Flow (LPS)	Comments
April 13, 2004	4		Creek was ice covered, refer to note 1
April 30, 2004	6		Creek was ice covered and freshet had started
May 11, 2004	18		refer to note2
May 25, 2004	96		refer to note2
June 14, 2004	25		refer to note2
June 22, 2004	3		refer to note2
July 6, 2004	1		Flow measured on July 8, 2004
July 8, 2004		555	
July 12, 2004	<1		Flow measured on July 15, 2004
July 15, 2004		361	
August 18, 2004	1	234	
August 30, 2004	<1	420	

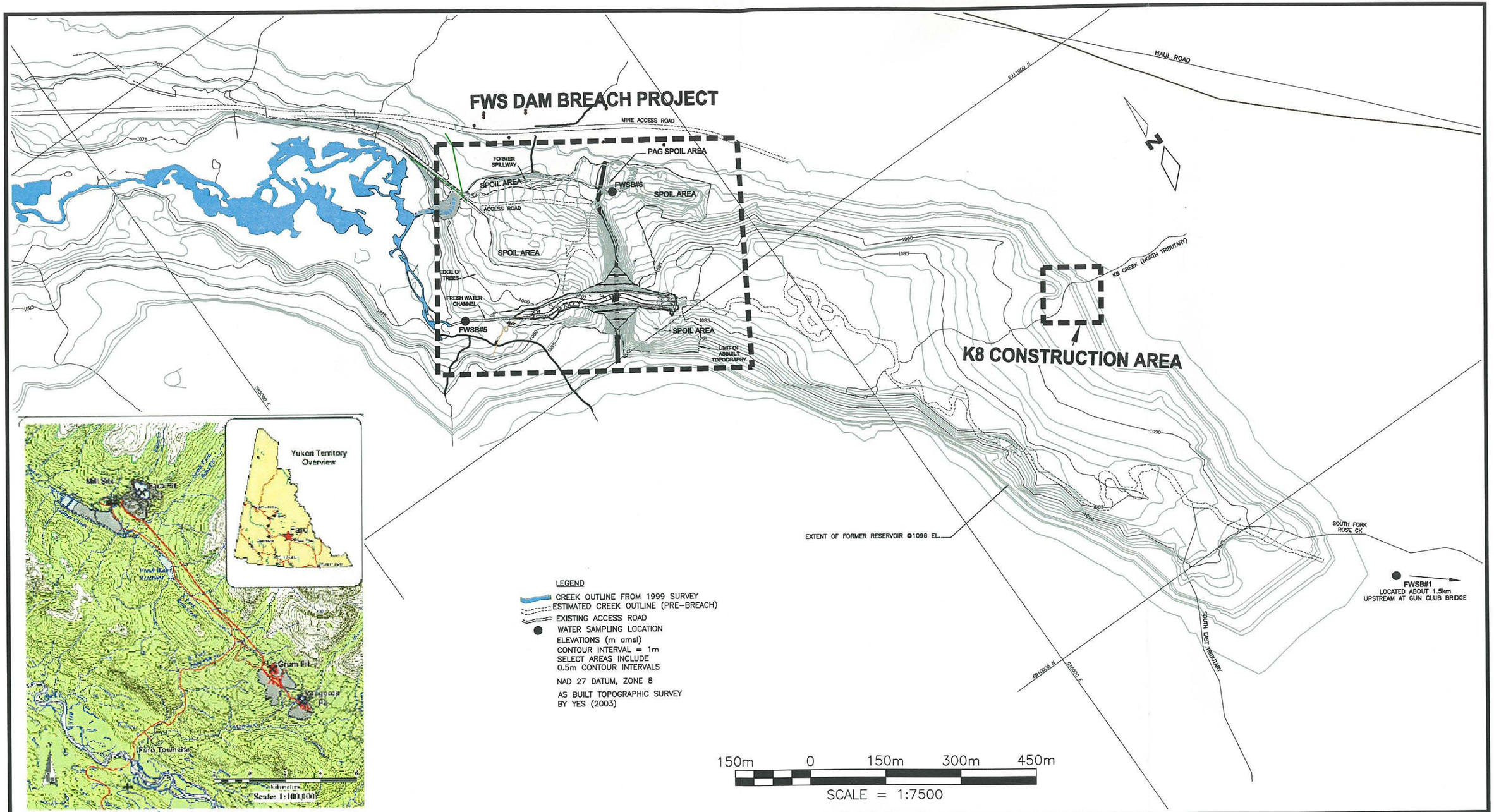
Note 1: The creek was ice covered and collection of reliable flow data was not possible.
Note 2: The creek was flowing near full and conditions were unsafe to collect flow data.

Table 3 - Laboratory Test Results for Run-off from PAG Spoil Area (FWSB 6)

Parameter	May 26, 2004 Results (mg/L unless noted)	Laboratory Detection Limit (mg/L)	Maximum Allowable Concentration (mg/L)[2]
Temperature	9.4°C		
pH[1]	8.1		
Total Suspended Solids	10		
Total Dissolved Solids	180		
Sulphate	68.7		
Conductivity	252 µS/cm		
Total Alkalinity	75.8		
Total Hardness	127		
Total Antimony (Sb)	<0.001	0.001	0.1
Total Arsenic (As)	0.002	0.001	0.05
Total Barium (Ba)	0.091	0.023	1
Total Cadmium (Cd)	<0.0002	0.0002	0.02
Total Copper (Cu)	0.007	0.001	0.2
Total Lead (Pb)	0.003	0.001	0.2
Total Mercury (Hg)	<0.02 µg/L	0.02 µg/L	0.005
Total Molybdenum (Mo)	0.0016	0.0005	0.5
Total Nickel (Ni)	0.005	0.001	0.5
Total Selenium (Se)	<0.001	0.001	0.05
Total Silver (Ag)	<0.00025	0.00025	0.1
Total Zinc (Zn)	0.012	0.005	0.5
[1] pH does not have units of mg/L.			
[2]Maximum Allowable Concentrations from Water Licence QZ03-058			

FIGURES

FWS DAM BREACH PROJECT



REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE	AS SHOWN
DATE	FEB 2005
DRAWN	CJT/GCB
DESIGNED	GWF
CHECKED	GWF
APPROVED	JWC

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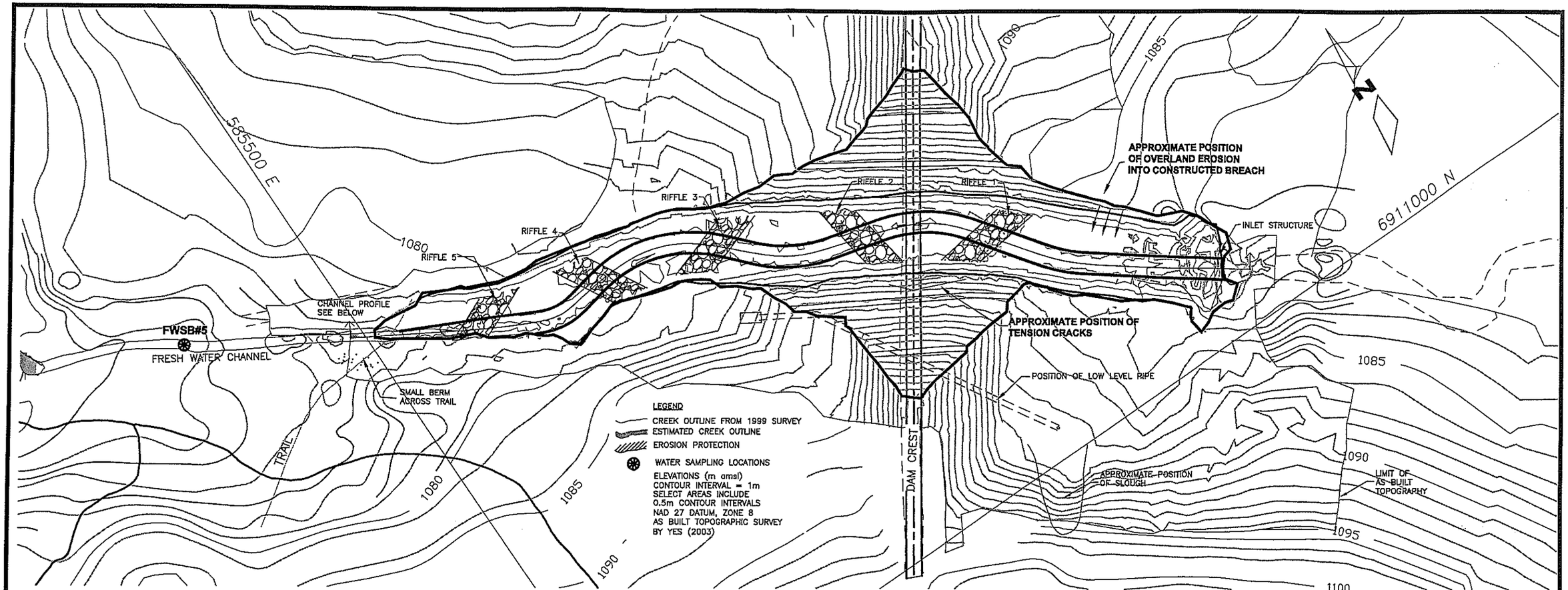
CLIENT Deloitte & Touche

PROJECT 2004 ANNUAL REPORT, FWSB

TITLE LOCATION PLAN

PROJECT No.	FIG.	REV.
0257-024-03	1	0

0257-024-03 001 FIGURE_1.dwg



REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE	AS SHOWN
DATE	FEB 2005
DRAWN	CJT
DESIGNED	GWF
CHECKED	GWF
APPROVED	JWC

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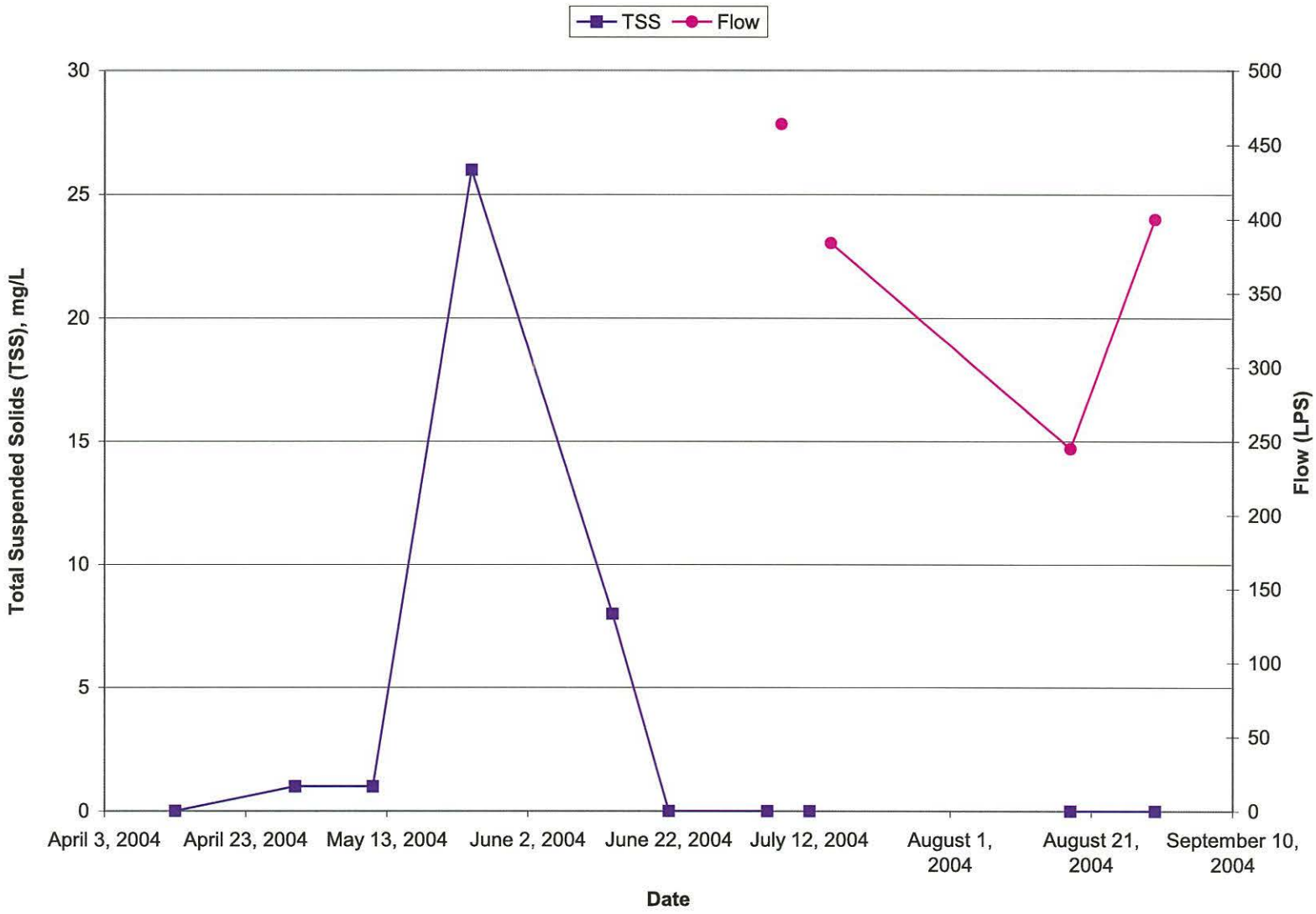
CLIENT Deloitte & Touche

PROJECT 2004 ANNUAL REPORT, FWSB

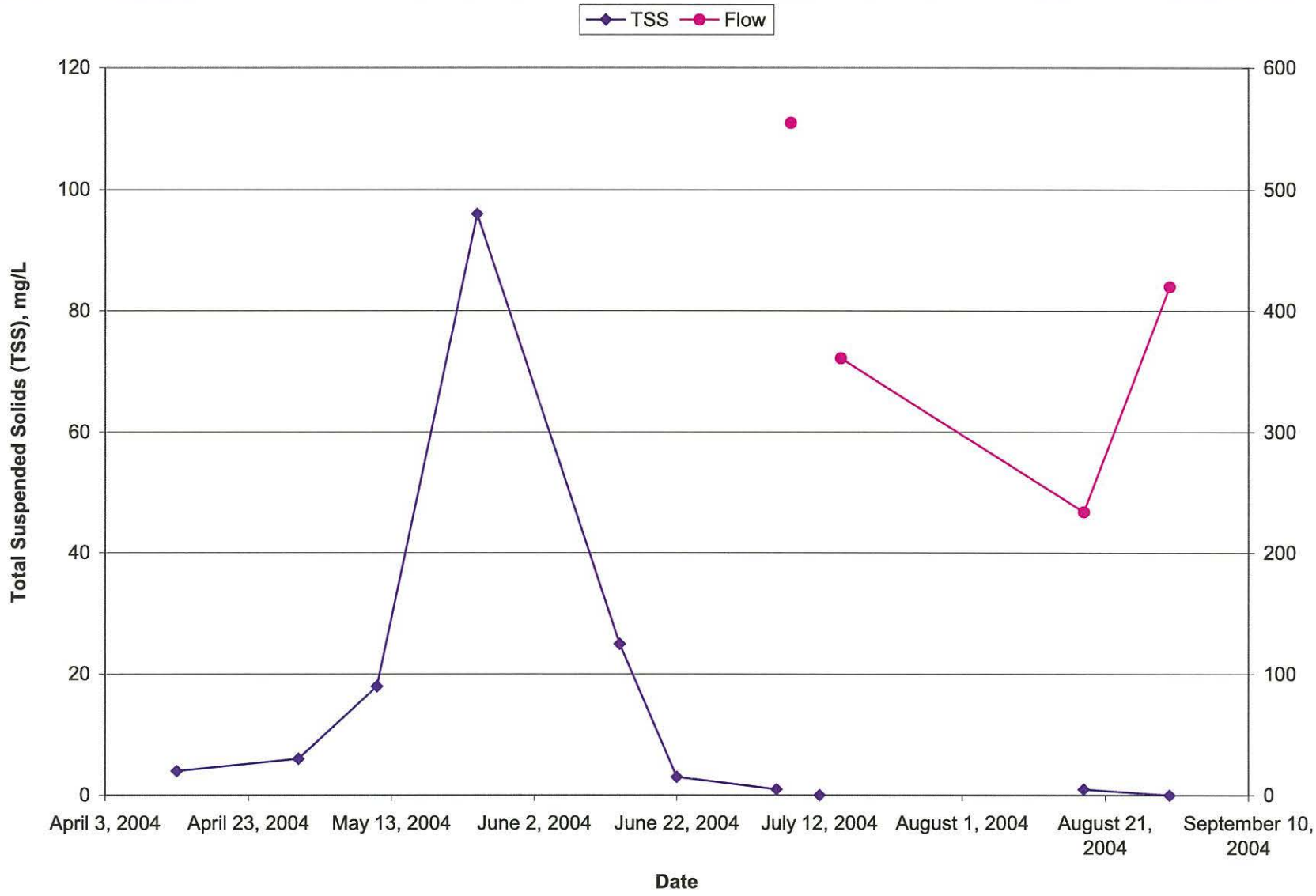
TITLE AS-BUILT FWSB PLAN AND PROFILE

PROJECT No.	FIG.	REV.
0257-024-03	2	0

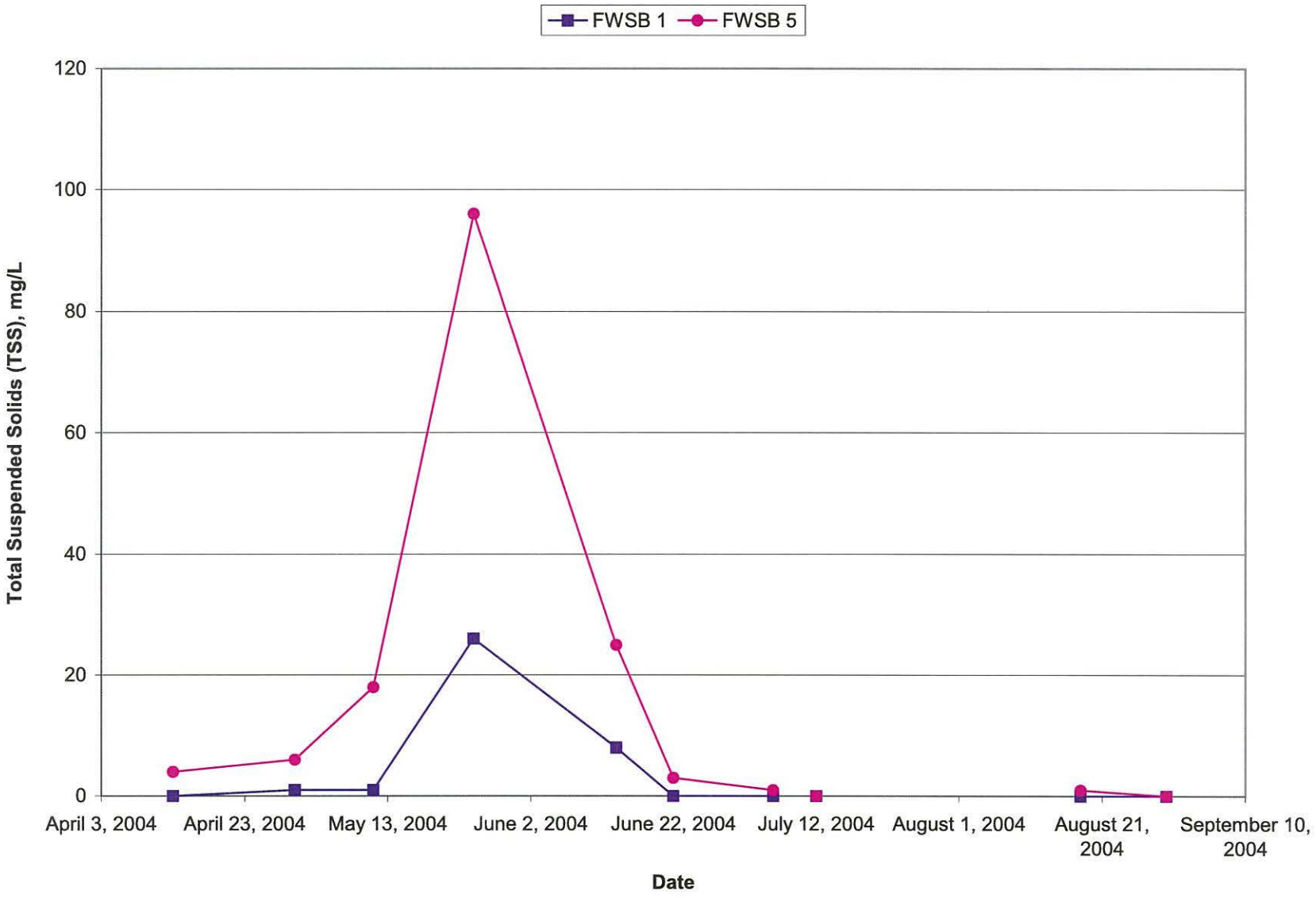
0257-024-03 002 FIGURE_2.dwg



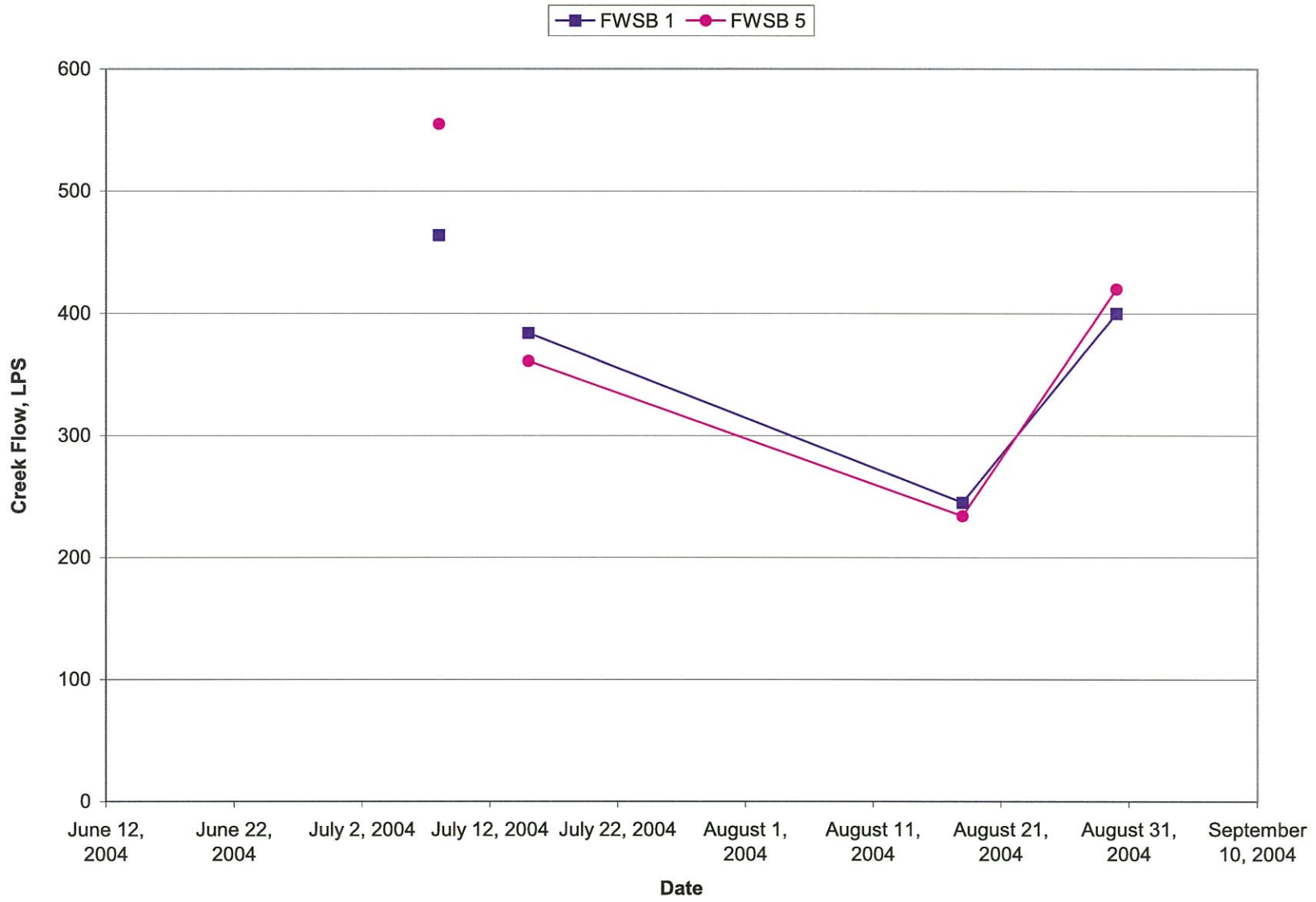
DATE: FEB 2005	DRAWN SLF	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY Calgary, Alberta Phone: (403) 250-5185	PROJECT 2004 ANNUAL REPORT, FWSB
REFERENCED DRAWING DESCRIPTION			TITLE MONITORING RESULTS FOR FWSB 1
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.		CLIENT Deloitte & Touche	PROJECT No. 0257-024-03 / DWG. No. 3 / REV. 0



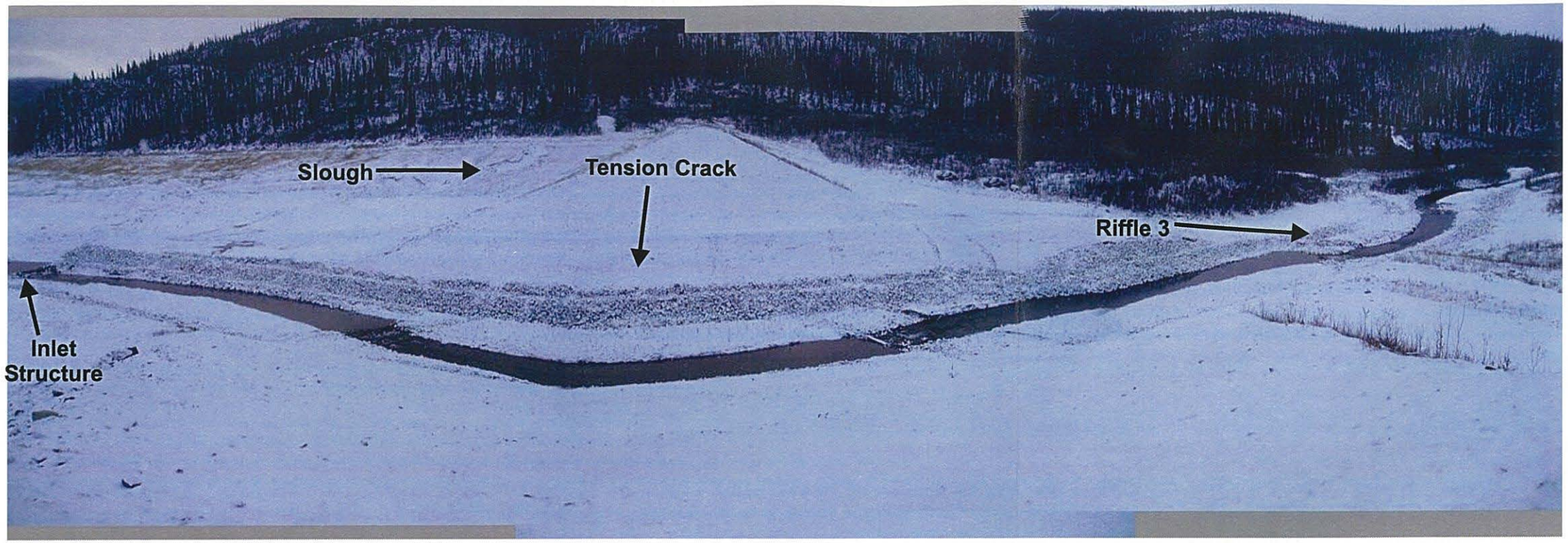
DATE: FEB 2005	DRAWN SLF	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY Calgary, Alberta Phone: (403) 250-5185	PROJECT 2004 ANNUAL REPORT, FWSB		
REFERENCED DRAWING DESCRIPTION			TITLE MONITORING RESULTS FOR FWSB 5		
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.		CLIENT Deloitte & Touche	PROJECT No. 0257-024-03	DWG. No. 4	REV. 0



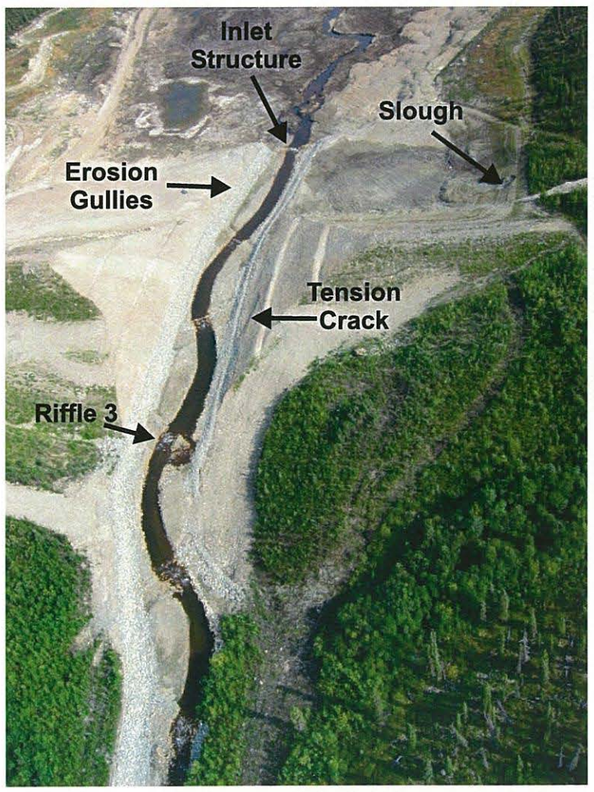
DATE: FEB 2005	DRAWN SLF	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY Calgary, Alberta Phone: (403) 250-5185	PROJECT 2004 ANNUAL REPORT, FWSB
REFERENCED DRAWING DESCRIPTION			TITLE COMPARISON OF TSS RESULTS FROM FWSB 1 AND FWSB 5
		CLIENT Deloitte & Touche	PROJECT No. 0257-024-03 / DWG. No. 5 / REV. 0



DATE: FEB 2005	DRAWN SLF	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY Calgary, Alberta Phone: (403) 250-5185	PROJECT 2004 ANNUAL REPORT, FWSB
REFERENCED DRAWING DESCRIPTION			TITLE COMPARISON OF FLOW RESULTS FROM FWSB 1 AND FWSB 5
		CLIENT Deloitte & Touche	PROJECT No. 0257-024-03 / DWG. No. 6 / REV. 0



September: Panoramic showing the configuration of the channel through the breach. On the left hand side can be seen the slough which had previously formed on the side of the reservoir. There still appears to be water seeping out of the area with the small pond formed at the toe of the seep area.



August: An aerial view of the breach section. This overview of the project shows the location of the breach and channel. Also shown is the slough on the former reservoir wall, the erosion gullies, the tension crack near riffle 2 and the water flowing around the left side of the channel at riffle 3.

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

SCALE:	N/A
DATE:	FEBRUARY 2005
DRAWN:	SLF
DESIGNED:	GWF
CHECKED:	GWF
APPROVED:	JWC

PROJECT: 2004 ANNUAL REPORT, FWSB

TITLE: OVERVIEW OF FWS DAM BREACH

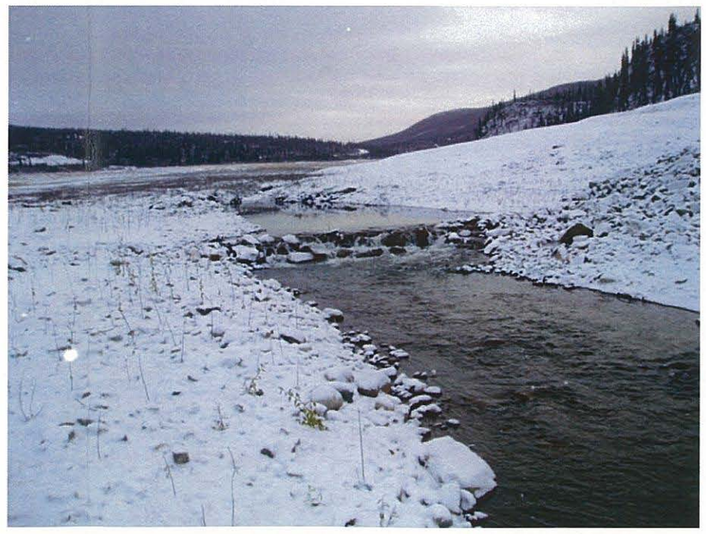
PROJECT No.	Figure No.	REV.
0257-024-03	7	0

BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary Alberta Phone: (403) 250-5185

May: View of the downstream portion of the channel during freshet flows.

August: Shows the downstream end of the channel during a normal summer flow period.

May: Shows the water flowing over the inlet structure during freshet flow period.



September: Shows the first water flowing over the inlet structure during normal flow period.

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

SCALE:	N/A
DATE:	FEBRUARY 2005
DRAWN:	SLF
DESIGNED:	GWF
CHECKED:	GWF
APPROVED:	JWC

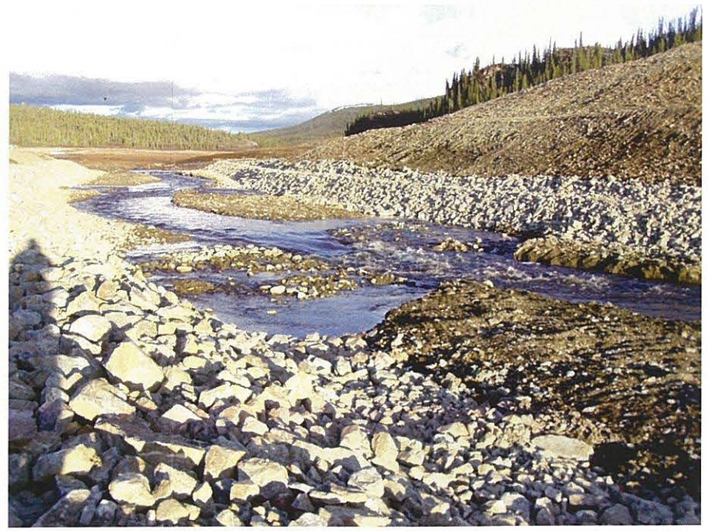
PROJECT: 2004 ANNUAL REPORT, FWSB

TITLE: CHANNEL FLOW

PROJECT No.	Figure No.	REV.
0257-024-03	8	0

BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary Alberta Phone: (403) 250-5185

May: Shows a view of the water flowing over Riffle 4 during freshet period. Most of the soil placed in winter on top of the rock has been eroded.



May: Shows water flowing over Riffle 2 during freshet period. Again, some erosion of the soil above the rock of the riffle has been eroded.

September: Shows Riffle 2 during normal flow condition. As can be seen, some of the routes from the riffle crest appears to have been moved downstream.

September: Shows Riffle 4 during normal flow. There appears to be some downstream movement of the larger fragments.

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

SCALE:	N/A
DATE:	FEBRUARY 2005
DRAWN:	SLF
DESIGNED:	GWF
CHECKED:	GWF
APPROVED:	JWC

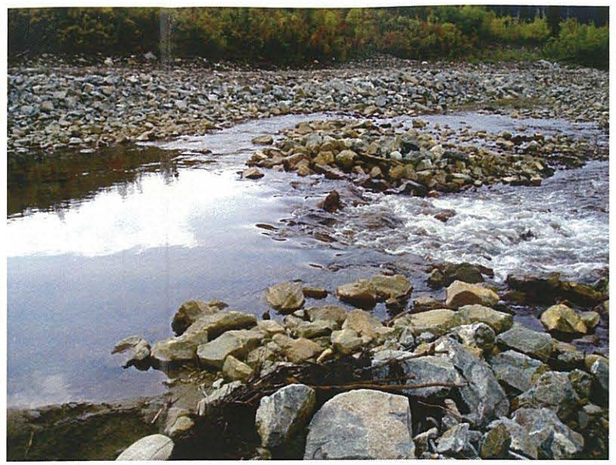
PROJECT: 2004 ANNUAL REPORT, FWSB

TITLE: FLOW OVER RIFFLES

PROJECT No.	Figure No.	REV.
0257-024-03	9	0

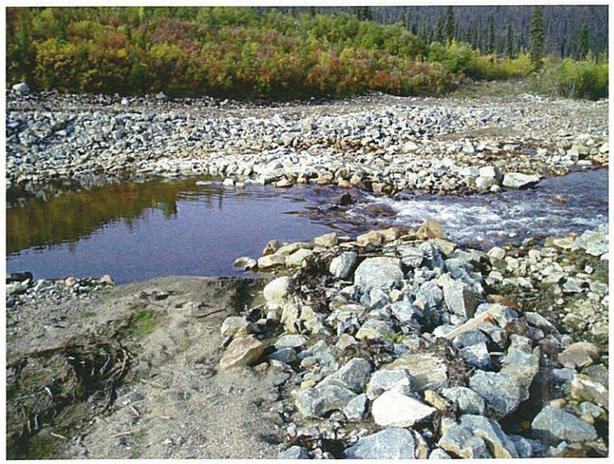
BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary Alberta Phone: (403) 250-5185

September: A view of Riffle 3 at the Fresh Water Supply Breach project. This is looking in the downstream direction. Water is mostly flowing in the main channel, but some 10 - 15% of the flow goes on the left side of the floodplain.



September: Shows another view of the water bypassing the centre of the channel. Looking along the alignment of the crest of the riffle.

September: Shows a view of Riffle 3 looking in a downstream direction following repair of the lefthand side of the riffle. Approximately 8 m^3 of riprap was used to repair this riffle.



September: Shows a view of the left side of Riffle 3 following the repairs. Note the riprap placed to match the riprap elevation elsewhere.

September: Shows an overview of the repaired Riffle 3. The newly placed riprap on the left side of the floodplain is high enough that the majority of the water is flowing in the centre of the channel.

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

SCALE:	N/A
DATE:	FEBRUARY 2005
DRAWN:	SLF
DESIGNED:	GWF
CHECKED:	GWF
APPROVED:	JWC

PROJECT
2004 ANNUAL REPORT, FWSB

TITLE
REPAIRS OF RIFFLE 3

PROJECT No.	Figure No.	REV.
0257-024-03	10	0

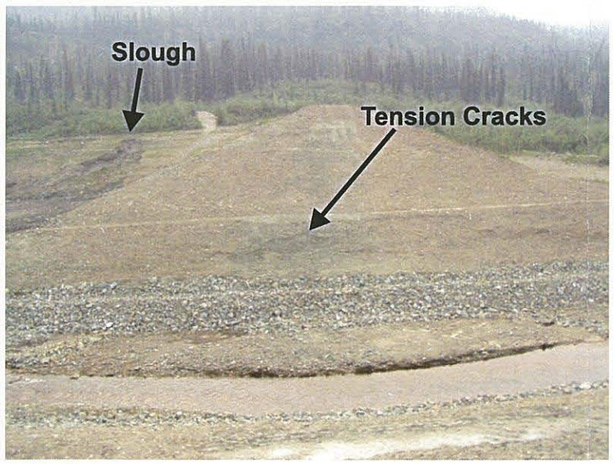
BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary Alberta Phone: (403) 250-5185

May: Shows a view of the water ponded behind the berm adjacent to the PAG spoil area.

May: Shows a view of the slough near the south abutment. There is some standing water located at the toe of this slough, which is likely caused by seepage from the valley wall at this location.

August: Shows the slough near the south abutment which appears to be increasing in size as compared to May. As noted before, there is some standing water at the toe perhaps indicating that the slough is driven by valley wall seepage.

September: Shows a number of small erosional gullies which are formed higher up on the cut channel. The erosional gullies are relatively minor except for the occasional one which is perhaps 1 metre across by perhaps 1/3 to 1/2 metre deep.



August: Shows a view of the cutslope on the south side of the breach. There is one scarp on this side of the channel, caused by some slumping of the material.

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

SCALE:	N/A
DATE:	FEBRUARY 2005
DRAWN:	SLF
DESIGNED:	GWF
CHECKED:	GWF
APPROVED:	JWC

PROJECT
2004 ANNUAL REPORT, FWSB

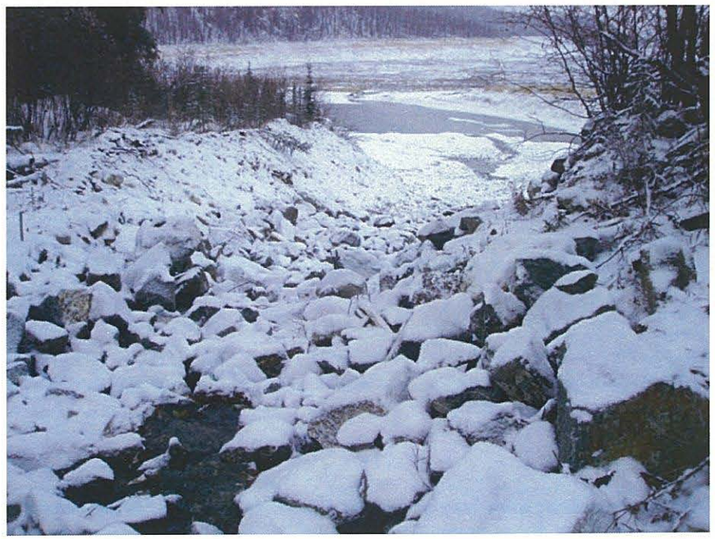
TITLE
VARIOUS FEATURES AT BREACH

PROJECT No.	Figure No.	REV.
0257-024-03	11	0

BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary Alberta Phone: (403) 250-5185

May: Shows a view, looking downstream at the water flowing across the repair portion of K8 creek.

May: Shows a view looking upstream of K8 Creek, during freshet, of the water flowing over the riprap apron.



September: Shows the water flowing during a normal flow period. There are no signs of erosion or major instability proximal to this channel. The water tends to flow into the void space within the armour material and is not flowing directly on the surface.

August: Shows a view of the steep section of K8 creek. A significant amount of angular riprap has been placed and the water appears to be flowing within the void space, without any signs of erosion.

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

SCALE:	N/A
DATE:	FEBRUARY 2005
DRAWN:	SLF
DESIGNED:	GWF
CHECKED:	GWF
APPROVED:	JWC

PROJECT
2004 ANNUAL REPORT, FWSB

TITLE
K8 CREEK OBSERVATIONS

PROJECT No.	Figure No.	REV.
0257-024-03	12	0

BGC
BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary Alberta Phone: (403) 250-5185

APPENDIX I – MONTHLY REPORTS

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Suite 1605–840 7th Ave. S.W.
Calgary, Alberta
Canada T2P 3G2
Tel: (403) 250-5185
Fax: (403) 250-5330

FAXED May 31/04

0257-024-01
May 31, 2004

Yukon Territory Water Board
Suite 106 - 419 Range Road
Whitehorse, Yukon
Y1A 3V1
Fax (867) 456-3890

Re: April Monthly Sampling Results for QZ03-058, Faro Mine, Yukon

Dear Board:

This letter report fulfills the monthly reporting requirement (item 15) for Water Licence QZ03-058 for the month of April 2004. I trust that this information is self-explanatory. However, if you have any questions please do not hesitate to contact us.

Table 1 Summary of Monthly Sampling Results, April 2004

Date	Sample	TSS (mg/L)	Flow (m^3/s)	Comments
April 13	FWSD-1	<1	note 1	Creek was ice covered
April 13	FWSD-5	4	note 1	Creek was ice covered
April 31	FWSD-1	1	note 1	Creek was ice covered
April 31	FWSD-5	6	note 1	Creek was ice covered

Note: 1. The creek was ice covered and collection of reliable flow data was not possible. Flow measurements will commence once it is safe to do so.

Yours truly,
BGC Engineering Inc.
Per:

Gerry Ferris

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

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
1605, 840 - 7 Avenue SW
Calgary, Alberta T2P 3G2
Tel.: (403) 250-5185
Fax: (403) 250-5330

0257-024-01
June 23, 2004

Yukon Territory Water Board
Suite 106 - 419 Range Road
Whitehorse, Yukon
Y1A 3V1
Fax (867) 456-3890

Re: May Monthly Sampling Results for QZ03-058, Faro Mine, Yukon

Dear Board:

This letter report fulfills the monthly reporting requirement (item 15) for Water Licence QZ03-058 for the month of May 2004. I trust that this information is self-explanatory. However, if you have any questions please do not hesitate to contact us.

Table 1 Summary of Monthly Sampling Results, May 2004

Date	Sample	TSS (mg/L)	Flow (m^3/s)	Comments
May 11	FWSB #1	1	Note 1	
May 11	FWSB #5	18	Note 1	
May 25	FWSB #1	26	Note 1	
May 25	FWSB #5	96	Note 1	

Note: 1. The creek was flowing near full and conditions were unsafe to collect flow data. Flow measurements will commence once it is safe to do so.

The results of the annual sampling at FWSD#6, the run-off water from the PAG storage area, are attached in Table 2. This table includes a column listing the maximum allowable concentration (from Water Licence QZ03-058) for each of the metals. As indicated in the table the measured concentrations for all parameters were below the allowable concentration.

Table 2 Summary of Annual Sampling for PAG stockpile (FWSB #6), May 2004

Parameter	Maximum Allowable Concentration (mg/L)	May 26, 2004 Results (mg/L unless noted)	Laboratory Detection Limit (mg/L)
Temperature		9.4°C	
pH		8.1	
Total Suspended Solids		10	
Total Dissolved Solids		180	
Sulphate		68.7	
Conductivity		252 µS/cm	
Total Alkalinity		75.8	
Total Hardness		127	
Total Antimony (Sb)	0.10	<0.001	0.001
Total Arsenic (As)	0.05	0.002	0.001
Total Barium (Ba)	1.00	0.091	0.023
Total Cadmium (Cd)	0.02	<0.0002	0.0002
Total Copper (Cu)	0.20	0.007	0.001
Total Lead (Pb)	0.20	0.003	0.001
Total Mercury (Hg)	0.005	<0.02 ug/L	0.02 ug/L
Total Molybdenum (Mo)	0.50	0.0016	0.0005
Total Nickel (Ni)	0.50	0.005	0.001
Total Selenium (Se)	0.05	<0.001	0.001
Total Silver (Ag)	0.10	<0.00025	0.00025
Total Zinc (Zn)	0.50	0.012	0.005

Yours truly,
BGC ENGINEERING INC.
Per:

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

GWF/sf

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
1605, 840 - 7 Avenue SW
Calgary, Alberta T2P 3G2
Tel.: (403) 250-5185
Fax: (403) 250-5330

0257-024-01
July 21, 2004

Yukon Territory Water Board
Suite 106 - 419 Range Road
Whitehorse, Yukon
Y1A 3V1
Fax (867) 456-3890

Re: June Monthly Sampling Results for QZ03-058, Faro Mine, Yukon

Dear Board:

This letter report fulfills the monthly reporting requirement (item 15) for Water Licence QZ03-058 for the month of June 2004. I trust that this information is self-explanatory. However, if you have any questions please do not hesitate to contact us.

Table 1 Summary of Monthly Sampling Results, June 2004

Date	Sample	TSS (mg/L)	Flow (m^3/s)	Comments
June 14	FWSB #1	8	Note 1	
June 14	FWSB #5	25	Note 1	
June 22	FWSB #1	<1	Note 1	
June 22	FWSB #5	3	Note 1	

Note 1: The creek was flowing near full and conditions were unsafe to collect flow data. Flow measurements will commence once it is safe to do so.

Yours truly,
BGC ENGINEERING INC.
Per:

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

GWF/sf

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
1605, 840 - 7 Avenue SW
Calgary, Alberta T2P 3G2
Tel.: (403) 250-5185
Fax: (403) 250-5330

0257-024-01
August 24, 2004

Yukon Territory Water Board
Suite 106 - 419 Range Road
Whitehorse, Yukon
Y1A 3V1
Fax (867) 456-3890

Re: July Monthly Sampling Results for QZ03-058, Faro Mine, Yukon

Dear Board:

This letter report fulfills the monthly reporting requirement (item 15) for Water Licence QZ03-058 for the month of July 2004. We trust that this information is self-explanatory. However, if you have any questions please do not hesitate to contact us.

Table 1 Summary of Monthly Sampling Results, July 2004

Date	Sample	TSS (mg/L)	Flow (m^3/s)	Comments
July 6	FWSB #1	<1	0.46	Flow measured on July 8, 2004
July 6	FWSB #5	1	0.55	Flow measured on July 8, 2004
July 12	FWSB #1	<1	0.38	Flow measured on July 15, 2004
July 12	FWSB #5	<1	0.36	Flow measured on July 15, 2004

Yours truly,
BGC ENGINEERING INC.
Per:

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

GWF/sf

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
1605, 840 - 7 Avenue SW
Calgary, Alberta T2P 3G2
Tel.: (403) 250-5185
Fax: (403) 250-5330

0257-024-01
September 21, 2004

Yukon Territory Water Board
Suite 106 - 419 Range Road
Whitehorse, Yukon
Y1A 3V1
Fax (867) 456-3890

Re: August Monthly Sampling Results for QZ03-058, Faro Mine, Yukon

Dear Board:

This letter report fulfills the monthly reporting requirement (item 15) for Water Licence QZ03-058 for the month of August 2004. We trust that this information is self-explanatory. However, if you have any questions please do not hesitate to contact us.

Table 1 Summary of Monthly Sampling Results, August 2004

Date	Sample	TSS (mg/L)	Flow (m^3/s)	Comments
August 17	FWSB #1	<1	0.24	
August 17	FWSB #5	1	0.23	
August 30	FWSB #1	<1	0.40	
August 30	FWSB #5	<1	0.42	

Yours truly,
BGC ENGINEERING INC.
Per:

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

GWF/sf

APPENDIX II – SUMMARY REPORT FROM SITE INSPECTION

CROSS VALLEY DAM

- A crack extends completely across the crest of the dam, starting on the north side of the emergency spillway and extending to the south abutment. This crack is mostly located on the upstream side of the crest, however near the center of the dam it is located on the downstream side of the crest. This appears to be related to the cracking of the crest prior to the grading last year.
- The staff gauge located at the center of the drainage collection point has been removed from its stand. This staff gauge should be re-established.

ROSE CREEK DIVERSION CANAL

- The crest of the canal dike was raised at two different locations. The crest was raised temporarily (as recommended in the April 22, 2004, memo from BGC) in the areas identified by BGC in April. The surface of the newly placed fill is locally showing cracks in its surface and is locally soft. The cracking and softness is generally coincident with the thickest placement of the temporary fill.
- Approximately 50 m downstream of the start of the upper weir section cracking parallel with the edge of the canal is occurring. One crack was encountered perpendicular to the crest of the canal dike. It appears that some erosion of the soil underlying the rip rap has occurred. This section of the canal should be reviewed on a regular basis.

NORTH FORK ROCK DRAIN

- Recommendations were provided to the construction metal stands that will contain the data loggers.
- The location of the metal stand and the creek data logger was established, site staff will install the metal stand and datalogger once it is constructed.
- Installed new (temporary) data logger system within the pond on the upstream side of the rock drain. Given the current high pond levels installation of the permanent instrument location was not possible. Therefore the datalogger was installed from a barge.
- The status of the barge should be monitored, ensuring that the position of the sensors is not disturbed. Once the pond level reduces appropriately, the permanent metal stand should be installed and the datalogger moved. Prior to moving the instruments from its current location, the location should be marked so that the elevation can be established by a survey at a later date.
- The pond on the upstream side of the rock drain appeared to be within about 0.5 m of the previous maximum high water mark.

MONITORING-RELATED

- Readings were taken throughout the site inspection at the Rose Creek staff gauge.
- The new data loggers for the pond on the upstream side of the flow through rock drain were installed.
- The data loggers for the pond and creek installations (flow through rock drain project) were initialized (set up to automatically record data).

CONSTRUCTION-RELATED AND MISCELLANEOUS

- A review of the gradation of the sand and gravel for the Canal Dike was reviewed. The rip rap gradation for the raise was also reviewed.
- As part of planning for the installation of a new trailer (with shower facility) investigations were performed for a septic field. This consisted of excavation of three test pits approximately 70 m to the south of the guard house. Within each of the test pits a percolation test was performed. The results of this testing will be provided separately from this memo.
- The locations of the test pits should be established by handheld GPS, using NAD 27 base and provided to BGC.

RECOMMENDATIONS

The recommendations resulting from this trip are summarized below:

- FWSD-5 sampling location should be moved from its current location to approximately 50 m downstream of the end of the breach (where the majority of water is contained within the main channel). The location used as FWSD-5 during the breach activities will not result in accurate measurements of either the flow or Total Suspended Solids (TSS) given that about 1/3 of the flow is outside of the main channel.
- The water which has collected behind the berm around the PAG stockpile area should be removed.
- The eroded material that has deposited on the lower road of the Intermediate Dam should be removed. This fine grained material is likely blocking the downstream drain. The outlet end of the downstream drain should be exposed.
- The section of the canal dike about 50 m downstream from the start of the upper weir section should be reviewed on a regular basis and changes reported to BGC.
- The status of the barge mounted data logger should be monitored. The ropes should be adjusted as necessary to maintain the barge position. Once the water level is reduced, a location for the permanent data logger should be established and installed. The temporary location of the probes should be marked prior to moving, so that the elevation can be established in a later survey. The probe elevation for the permanent installation should also be established, once installed.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
1605, 840 - 7 Avenue S.W. , Calgary, Alberta, Canada. T2P 3G2
Phone (403) 250-5185 Fax (403) 250-5330

PROJECT MEMORANDUM

To:	Anvil Range Mining Corp.	Fax No.:	(867) 994-3349
Attention:	Dana Haggar	CC:	Doug Sedgwick (416) 601-5902
From:	Jim Cassie	Date:	Sept. 30, 2004
Subject:	Summary of September Inspection Visit Various Facilities at Faro Mine,YT		
No. of Pages (including this page): 2 Pages		Project No:	0257-022-04

Jim Cassie, P.Eng., of BGC Engineering Inc. (BGC), visited the Faro Mine from Sept. 28 to 30, 2004. The following memo serves as a record of the conditions observed and provides recommendations, if so required.

FWS Dam

- The slough continues on the south valley wall, just upstream from the south abutment of the breached dam. The extent of the slough should be monitored and rehabilitation work may be required next year.

K8 Creek Rehab.

- The rip rap and the creek flow appear in good condition.

Intermediate Dam

- Numerous erosional gullies previously formed on the downstream slope shouldbe monitored next spring following runoff and thaw.
- All excess slough and debris accumulated at the toe of the downstream face should be excavated/graded off so that the drain in the dam can work properly.
- No seepage was noted at the south abutment toe.

Cross Valley Dam

- No concerns noted.

Rose Creek Diversion Canal and Weir Sections.

- No signs of significant sloughs noted on the face of the backslope.
- Some longitudinal cracks are occurring on the uphill side of the canal dike crest, just east of CD-10 and at the fourth to sixth weirs in the Weir Section. These cracks are

likely due to the slightly over-steepened nature of the rip rap on the inside face of the channel. Continue to monitor these cracks next spring.

- No other concerns were noted.

North Valley Wall Interceptor Ditch (NVWID).

- Selected sections were inspected, including the Outfall Section at the access road, and no concerns were noted.

Faro Creek Diversion Channel

- Channel appears in good condition. Check for any additional ravelling next spring after runoff.

North Fork Rose Creek Rock Drain

- Drain appears in good condition.

Selected Waste Dumps (overlooking NFRC)

- No signs of major instability noted from a traverse along the toe area. Some minor sloughing of till materials on the NE Dump is continuing but debris only reaches the dump toe.

Monitoring-Related

- The two dataloggers from the head-pond and the creek below the North Fork Rock Drain were removed and the data downloaded.
- Discussion held with Ronnie with respect to installation of datalogger / new pressure cable / protection pipe in the headpond of the NFRD.

Closure

It should be noted that some snow fell on the first day of the inspection, hence partially obscuring the surface conditions. All recommendations provided herein are of a minor nature, but monitoring should be undertaken. If the noted conditions worsen in the future, BGC should be consulted. Please contact the undersigned should you have any questions.

Respectfully submitted
BGC Engineering Inc.
per:

James W. Cassie, M.Sc., P.Eng.
Specialist Geotechnical Engineer

APPENDIX III – RE-VEGETATION REPORT

DRAFT REPORT PREVIOUSLY RECEIVED

FINAL REPORT TO BE SUBMITTED BY ARCTIC ALPINE SEED LTD. UNDER SEPARATE COVER TO THE WATER BOARD

APPENDIX IV – AQUATIC REPORT

FISH HABITAT AND FISH UTILIZATION ASSESSMENTS WITHIN THE DE-WATERED FRESHWATER SUPPLY RESERVOIR

ANVIL RANGE MINE SITE
FARO, YUKON
June/August 2004

Prepared For: Deloitte and Touche Inc.
October, 2004

WHITE MOUNTAIN ENVIRONMENTAL CONSULTING

TABLE OF CONTENTS

1.0 INTRODUCTION

The Freshwater Reservoir at the Faro Mine Site was permanently de-watered during fall and early winter of 2003 with the construction of a new channel through the old dam site. The following report details the 2004 evaluation of fish habitat in the newly reformed channels and fish utilization and distribution in the vicinity of the de-watered reservoir. This assessment was committed to in the *Environmental Management Plan for the Breaching of the Fresh Water Supply Dam at the Faro Mine*. Evaluations of fish habitat and fish distribution in Rose Creek through the reservoir basin were conducted during mid June and early August, 2004.

2.0 STUDY AREA

The Freshwater Reservoir Basin was created over a reach of the South Fork of Rose Creek. Within the reservoir basin two small tributaries join the South Fork of Rose Creek. The 2004 breach of the freshwater dam has re-exposed the original channel. The fish habitat and fish utilization assessments of Rose Creek occurred within the newly exposed channel, the two small tributaries, the newly created channel through the breach, in the lower section of the South Fork of Rose Creek immediately downstream of the breach, and Rose Creek in the vicinity of water sample site X14. These monitoring locations met the objectives set out by the EMP.

3.0 METHODS

Fish habitats were assessed during June and August. The June investigation served as a post freshet assessment to identify areas of channel instability and to identify potential barriers to fish movements. During August, detailed mapping of fish habitats and an assessment of fish utilization within the study area was conducted.

Rose Creek, within the reservoir basin was divided into three separate reaches based on channel slope and corresponding channel morphology. The area of construction activities and the previously modified channel downstream of the old reservoir were also described as separate reaches. The reaches are shown in Figure 1.

Large scale maps generated from aerial photographs taken prior to the construction of the dam were used in the field to plot sample locations, reach breaks and habitat features. A hand held GPS was used to document observation locations and elevations. A laser range finder was used to measure distances within each reach. Habitat evaluations throughout the study area included assessments of creek width (wet and dry), water depth, velocity (floating object technique), bank stability, bottom substrates, available cover and riparian vegetation.

Photographs representative of each reach and observed unique features of the channel, were taken during both field sessions to provide a record for long term monitoring of habitat stability.

Fish utilization and distribution was assessed with a variety of techniques to ensure capture of all species present. Crew members wore polarized sunglasses at all times to assist in fish viewing. All visual observations were recorded.

Minnow trapping was conducted with "Gee type" minnow traps (¼" mesh). Traps were baited with salmon roe (Yukon River origin) suspended in the trap in a perforated plastic bag. Traps were set in a all habitat types for an overnight period with the total time of set ranging from 16 to 24 hours. A simple site description was recorded for each trap set and velocities at each location were visually estimated. This style of minnow trapping has previously been shown to be highly effective for the capture of juvenile chinook salmon (jcs). This technique is also effective for the capture of slimy sculpin and burbot juveniles, however, is not viewed as a reliable tool for documenting Arctic grayling.

Electro-fishing was conducted with a Smith-Route POW type 12A back pack, battery powered electro-fisher. The operator was accompanied by two crew members with dip nets. Fish densities within the newly created channel and the newly exposed channel sections were assessed using a 2 pass block net, electro-fishing technique. Block nets (1/8" rochel weave) were installed in the creek 100 meters apart. Electro-fishing of the entire blocked reach was conducted twice, moving in an upstream direction each time. Effort, measured in seconds of shocking time, varied between the reaches due to complexity of habitats.

Electro-fishing below the breach and at Site X-14 was conducted as a single pass over a 100 meter reach with no block nets.

Angling was conducted with light spin casting gear and a variety of small lures. Effort was recorded as minutes fished.

All fish captured were identified as to species and recorded; a sub-sample of fish captured were live measured for fork length (+/- 1 mm) and weighed (+/- 1.0 gm). All fish captured were handled delicately to allow for live release and no fish mortality occurred during the project.

4.0 RESULTS

At the time of the June investigation a rainfall event coupled with the tail end of the spring freshet caused a significant flow to occur in the watersheds around the Anvil Range Mine Site. Rose Creek was in flood stage, the creek within the reservoir basin was overcharged and large areas of the reservoir basin were flooded. Flooding significantly reduced the ability to assess bank stability and evaluate fish habitat. During the August investigation flows had subsided and channel conditions including bank stability and fish habitats were clearly visible. Flow conditions in Rose Creek entering the reservoir basin, during June and August are shown in photos 4 and 3 respectively.

Rose Creek was divided into 5 distinct reaches for this investigation (Figure 1). The reaches were originally defined during the June investigation; the boundaries were refined during lower flow conditions in August.

Reach #1
Begins 30 meters above the upstream edge of the old reservoir basin and extends downstream approximately 340 meters (photos 5 and 8). The break between Reach #1 and #2 was set just downstream of the confluence of the south east tributary at a point

where slope of the basin decreases sharply from 4% to 1%, velocity decreases and substrates become finer.

Reach #2
Flows downstream from the end of Reach #1 for approximately 690 meters to the start of Reach #3 (photos 9 and 10). The break between Reach #2 and #3 was set at a point where slope decreases from 1% to <0.5%, velocity and substrate size decrease and the creek begins to meander after a long, relatively straight run.

Reach #3
Starting from the downstream end of Reach #2 this reach flows for approximately 950 meters to the old Coffer dam at the downstream end of the reservoir basin (photos 11,12,13,14,15). The Coffer Dam represents the upstream edge of construction activities resulting from the decommissioning of the dam.

Reach #4
Flows through the 265 meter reach where dam breach and channel construction activities occurred in 2003 (photos 16,17,18,19,20,21). The reach starts at the old Coffer Dam site and continues through the breach to the downstream limit of channel modifications.

Reach #5
Begins at the downstream limit of 2003 construction activities and flows 220 meters through an old channel constructed at the same time as the dam and extends approximately 40 meters into natural channel (photo 22).

Site X-14
Site X-14 is well below construction activities of 2003 at the fresh water supply dam. It is located at the downstream end of the diversion channel around the tailings area and just upstream of the outlet from the settling ponds. The site extended from water sampling site X-14 and extended upstream to the limit of the lower steep section of the diversion canal. This site was the site of release for a large number of fish salvaged from the reservoir basin during de-watering in 2003 as detailed in the As-built Report prepared by SRK, 2004.

4.1 Fish Habitat

Flows within the reservoir basin have re-established in the previously existing channels of Rose Creek and the south east tributary, flow from the north tributary goes to ground at the edge of the reservoir basin and has no distinct above ground channel within the reservoir. Heavy flows during June flushed the old channel of Rose Creek clear of silt and other fines, especially in the upper reaches. Silt depositions of between 3 and 8 cm were observed in reservoir base areas flooded during high flows. Sand and fine gravel depositions occurred in low velocity areas within the creek channel itself.

Within the Reservoir Basin, "root mats", the remnants of old vegetation dating from the time the reservoir was originally flooded continue to provide channel stability. Banks within the newly exposed channel of Rose Creek are mostly confining. Woody materials that make up the root mats and had maintained structural integrity while under water

were showing signs of weakening over the span of the summer of 2004. These materials will continue to lose structural integrity leaving the creek in a state of flux and vulnerable to erosion. Large woody materials within the basin consist only of spruce stumps as all large material was removed prior to flooding. Further erosion of creek banks should be anticipated until riparian vegetation re-establishes. This process may take years, however, the grass and willow plantings conducted in 2003 and 2004 will mitigate erosion.

In its current state Rose Creek provides a good variety of fish habitats particularly for all life stages of Arctic grayling and slimy sculpin. It should be anticipated that over the next few years more bank erosion and gravel deposition will occur resulting in a wider, shallower creek channel and potentially a change in the fish assemblage and level of utilization.

Reach #1
Has low profile moderately stable banks maintained by thick root mats with boulder substrates underneath. Significant bank erosion did occur in 2004 at 2 locations within the reach (Figure 1 points 3 and 6), (photos 6 and 7). At both these locations channel widths were extended between 8 and 12 meters at outside corners of gentle curves. The area of erosion shown in photo 5 was in part due to re-channelization efforts conducted during the de-watering of the reservoir in 2003. Smaller areas of bank erosion were in evidence through most of the reach. The reach has excellent fast water cover for small fish in the form of deep spacing between boulders and turbulent flows.

Reach #2
Had considerable bank movement of the outside corners at a tight meander "S" bend near the top of the reach. Point bars have developed on the inside corners and deep pools have formed in several places (Figure 1, points 7-9) (photo 9). Below the meanders, Reach #2 flows as a relatively straight channel (photo 10) with low and stable banks and laminar flows. Areas with higher banks through this area have been undercut and many have rolled or folded into the creek (Figure 1, point 12). Several small areas of instream deposition have occurred through the reach, mostly on point bars and in areas near the meanders. Deposition also occurred at an outside corner where the old channel from the south east tributary historically flowed into Rose Creek. Cover is very limited.

Reach #3
Has large areas of under cut and collapsed banks accompanied by the most extensive gravel bar formation in the reservoir basin (Figure 1, points 17-20) (photos 11,12,13,14). Deeper pools have formed in the lower portions of the reach. Two small islands surrounded by deep pools occur immediately upstream of the Coffer Dam (Photo 15). Limited amounts of cover occur in the upper parts of the reach, cover increases from undercut banks and increased depth in the lower reaches. Several areas of the reach may provide possible Arctic grayling spawning areas.

Reach #4
The newly constructed channel has very stable banks and channel features. Some sedimentation of the new rip rap in low flow areas has occurred and the constructed riffles have maintained their shape through the high flow event (Figure 1, points 26,27 and 28) (Photos 16,17,18,19,20,21). Some movement of native materials used in reconstruction of the riffles has occurred and low velocity areas have light silt coverings over boulders and cobbles. In general the newly created channel provides good fish

habitats. Fish cover amongst the cobbles and boulders is enhanced by depth and by the adjacent riffles. The inlet structure constructed at the upstream margin of the newly created channel (Figure 1, point 25), (Photo 16) rises 1.2 meters in height at a 50% slope and may pose a problem to fish migration at water levels lower than those observed during the August field investigations. This site should be re-evaluated during summer of 2005 with the goal of implementing a plan to modify and improve the fish passage situation.

Reach #5
Downstream of the 2003 construction; the channel banks remains stable and clear with some areas of deposition occurring in the channel. Boulders and cobbles are clear of fines and provide good interstitial spacing. Well established riparian vegetation exists through the reach. Areas of deposition occur in vegetated areas adjacent to the creek (Figure 1, points 29 and 30) (Photo 21).

Significant amounts of suspended organic debri and fines were observed in the water column at the downstream end of the breach during June flows. Visual assessments of June flows at the confluence of the North and South Forks of Rose Creek indicated that most of the organics and associated turbidity were settled out in the large wetland area downstream of the reservoir basin, as assumed in the EMP.

Site X-14
The downstream end of the diversion channel with boulder step rapids between deep pools consisting of a very stable man made channel was the upstream end of the investigated channel. The native channel below the diversion channel provides a mix of habitat types with long glide areas, deep flowing pools, side pools and shallow gravel riffles. Cover is provided by large woody debri, root wads and submerged willows. Erosion and deposition occur in a natural pattern with deep cut banks opposite and upstream from deposition areas. Excellent cover for larger fish occurs in this reach.

4.2 Fish Utilization

Electro-fishing results varied for each reach within the newly exposed and newly created channels (Table 1). Slimy sculpin adults were well dispersed throughout the study area, sculpin fry (0+ years) were common in Reach #2, uncommon in Reach #3 and absent from the rest of the reservoir basin. Arctic grayling juveniles were common in Reach #1 and #4 and occasional in Reach #2 and #3. Numerous adult grayling were taken in Reach #5; the only other adult taken in the Reservoir Basin was in Reach #3. Two Arctic grayling adults were electro-fished at Site X-14 and several were observed.

Single pass electro-fishing at site X-14 was conducted in Rose Creek downstream of the outlet of the tailings pond discharge channel (Site R2) (Table 1). Large numbers of slimy sculpin adults were recorded, possibly a remnant population from fish released from the reservoir basin during fish salvage operations in 2003. Minnow traps set at X-14 captured numerous juvenile chinook salmon. Juvenile chinook salmon were not recorded at any of the other sampling locations during this investigation.

A total of 51 minnow traps, spaced approximately 50 meters apart, were set throughout the reservoir basin, through the breach and into the old constructed channel. This includes; 7 traps in reach #1, 1 in the South East Tributary, 14 in reach #2, 18 in reach #3, 5 in reach #4 and 4 traps were set in reach #5. Of the traps set, 10 captured fish, the catch was comprised of 4 slimy sculpin, 3 burbot and 7 Arctic grayling juveniles (5 were taken in a single trap) (Appendix 2).

General visual observations relating to Arctic grayling distribution through all reaches of the reservoir basin indicated that adult and sub adult were well dispersed through reaches #3 and # 4, occasional in #2 and #5. The densest aggregations of grayling near the reservoir basin occurred in the deep water areas immediately upstream of the old coffer dam.

Numerous Arctic grayling adults were observed and angled at site X-14. Arctic grayling were observed surface feeding and were easily angled at this site. The site has easy access and has been a popular angling location for locals. These grayling may be remnants from salvage releases, migrants unable or unwilling to pass into the diversion channel or resident fish.

A single Arctic grayling with a tag was observed in Reach #3 on August 10, 2004 and an unconfirmed report of a tagged grayling being angled in the same reach in July was reported.

Reach # 1
During the two pass block net surveys the first pass recorded 10 juvenile and 2 sub-adult Arctic grayling, 10 adult slimy sculpins and 7 sub-adult burbot. The second pass recorded 16 juvenile and 3 sub-adult Arctic grayling, 11 adult slimy sculpins and 4 sub-adult burbot (Table 1).

A total of 7 minnow traps were set in Reach #1 (Appendix 2) for an average time of 19.6 hours. One trap captured a single adult slimy sculpin adult and one trap captured a single burbot sub-adult. A single trap was placed 10 meters upstream of the Rose Creek confluence within the South East Tributary, this trap did not capture fish.

Reach # 2
During the two pass block net surveys the first pass recorded 2 juvenile Arctic grayling, 30 adult and 33 fry slimy sculpins. The second pass recorded 5 juvenile Arctic grayling, 16 adult and 53 fry slimy sculpins (Table 1).

A total of 14 minnow traps were set in Reach #2 (Appendix 2) for an average time of 19 hours each. One trap captured a single burbot sub-adult and 2 others each captured single Arctic grayling juveniles.

Reach # 3
During the two pass block net surveys the first pass recorded 1 adult Arctic grayling, 14 adult and 7 fry slimy sculpins and 4 sub-adult burbot. The second pass recorded 3 juvenile and 1 sub-adult Arctic grayling, 14 adult and 4 fry slimy sculpins, 6 sub-adult and 1 adult burbot Table 1).

A total of 18 minnow traps were set in Reach #3 (Appendix 2) for an average time of either 19 or 25.5 hours each. One trap captured a single slimy sculpin adult.

Visual observation on Aug 13, through lower 600 meters of Reach #3 counted 48 Arctic grayling adults and sub-adults, 16 of these were within 60 meters of the downstream end of Reach #3 at the coffer dam site. A similar number of grayling were observed on August 12, although an exact count was not conducted one of the grayling had at a tag from last season.

Reach # 4

During the two pass block net surveys the first pass recorded 18 juvenile and 1 sub-adult Arctic grayling, 6 adult slimy sculpins and 6 sub-adult burbot. The second pass recorded 18 juvenile and 1 sub-adult Arctic grayling, 13 adult slimy sculpins and 5 sub-adult burbot (Table 1).

A total of 6 minnow traps were set in Reach #4 (Appendix 2) for an average time of 25.3 hours each. One trap captured a single Arctic grayling juvenile and another trap captured 5 Arctic grayling juveniles.

Reach # 5

Electro-fishing in Reach #5 was conducted as a single pass survey and recorded 10 juvenile and 11 adult Arctic grayling, 6 adult slimy sculpin and 5 sub-adult burbot (Table 1).

A total of 5 minnow traps were set in Reach #5 (Appendix 2) for an average time of 18 hours each. One trap captured a single Arctic grayling juvenile and one trap captured a single burbot sub-adult.

Site X-14

Electro-fishing at site X-14 was conducted downstream of the confluence of the tailings pond discharge with Rose Creek as a single pass survey and recorded 2 adult Arctic grayling, 8 fry and 116 adult slimy sculpin and 2 sub adult burbot (Table 1).

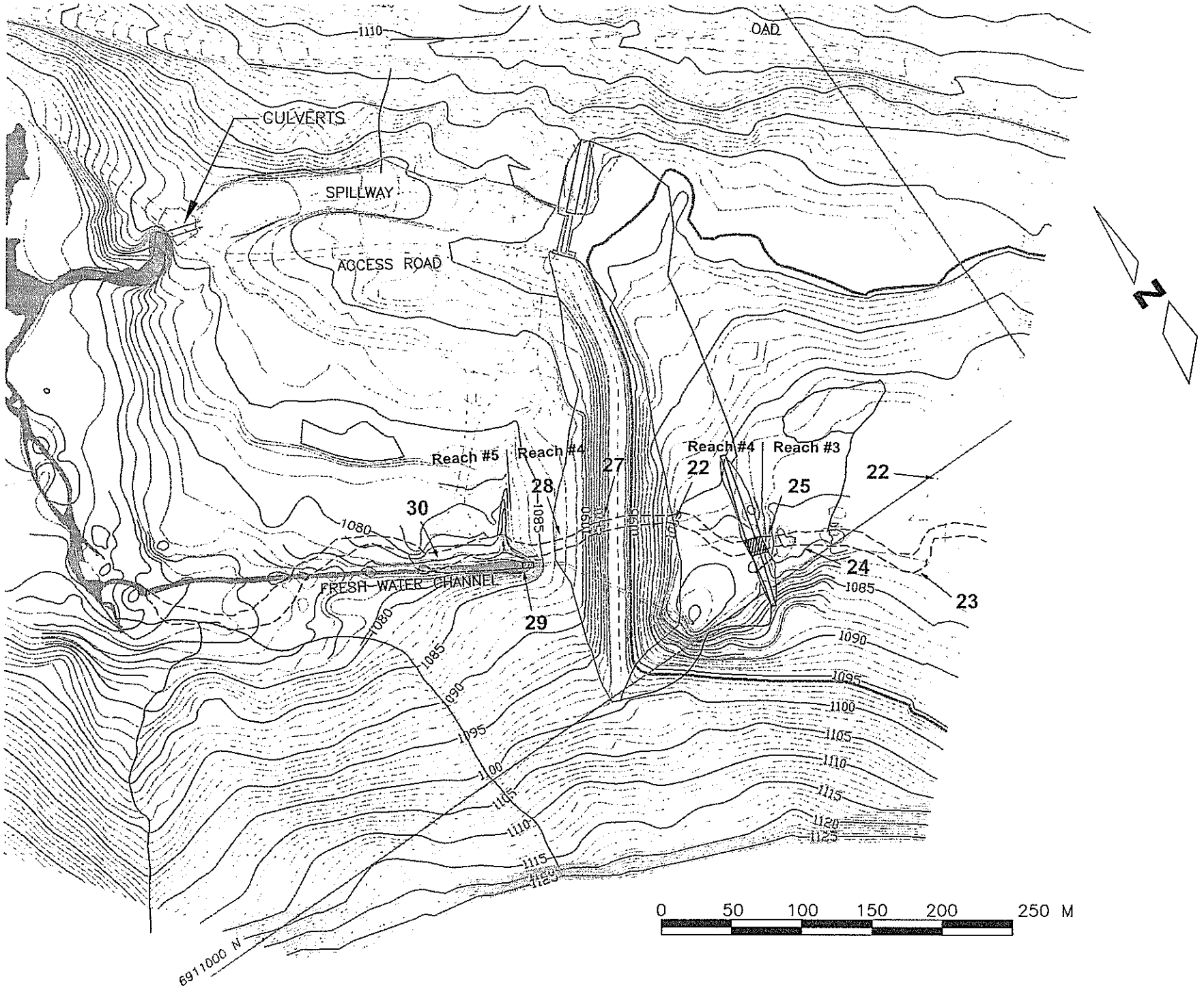
A total of 14 minnow traps were set at site X-14 from the lower end of the Rose Creek diversion channel to the confluence of the tailings discharge channel with Rose Creek. Traps were set for an average time of 23.5 hours. Of the traps set, 6 captured juvenile chinook salmon (a total of 23 were captured), 2 captured sculpin and one of the traps that captured juvenile chinook also captured a juvenile burbot (Appendix 2).

Table 1: Results of electro-fishing surveys conducted in Rose Creek in the de-watered reservoir basin, through the breach of the old dam and at site X-14 during August, 2004.

			Catch		
Site	Pass #	Shock time (seconds)	Arctic Grayling	Slimy Sculpin	Burbot
Reach #1	1	1,555	10 juv. 2 sub.ad	10 adult	7 sub.ad.
	2	1,530	16 juv. 3 sub. ad.	11 adult	4 sub.ad.
Reach #2	1	1,384	2 juv.	30 adult 33 fry	
	2	1,699	5 juv.	16 adult 53 fry	
Reach #3	1	970	1 adult	14 adult 7 fry	4 sub.ad.
	2	905	1 sub.ad.. 3 juv	13 adult 4 fry	1 adult 6 sub.ad
Reach #4	1	1,508	1 sub.ad. 18 juv.	6 adult	6 sub.ad.
	2	1,479	1 sub.ad. 18 juv.	13 adult	5 sub.ad.
Reach #5	1	878	20 adult and sub-ad 6 juv.	5 adult	2 sub ad.
Site X-14	1	741		116 adult 8 fry	2 sub ad.

Juv. =juvenile, sub.ad = sub adult,

Figure 1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CULVERTS
SPILLWAY
ACCESS ROAD
N
Reach #5
Reach #4
Reach #4
Reach #3
30
28
27
22
25
22
1080
1085
1090
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1100
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FRESH WATER CHANNEL
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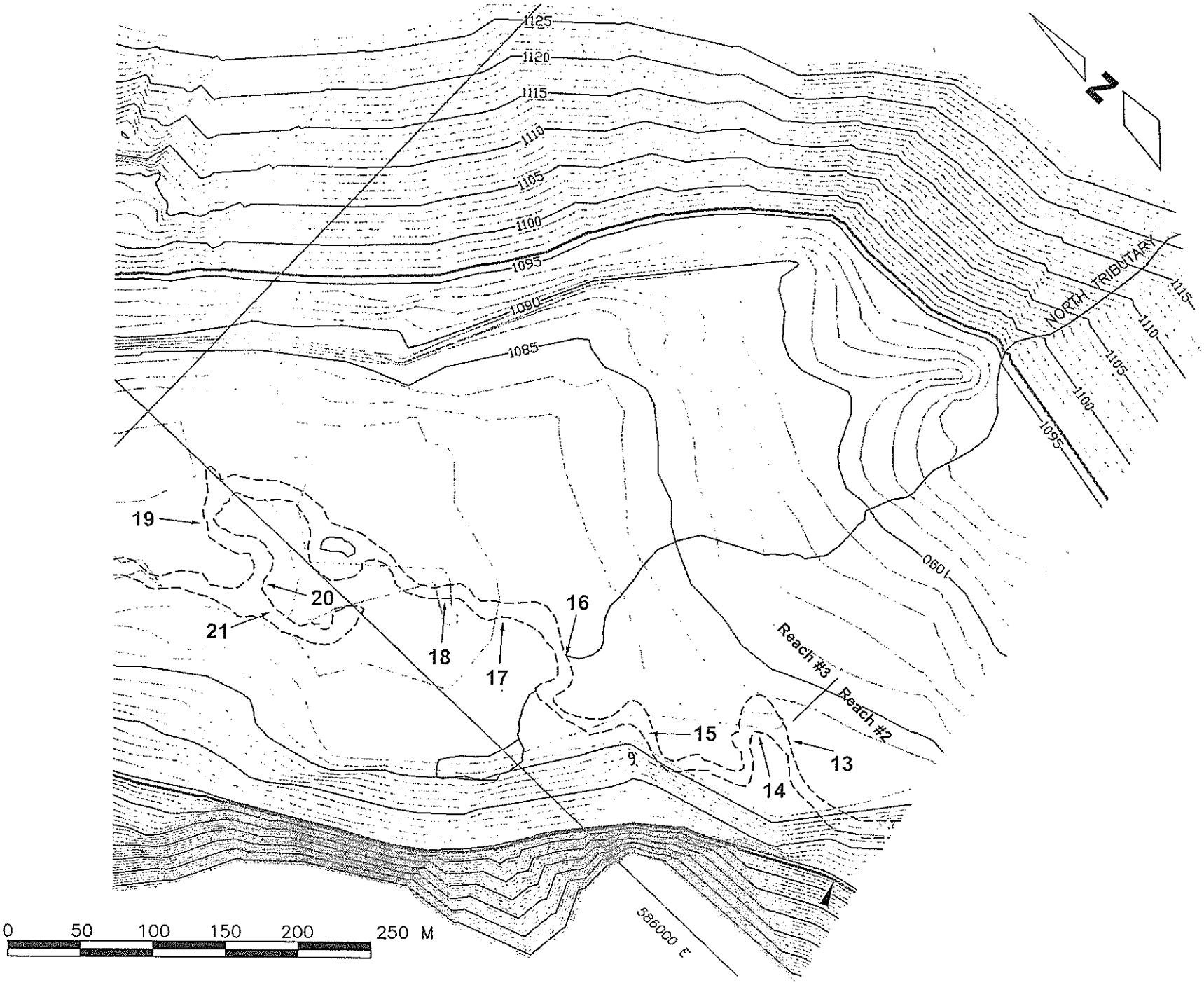
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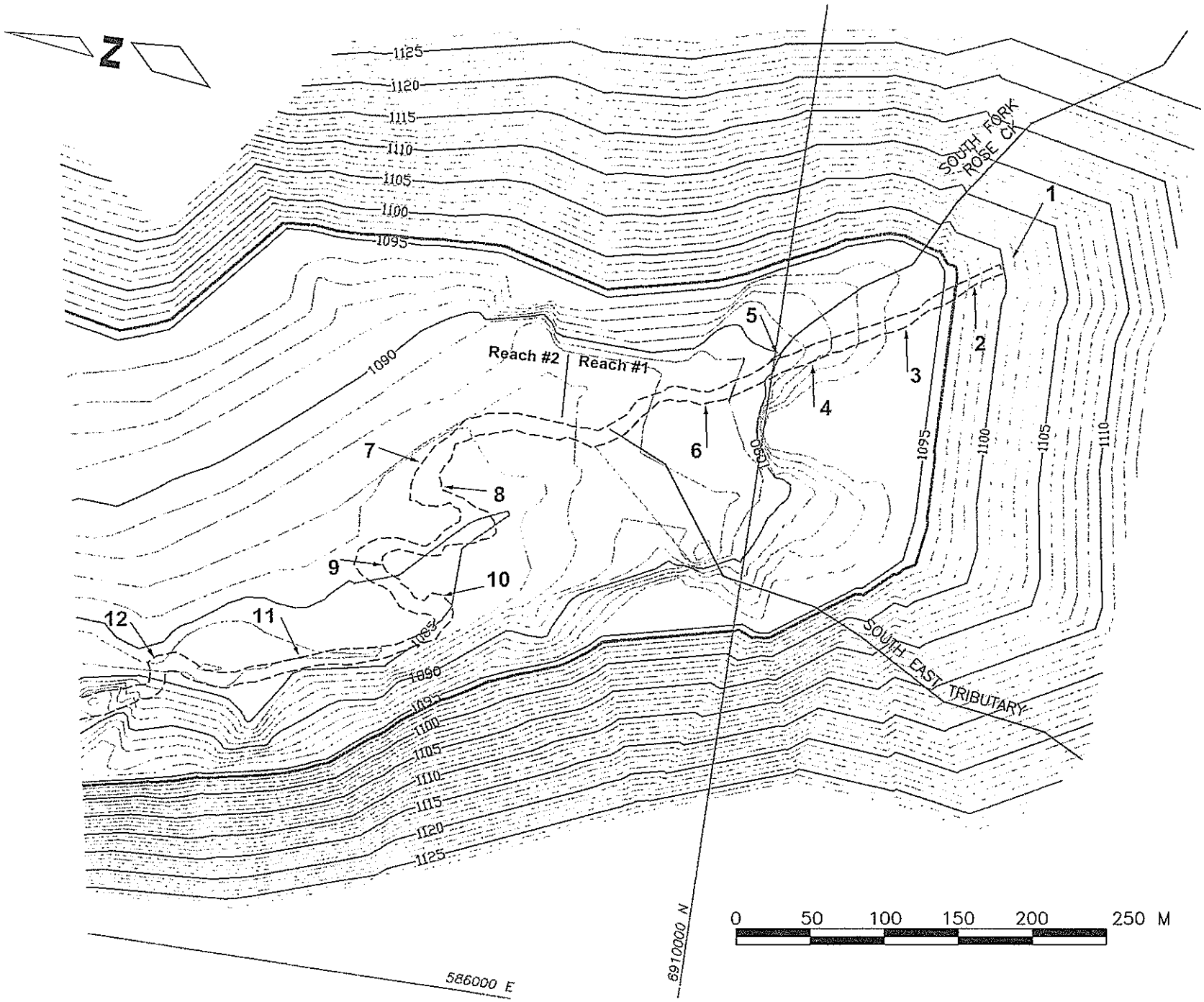
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6910000 N

FIGURE 1: Map Legend

Reach #1

1 Delta area formed during the life of the reservoir at the inlet of Rose Creek where it entered the old reservoir. Reservoir influence extends 20 meters upstream of the edge of the reservoir high water mark; the resulting braided channel exists as 4 separate channels that continue to enter the old reservoir basin. Fish habitats upstream of the reservoir basin consist of single well defined channel with boulders being the predominant substrate (photos 2,3). The 4 channels come back into 2 channels at the edge of the former reservoir, the channels flow over the former reservoir basin edge across a flat area with exposed rocks in the middle and channels on either side (photo 5).

2 Channels merge into a single channel within 30 meters of the former reservoir margin. Substrates consist of large boulders with some gravel infill to produce stepped rapids with bank erosion visible on both sides (photo 7).

3 High water during June caused extensive erosion and movement of the channel by approximately 16 meters on the left bank. The main thalwag continues to flow in the original channel (photo 6). The creek flow was directed into the existing channel at this location during dewatering in summer, 2003 to prevent overland flows and potential glaciation.

4 Side to side erosion occurred during June of 2004 exposing boulders of the right bank. The left bank had less erosion due to old root mat protection (photo 7).

5 Well defined banks protected by old root mats confine the channel into a stepped boulder raid with small pools interspersed (photo 8).

6 Banks have eroded as much as 10 meters on either side creating dry gravel/cobble side areas with small perched side channels and sand bars.

Reach #2

7 Erosion of outside corners has created a large corner pool with a small sand island over the original channel.

8 Erosion of side banks and creation of sand and gravel point bars continues through area of tight meanders.

9 outside corner of meander has moved 8-10 meters leaving a new sand/ gravel point bar

10 Shallow pool on outside corner, with extensive erosion during 2004 has become a point of deposition with thalwag eroding the point inside the curve by several meters.

11 Long (175 meters) straight stretch partially confined by the hillside on the left bank. Right bank is low (0.4 meters) with exposed boulder edges. Small cobble and gravel substrates typical of reach 2 (photo 10).

12 Channel constricted on right by 3-4 meter eroding bank consisting of aggregate materials, confined on left bank by hillside. Old, grass covered point bar exists 20 meters downstream.

13 Ground flow, likely from the North Tributary, comes to surface 20 meters from right bank and flows into Rose Creek.

14 Large sand and gravel deposit opposite deeply eroded outside corner.

Reach #3

15 First mid channel gravel bar.

16 Old North Tributary channel, minimal flows enter Rose Creek, channel is back flooded 30 meters by Rose Creek to a point where several small rivulets enter this channel.

17 Series of undercut and collapsing banks on both banks with associated deep side pools >1 meter depth.

18 Gravel bar formations with much bank movement in the area (photo 11).

19 Channel actively shifting, banks non-existent in a flat flood plain area, gravel bar formations (photo).

20 New bank erosion, with much undercutting and deposition areas, the channel consists of 40% gravel bar (photo 14).

21 Old meander scroll channel remains wet and flows, but only as a trickle.

22 Small side slough connected to the Downstream end of the North Tributary.

23 Perched areas of ponding behind levee on left bank.

24 Channel braids and forms two small islands of local materials consisting of very fragile, unconsolidated mud. Deep pools surround the islands (photo 15).

Reach #4

25 Inlet structure constructed at the upstream margin of the newly created channel. Steep rip rap rock, rapid, 1.2 meters in height with a slope of almost 50% (photo 16).

26 First constructed riffle in the breach.

27 Second constructed riffle in the breach (photo 17).

28 Third constructed riffle in the breach (photo 18).

29 Boulder armor ends directing flow into channel built at the time of original dam construction (photo 19).

Reach #5

30 End of channel built at the time of original dam construction (photos 22,23).

APPENDIX 1

GENERAL SITE DESCRIPTIONS

APPENDIX 1

GENERAL SITE DESCRIPTIONS

LOCATION: Reach #1

UTM upstream end: Zone 8V 5 86 518 E / 69 09 900 N
Elevation: 3,608 feet
Site Location Description: South Fork Rose Creek at the upstream end of de-watered reservoir.
Date Sampled: August 10, 11, and 12, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	370 meters
Average Channel Width:	6.5 meters
Average Wetted Width:	3.5 meters
Slope	4%
Average Depth:	0.3 meters
Average Velocity	>1 meters per second
% Pool, Riffle, Run / Glide:	45 % short runs, 25% stepped rapids over boulders and 30% small pools
Cover	Boulder pools, turbulence and perched boulders and cobbles
Overhead vegetation	Non-existent
Riparian Vegetation	newly planted grasses, willow stems and poplar stems

BED MATERIAL:

Unconsolidated
50% boulder, >35% cobble, <10% gravel, 5% sand (sand only in deposition points along side areas)

BANK CHARACTERISTICS: Banks rise an average of 0.8 meters; evidence of erosion from 2004 occurs on both banks exposing old vegetation mats. Two separate areas of significant erosion occurred within reach #1 during the 2004 freshet, channel movements of 8 to 10 meters were recorded. On top of the banks fine silts to a depth of 15 cm have been newly deposited. Grass plantings from the fall of 2003 and the spring of 2004 have established growth. Some of the willow and black poplar plantings from spring 2004 have taken.

STREAM FLOW CHARACTERISTICS: Flows consist of a stepped rapid consisting of 30% boulder pools mixed with short run areas 2-5 meters in length between boulder steps.

PHOTOS: See photos 2, 3, 4, 5, 6, 7, 8, and 24

LOCATION: South East Tributary

UTM at confluence with Rose Creek: Zone 8V 5 63 383 E / 69 10 127 N
Elevation: 3,573 feet
Site Location Description: Small tributary within the reservoir basin that feeds into Rose Creek.
Date Sampled: August 10, 11, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	<250 meters
Average Channel Width:	2.75 meters
Average Wetted Width:	2.75 meters
Average Depth:	0.15 meters
Average Velocity	<0.5 meters per second
% Pool, Riffle, Run / Glide:	90% riffle/ run, and 10% small pools
Cover	limited; boulders, some organic debri and turbulence
Overhead vegetation	Non-existent
Riparian Vegetation	lower reach has grass planted in 2004, upper reach has well established grass planted in fall of 2003

BED MATERIAL: Substrates become finer moving downstream from the edge of the old reservoir to the confluence with Rose Creek. A decrease in slope occurs 100 meters from the edge of the old reservoir basin.

Upper reach 80% boulder, 20% cobble.
Lower reach 35% boulder, 35% cobble, 20% gravel and 10% sand

BANK CHARACTERISTICS: Upper 100 meters is entrenched with abrupt banks that rise to a maximum of 1.5 meters and are eroding. Lower 150 meters also entrenched with banks consistently rising abruptly to 0.6 meters.

STREAM FLOW CHARACTERISTICS: Upper 100 meters is 100% boulder strewn run with organic deposition area at slope change, lower 250 meters is 90% riffle run with 2 small pools (10%) near Rose Creek

LOCATION: Reach #2

UTM at upstream end: Zone 8V 5 86 379 E / 69 10 178 N
Elevation: 3,567 feet
Site Location Description: Reach starts approximately 340 meters downstream of the edge of the old reservoir basin and extends approximately 690 meters downstream.
Date Sampled: August 9, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	690 meters
Average Channel Width:	6.0 meters
Average Wetted Width:	5.5 meters
Average Depth:	0.18 meters
Slope	>1%
Average Velocity	>1 meters per second
% Pool, Riffle, Run / Glide:	20% riffles, 60% glide and 20% pools
Cover	very little cover, some provided by deep corner pools
Overhead vegetation	non-existent
Riparian Vegetation	new grass and willow plantings

BED MATERIAL: Substrates become finer moving down the reach. Cobbles, common in the upper portions of the reach become rare in the lower portion.

Occasional boulder, 30% cobble, 60% gravel, 10% sand

BANK CHARACTERISTICS: Mostly entrenched rising abruptly an average of 0.4 meters. Banks consist of eroding vegetative mat.

STREAM FLOW CHARACTERISTICS: Long glide areas interspersed with occasional gravel riffles. A total of 6 large pools occur.

PHOTOS: See photos 9, 10, and 26

LOCATION: Reach #3

UTM upstream end: Zone 8V 5 86 148 E / 69 10 551 N
Site Location Description: Reach extends from just upstream of the old North Tributary confluence to the site of the old coffer dam.
Date Sampled: August 10, 11, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	Approximately 950 meters
Average Channel Width:	5.0 meters
Average Wetted Width:	4.5 meters
Average Depth:	0.4 meters
Slope	0.5%
Average Velocity	>0.5 meters per second
% Pool, Riffle, Run / Glide:	10% riffles, 80% glide and 10% pools
Cover	Very limited, small riffles and occasional pool
Overhead vegetation	Non-existent
Riparian Vegetation	newly seeded grass

BED MATERIAL: Loosely consolidated gravels and sand, cobbles and boulders firmly consolidated.

10% boulder, 10% cobble, 70% gravel, 10% sand (sand in deposition points only)

BANK CHARACTERISTICS: 70% of banks cut and eroding with rise to flood plain varying from 0.2 meters to 1.0 meters, 30% deposition points

STREAM FLOW CHARACTERISTICS: Channel is predominantly flat and featureless with occasional side pools

PHOTOS: See photos 11, 12, 13, 14, 15 and 27

LOCATION: North Tributary

UTM old channel confluence with Rose:
Site Location Description: Small tributary that enters Rose Creek from the West
Date Sampled: August 10, 2004

BED MATERIAL: Substrates consist primarily of fine gravels and sand with heavy orange colored siltation. Boulders in a steep area upstream of the old gravel pit pond have been placed to protect from head-ward erosion.

BANK and STREAM FLOW CHARACTERISTICS: The channel of this tributary within the reservoir basin is indistinct; during spring flows this tributary entered the reservoir basin cascading down a boulder shoot immediately below the road then formed a pond in an old gravel pit. Flows exited the pond through a well defined channel for 20 meters before charging overland and over the flood plain with no distinct channel. Flows entered Rose Creek as small rivulets. During August investigations the flow went to ground in the boulder shoot upstream of the pond, the pond was partially charged, however no distinct flow came out of the pond and all flow from this creek went to ground. Two small rivulets arising from the ground 20 meters from Rose Creek were the only surface flow observed.

PHOTOS: see photos 23, 25 and 27

LOCATION: Reach #4

UTM Upstream end of reach: Zone 8V 5 85 764 E / 69 11 037 N
Site Location Description: Reach extends from the old coffer dam through the breach of the old dam.
Date Sampled: August 10, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	265 meters
Average Channel Width:	6.0 meters
Average Wetted Width:	5.5 meters
Average Depth:	0.3 meters
Average Velocity	<0.5 meters per second
% Pool, Riffle, Run / Glide:	10% riffles/ rapid, 90% glide
Cover	riffle areas and interstitial spaces along shoreline blast rock
Overhead vegetation	non-existent
Riparian Vegetation	none

BED MATERIAL: Substrates are heavily silted in glide areas.

60% angular boulder, 20% cobble, 20% gravel, % sand

BANK CHARACTERISTICS: Confining and stable banks consist of stepped and contoured blast rock constructed during 2003.

STREAM FLOW CHARACTERISTICS: Channel is flat flowing predominantly as a glide, riffle/ rapids are constructed.

PHOTOS: See photos 16, 17, 18, 19, 20, 21, 22, 29 and 30

LOCATION: Reach #5

UTM upstream end: Zone 8V 05 83 690 E / 69 12 366 N
Site Location Description: downstream of the breach and construction activity
Date Sampled: August 13, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	260 meters
Average Channel Width:	3.0 meters
Average Wetted Width:	3.0 meters
Average Depth:	0.4 meters
Average Velocity	1.0 meters per second
% Pool, Riffle, Run / Glide:	20% riffles, 50% run and 5% pools (pools along edges and at corners)
Cover	Perched cobbles, steep banks, occasional corner pools and turbulence below riffles
Overhead vegetation	5% coverage from willows and dwarf birch
Riparian Vegetation	willow, poplar, some cinquefoil and sedges

BED MATERIAL: Substrates highly compacted and consolidated.

10% boulder, 80% cobble, 10% gravel with very few fines

BANK CHARACTERISTICS: Banks are well defined and confining, rising 0.6 meters to an open flood plain. This reach was a constructed channel built at the time of the original dam construction

STREAM FLOW CHARACTERISTICS: Creek bottom is flat and the channel flows arrow straight through the constructed channel. Meanders at the downstream end are straightening and flows may shift to original channel in subsequent high water events.

PHOTOS: See photos 22, 28 and 31

LOCATION: Site X-14

Site Location Description: Rose Creek from the downstream end of the diversion channel to 100 meters downstream of the confluence with the tailings pond channel.
Dates Sampled: August 14 and 15, 2004

CHANNEL CHARACTERISTICS:

Reach Length:	360 meters
Average Channel Width:	17.0 meters
Average Wetted Width:	8.0 meters
Average Depth:	0.7 meters
Average Velocity	0.5 meters per second
% Pool, Riffle, Run / Glide:	10% riffles, 80% glide/run and 10% pools
Cover	deep pools, collapsed banks and instream woody debri
Overhead vegetation	15% coverage from willows and occasional spruce sweeper
Riparian Vegetation	willow, sedges and occasional spruce

BED MATERIAL: Substrates loosely compacted and mobile.

Small cobble patches near riffles 15%, 85% gravel

BANK CHARACTERISTICS: Wide gravel aprons opposing actively eroding cut banks

STREAM FLOW CHARACTERISTICS: The channel flows consistently with a deep side opposite of a gravel apron with occasional flat channels near riffle areas.

APPENDIX 2

Minnow Trapping Results
(See attached excel files)

Site	location	date set	date lift	time set	time lift	hours set	s. sculpin	A.grayling	burbot	juv.chin.salm.	comments
R1-1	30m u/s old shore	Aug.11	Aug.12	1858	1416	19.3	0	0	0	0	below rapid, V=<.4 m/sec, willow cover
R1-2	40m d/s old shore	Aug.11	Aug.12	1852	1412	19.3	0	0	0	0	lg. bldrs, V=<.5 m/sec
R1-3	90m d/s old shore	Aug.11	Aug.12	1848	1418	19.5	1 (92mm)	0	0	0	mid chan, above washout
R1-4	140m d/s old shore	Aug.11	Aug.12	1843	1422	19.6	0	0	0	0	side flow, cobs and bldrs
R1-5	200m d/s old shore	Aug.11	Aug.12	1838	1423	19.7	0	0	0	0	bldrs with washed out veg edge
R1-6	240m d/s old shore	Aug.11	Aug.12	1833	1424	19.9	0	0	0	0	side of riffle. Bldr/cob, V=>1 adj.
R1-7	290m d/s old shore, 50m u/s Reach #2	Aug.11	Aug.12	1827	1428	20	0	0	1 (180mm)	0	imm. u/s SE Trib side bank, bldrs, V=<.5 m/sec
SE Trib	10 m u/s Rose	Aug.11	Aug.12	1920	1428	20.1	0	0	0	0	hole between bldrs
R2-1	top of reach #2	Aug.11	Aug.12	1822	1428	20.1	0	1 (55mm)	0	0	cut bank, co/bldr adj, woody debri, V=>.1 m/sec
R2-2	45m d/s R2-1	Aug.11	Aug.12	1817	1430	20.2	0	1 (50mm)	0	0	mid chan, below cob riffle, V=<.3 m/sec
R2-3	110m d/s R2-1	Aug.11	Aug.12	1925	1434	19.1	0	0	0	0	btm of lg wash out pool, lg woody debri
R2-4	170m d/sR2-1	Aug.11	Aug.12	1930	1434	19.1	0	0	0	0	cut bank side eddy, fine grav. and seds
R2-5	185m d/s/ R2-1	Aug.11	Aug.12	1930	1438	19.1	0	0	0	0	cut bank, below riffle, mud
R2-6	235m d/s R2-1	Aug.11	Aug.12	1934	1440	19.1	0	0	0	0	cut bank, edge of glide
R2-7	285m d/s R2-1	Aug.11	Aug.12	1938	1442	19.1	0	0	0	0	cut bank, silted cobs
R2-8	340m d/s R2-1	Aug.11	Aug.12	1940	1442	19	0	0	0	0	side of riffle, sand,cob, bldr,V=<.25 m/sec
R2-9	385m d/s R2-1	Aug.11	Aug.12	1945	1444	19	0	0	0	0	top of riffle, log adj, cob, grav.
R2-10	440m d/s R2-1	Aug.11	Aug.12	1950	1448	19	0	0	0	0	cut bank, top of eddy pool
R2-11	490m d/s R2-1	Aug.11	Aug.12	1953	1451	19	0	0	1 (140mm)	0	gravel toe, cobs, V= >.25 m/sec
R2-12	545m d/s R2-1	Aug.11	Aug.12	1957	1453	18.9	0	0	0	0	lg stump, grav, V=<.2 m/sec
R2-13	595m d/s R2-1	Aug.11	Aug.12	2000	1455	18.9	0	0	0	0	cut bank, lg bldr eddy pool, V=-.2 m/sec
R2-14	655m d/s R2-1 and 30m u/s reach #3	Aug.11	Aug.12	2002	1459	19	0	0	0	0	trap washed out V=>.5 m/sec
R3-1	30m d/s Reach #2	Aug.11	Aug.12	2005	1500	18.9	0	0	0	0	cut bank, silted grav, V=>.25 m/sec
R3-2	80m d/s R#2	Aug.11	Aug.12	2010	1501	18.9	0	0	0	0	spr tree, silted cobs, V= >.3 m/sec
R3-3	120m d/s R#2	Aug.11	Aug.12	2010	1502	18.9	0	0	0	0	cut bank with eddy, V=>0 m/sec
R3-4	160m d/s R#2	Aug.11	Aug.12	2012	1503	18.9	0	0	0	0	deep hole near slough, pea grav, V= >.2 m/sec
R3-5	210m d/s R#2	Aug.11	Aug.12	2015	1504	18.8	0	0	0	0	cut bank, fine subs
R3-6	260m d/s R#2	Aug.12	Aug.13	1508	1635	25.5	0	0	0	0	cut bank, woody debri, V= <.2 m/sec
R3-7	360m d/s R#2	Aug.12	Aug.13	1510	1638	25.5	1 (75mm)	0	0	0	side flow, cut bank, V=.2 m/sec
R3-8	420m d/s R#2	Aug.12	Aug.13	1523	1643	25.3	0	0	0	0	cut bank, V= .2 m/sec
R3-9	475m d/s R#2	Aug.12	Aug.13	1517	1648	25.4	0	0	0	0	lg collapsed bank, san, grav V= <.1 m/sec
R3-10	525m d/s R#2	Aug.12	Aug.13	1520	1651	25.4	0	0	0	0	cut bank, sand, V= .2 m/sec
R3-11	575m d/s R#2	Aug.12	Aug.13	1526	1655	25.5	0	0	0	0	flooded woody veg, V= .2 m/sec
R3-12	610m d/s R#2	Aug.12	Aug.13	1529	1700	25.5	0	0	0	0	cut bank notch, sand, grav, V=<.5 m/sec
R3-13	670m d/s R#2	Aug.12	Aug.13	1533	1704	25.5	0	0	0	0	cut bank, grav adj, V=<.5 m/sec
R3-14	720m d/s R#2	Aug.12	Aug.13	1536	1710	25.6	0	0	0	0	cut bank, bldrs, washed sand, V= .2 m/sec
R3-15	780m d/s R#2	Aug.12	Aug.13	1541	1714	25.5	0	0	0	0	willow wad near washout area,sand, V= >.1 m/sec
R3-16	830m d/s R#2	Aug.12	Aug.13	1546	1720	25.6	0	0	0	0	above riffle, gravel and silted grav, V= .1 m/sec
R3-17	890m d/s R#2	Aug.12	Aug.13	1548	1724	25.6	0	0	0	0	tall cut bank, silted bldrs, V= .2 m/sec
R3-18	940m d/s R#2 and 50m u/s R#4	Aug.12	Aug.13	1552	1729	25.6	0	0	0	0	braid area, bldrs, V= -.3 m/sec
R4-1	u/s end of R#4	Aug.12	Aug.13	1602	1722	25.5	0	0	0	0	imm u/s first rapid, silted cob, V= .2 m/sec
R4-2	50m d/s R4-1	Aug.12	Aug.13	1603	1720	25.3	0	0	0	0	run area, silted cob, V= .3 m/sec
R4-3	125m d/s R4-1	Aug.12	Aug.13	1608	1717	25.2	0	0	0	0	bldr cob edge, V=.2 m/sec
R4-4	195m d/s R4-1	Aug.12	Aug.13	1610	1715	25.1	0	5 (49,48,5'	0	0	imm d/s riffle, bldr, cob
R4-5	235m d/s R4-1	Aug.12	Aug.13	1612	1712	25	0	0	0	0	imm d/s riffle, washed cob, V=.4 m/sec
R4-6	265m d/s R4-1 and at d/s end reach #4	Aug.12	Aug.13	1616	1720	25.1	0	1 (51mm)	0	0	imm u/s riffle, sand, willows, V=.2 m/sec
R5-1	u/s end of R#5	Aug.12	Aug.13	1620	1705	24.8	0	0	0	0	drop pool, over head veg, eddy
R5-2	25m d/s R5-1	Aug.13	Aug.14	1750	1120	17.5	0	1 (49mm)	0	0	constructed chan, willow over, cob, V= .4 m/sec
R5-3	75m d/s R5-1	Aug.13	Aug.14	1755	1115	17.3	0	0	1 (170)	0	undercut bank, willow over, cob, grav, V=>.2 m/sec
R5-4	125m d/s R5-1	Aug.13	Aug.14	1800	1030	17.5	0	0	0	0	edge of eddy, sm bldrs

R5-5	180m d/s R5-1	Aug.13	Aug.14	1805	1035	17.5	0	0	0	0	abrupt bank, cobs,, V=.5 m/sec, natural chan
X-14-1	Bottom of const. bldr channel	Aug.14	Aug.15	1540	1520	23.6	0	0	0	2 (77,82)	imm. d/s of bldr rapids, ang bldr, eddy
X-14-2	10m d/s X-14-1	Aug.14	Aug.15	1540	1520	23.6	0	0	0	0	mid chan. edge of flow, cob, grav
X-14-3	Adj to X-14-1	Aug.14	Aug.15	1545	1520	23.8	0	0	0	0	btm of rapid, bldrs, V=.4
X-14-4	5m d/s X-14-1	Aug.14	Aug.15	1545	1530	23.8	0	0	0	0	pool below rapid, v=.1
X-14-5	10m u/s X-14-1	Aug.14	Aug.15	1600	1530	23.5	0	0	0	16 (74-92)	pool between rapids, bldrs, v=-.2
X-14-6	10m u/s X-14-1	Aug.14	Aug.15	1600	1530	23.5	0	0	1(240)	1 (80)	pool between rapids, bldrs, v=-.2
X-14-7	50m u/s X-14-1	Aug.14	Aug.15	1600	1530	23.5	0	0	0	0	Mid chan belw 3rd u/s rapid, V= eddy
X-14-8	75m d/s X-14-1	Aug.14	Aug.15	1615	1530	23.3	0	0	0	0	u/s end of ang bldr armor
X-14-9	110m d/s X-14-1	Aug.14	Aug.15	1620	1540	23.3	0	0	0	1 (75)	corner pool, roots over
X-14-10	20m d/s X-14-9	Aug.14	Aug.15	1620	1540	23.3	0	0	0	1 (55)	mud cut bank, sub. willow, mudy gravel, V=.3
X-14-11	25m d/s X-14-10	Aug.14	Aug.15	1623	1540	23.3	0	0	0	0	mudded gravel, V=.3
X-14-12	25m d/s X-14-11	Aug.14	Aug.15	1623	1540	23.3	1 (80)	0	1 (180)	0	small side riffle, grav. V=.3
X-14-13	20m d/s X-14-12	Aug.14	Aug.15	1625	1545	23.3	0	0	0	2 (75,79)	collapsed bank, sub willow, pool, V=.1
X-14-14	25m d/s X-14-13	Aug.14	Aug.15	1630	1545	23.3	1 (22)	0	0	0	collapsed bank, eddy pool, roots, V=.25

APPENDIX 3

Photographs

Appendix 3: Photographs

Photo 1: Aerial view of the study area during August, 2004

Photo 2: Rose Creek, immediately upstream of the reservoir basin showing the old inlet area.

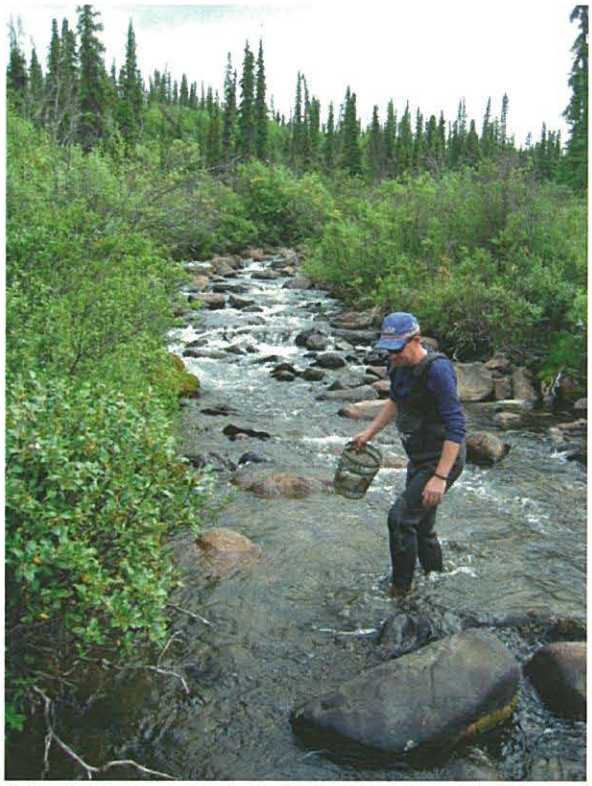

Photo 3: Rose Creek upstream of the Reservoir Basin during August.

Photo 4: Rose Creek upstream of the Reservoir Basin during June freshet, from the same location as photo 3.

Photo 5: Rose Creek as it enters the Reservoir Basin at the top of Reach #1.

Photo 6: Reach #1, extensive bank erosion in area flows were put back into original channel during the de-watering process. Note sediment depositions and old root mat.

Photo 7: Bank erosion and typical substrates of Reach #1.

Photo 8: Non-eroded banks of Reach #1 showing stabilizing root mat and areas of deposition adjacent.

Photo 9: Outside corner deposition area was old outlet area for the south east tributary.

Photo 10: Low and stable banks of Reach #2 in typical flow area.

Photo 11: Gravel and sand depositions in Reach #3. Note undercut banks have rolled into the channel.

Photo 12: Shallow, destabilized banks in Reach #3 with sedimentation areas.

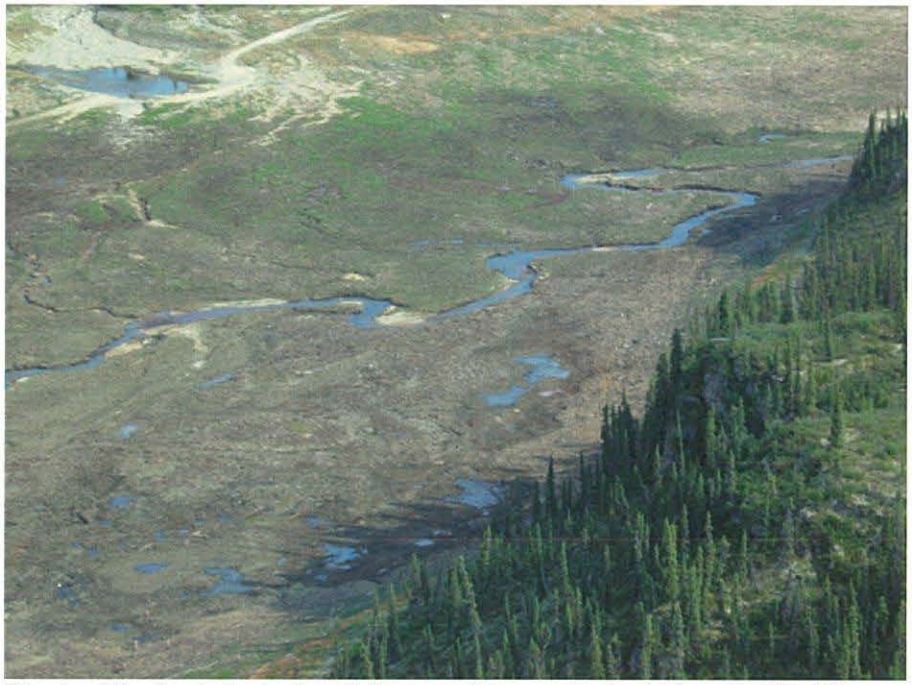

Photo 13: Aerial photo of the upstream end of Reach #3. The north tributary drainage pattern below the pond area is also visible.

Photo 14: Aerial view of mid-section of Reach #3 showing deposition areas and extent of gravel bar formation during 2004.

Photo 15: Aerial view of the downstream end of Reach #3 showing island formation above the old coffer dam site.

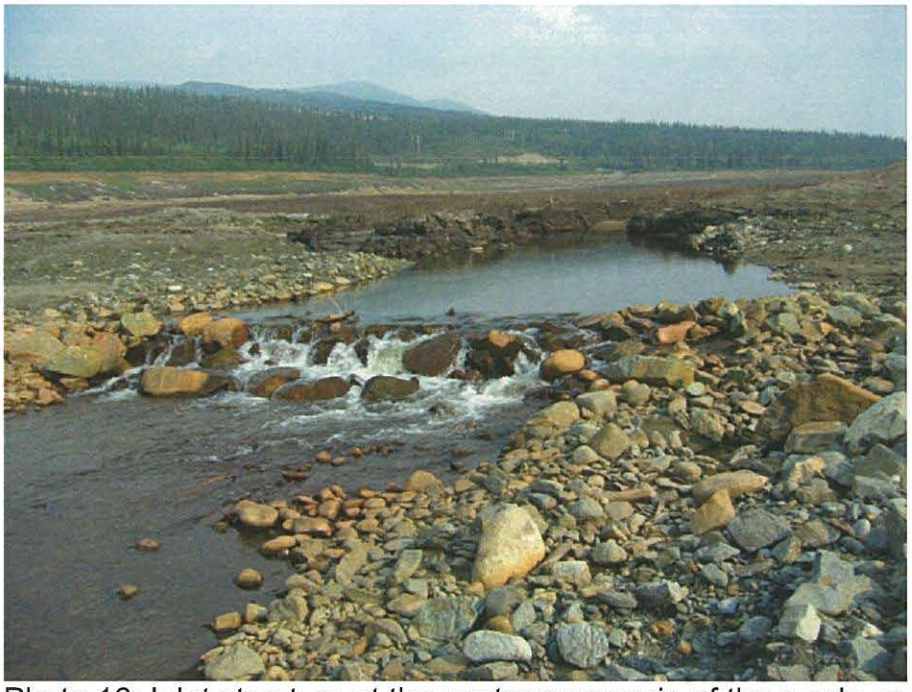

Photo 16: Inlet structure at the upstream margin of the newly created channel and start of Reach #4.

Photo 17: Stable channels looking upstream through the breach area.

Photo 18: Riffle in Reach #4.

Photo 19: The downstream end of the constructed channel area.

Photo 20: Aerial view of the constructed channel through the breach.

Photo 21: Aerial view of the constructed channel within the breach.

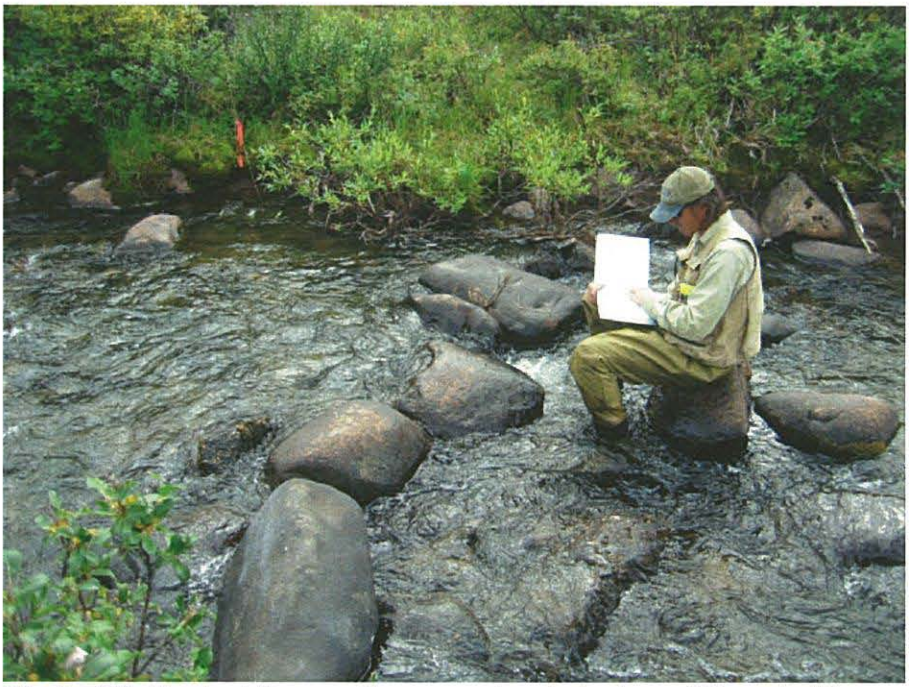

Photo 22: Typical flow patterns and substrates of Reach #5.

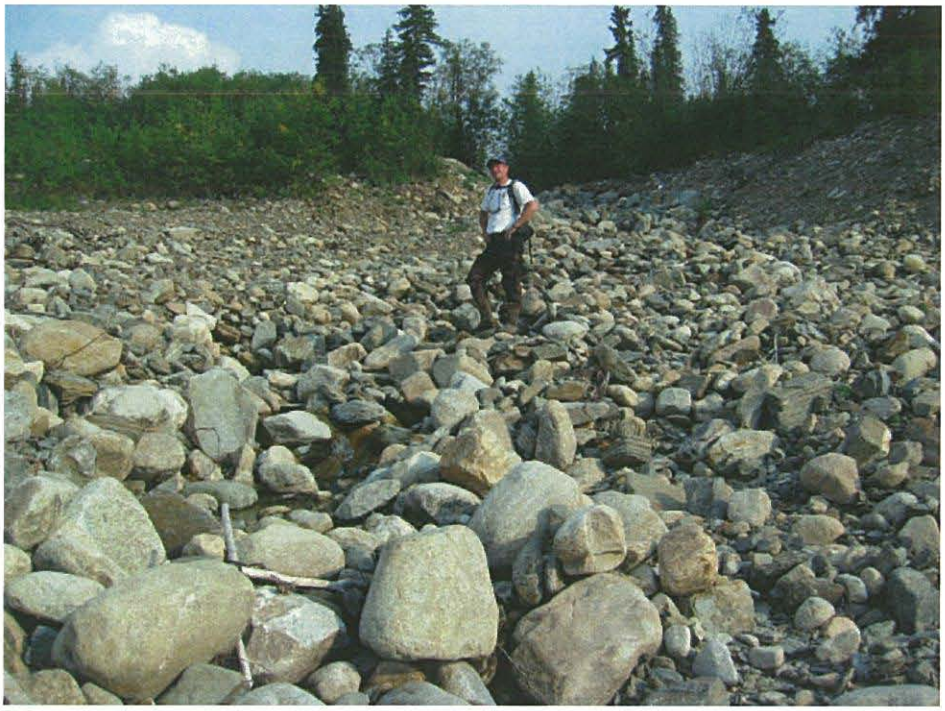

Photo 23: Boulder out race of the north tributary as it enters the reservoir basin and goes to ground during August.

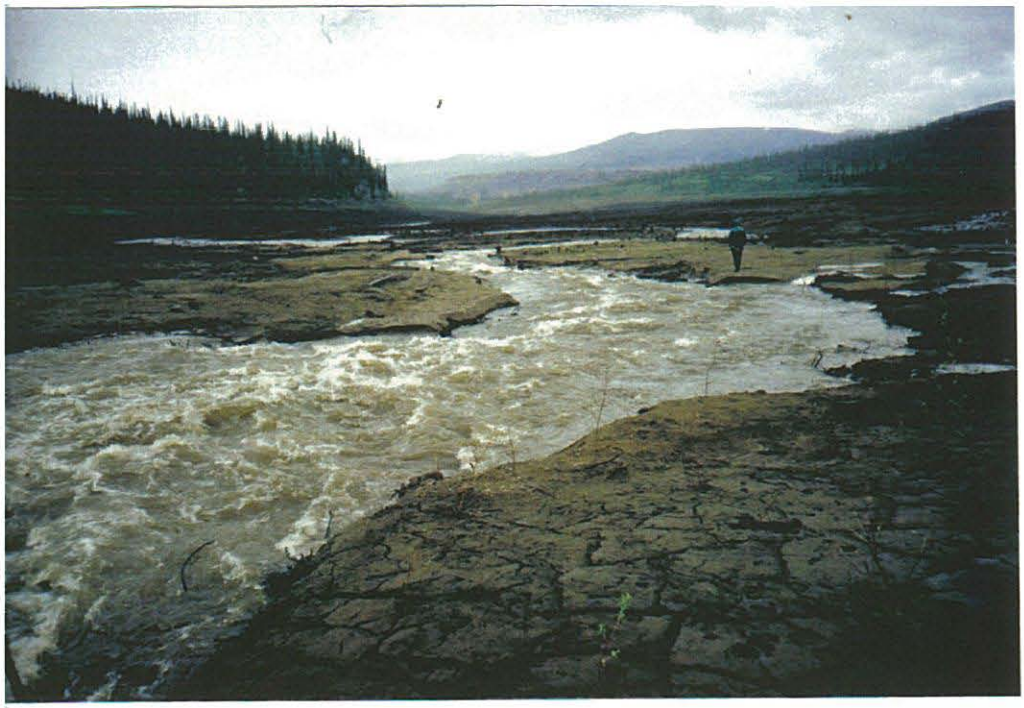

Photo 24: June flows at the downstream end of Reach #1, extending into reach #2.

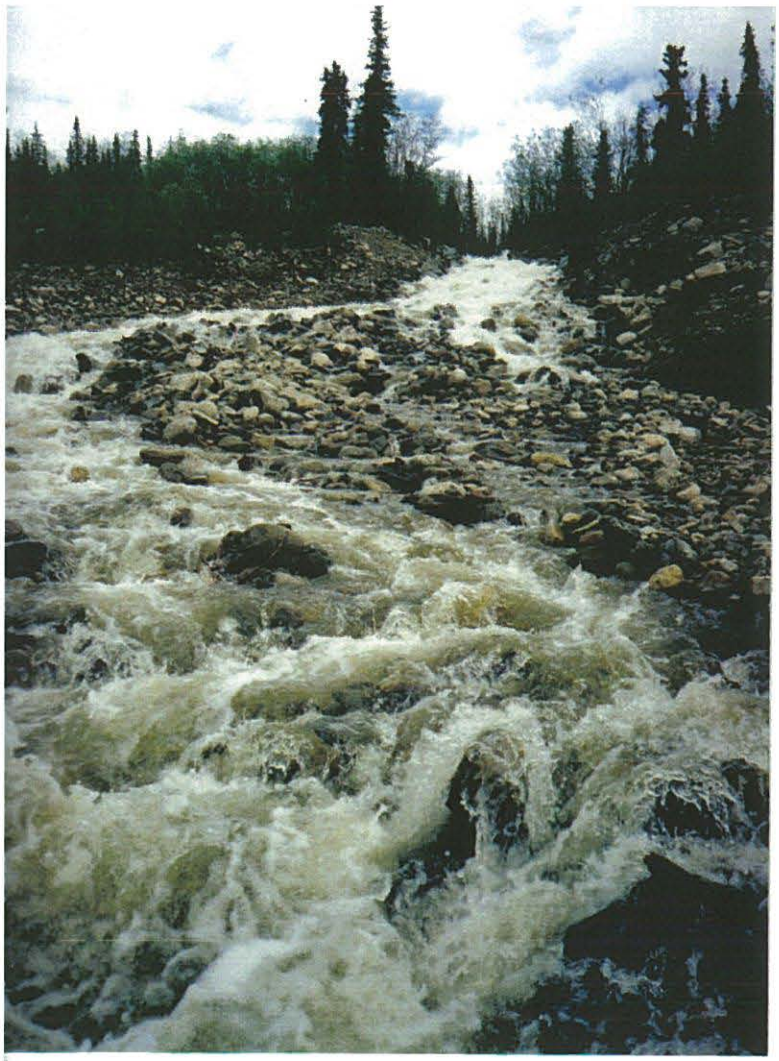

Photo 25: June flows over the boulder out race of the north tributary as it enters the reservoir basin.

Photo 26: Flooding in Reach #3 during June freshet.

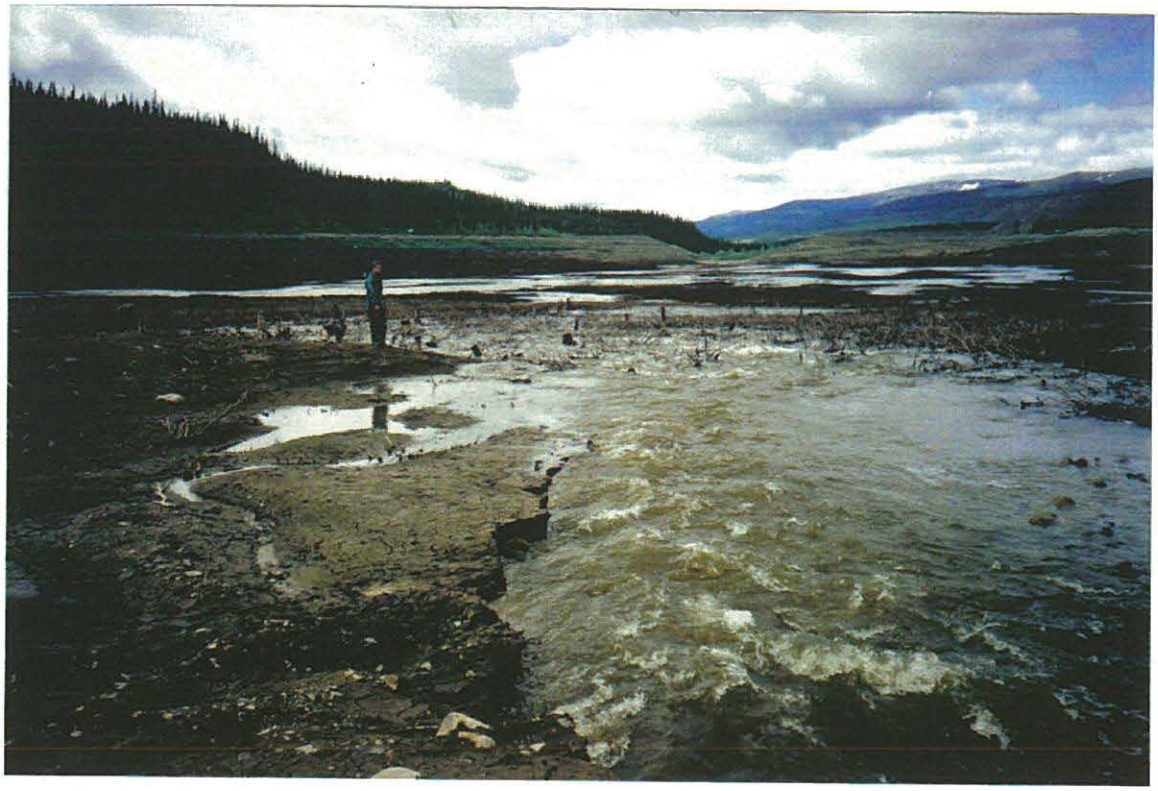

Photo 27: The north tributary flowing out of the pond area in June.

Photo 28: June flows in the wetland habitats downstream of the construction zone that acted as a settling area for fines and organics washed out of the reservoir basin.

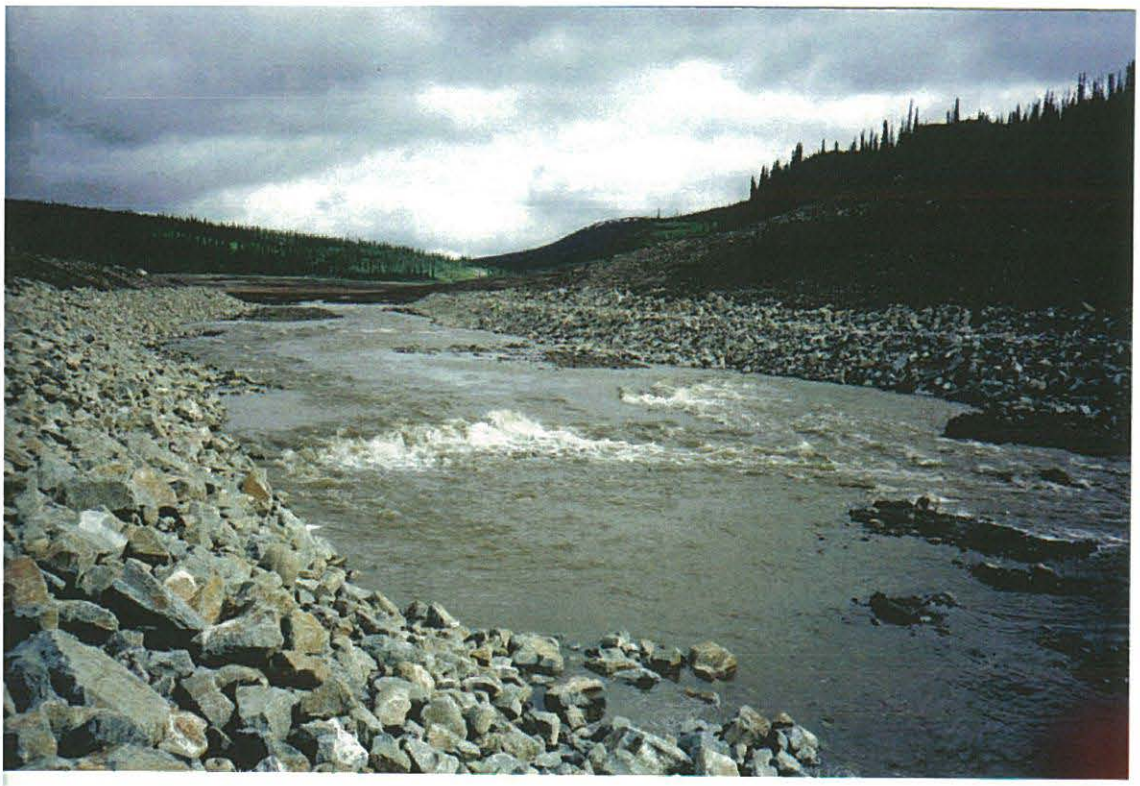

Photo 29: June freshet easily handled by the newly constructed channel through the breach.

Photo 30: June flows through the breach and newly constructed channels.

Photo 31: June flows through Reach #5.