BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

DELOITTE & TOUCHE INC.

NVWID OUTFALL SECTION CULVERT AS BUILT REPORT

FARO MINE, YT

FINAL REPORT

PROJECT NO.: 0257-026-03
DATE: JUNE 28, 2005

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Project No. 0257-026-03
Date: June 28, 2005

Deloitte & Touche Inc.
79 Wellington Street West
TD Centre, Suite 1900
Toronto, Ontario M5K 1B9

Attention: Mr. Doug Sedgwick

Re: NVWID Outfall Section Culvert, As-Built Report

Dear Doug:

Please find attached two copies of our above referenced report dated June 28, 2005. Other copies of this report have been sent to the distribution list on the front cover. This report presents the as-built installation record for the NVWID culvert. This work was undertaken in the summer of 2004.

Should you have any questions or comments, please contact me at the number listed above.

Yours truly,
BGC Engineering Inc.
per:

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

encl: Final Report

GWF/sf

TABLE OF CONTENTS

1.0 Introduction 1

2.0 Personnel Involved 2

3.0 Construction 3
3.1 General 3
3.2 Construction Materials and Process 3
3.3 Construction Material Testing 4

4.0 Post-Construction Monitoring 4

5.0 Conclusions and Recommendations 5

6.0 Closure 6

References 7

PHOTOGRAPHS

FIGURES

Figure 1 – Location Plan
Figure 2 – Mine Site Overview
Figure 3 – Plan View, Pre-Construction Conditions
Figure 4 – Plan View, As-Built Conditions
Figure 5 – Profile of through 2200 mm Culvert, As-built

APPENDICES

Appendix I – Background Memoranda
Appendix II – Daily Construction Reports
Appendix III – Laboratory and Field Testing Results

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 our written approval.

1.0 INTRODUCTION

The Faro Mine is located in the central Yukon, as shown in Figure 1, approximately 200 km north-northeast of Whitehorse and approximately 20 km north of the Town of Faro. The North Valley Wall Interceptor Ditch (NVWID) is located to the north of the tailings impoundment, along the north side of the Rose Creek Valley, as shown in Figure 2.

The NVWID diverts the water from the Upper Guardhouse Creek around the tailings and polishing ponds at Faro Mine. The NVWID was constructed in 1980/81 as part of the Down Valley Tailings Project. The design flood for the ditch was the 50 year return period flood (17.7 m^3/s at the culvert location) plus it was designed to have one half (0.5) meter freeboard above the design flood level (Golder, 1980). Recently, the hydrology and the drainage areas for the Faro Mine have been updated. The design flood values were significantly reduced based on the updated drainage area as compared to the original design. Based on the recent work of Northwest Hydraulic Consultants (nhc), it is presumed that the 1980/81 design used a drainage area further downstream. The revised and updated 50 year return period flood for the NVWID outfall section culvert has a value of 3.0 m^3/s and the updated 500 year return period flood is 5.4 m^3/s (nhc 2004a, also included in Appendix I).

Prior to this 2004 construction project, at the NVWID outflow section, water passed under the main access road north of the Polishing Pond via two culverts: a 960 mm Corrugated Metal Pipe (CMP) and a 600 mm plastic pipe, as shown in Photographs 1, 2 and Figure 3. These two culverts had a combined capacity of 1.5 m^3/s, which is approximately half of the design flood (nhc 2004a). In addition, each winter these two culverts became blocked with ice and required steaming to keep them clear for water flow.

Following discussions between BGC Engineering Inc. (BGC), nhc, Deloitte and Touch Inc. (D&T) and Anvil Range Mining Corp. (Anvil) staff with regards to construction options, D&T decided to install a 2,200 mm diameter culvert at this location to replace the existing culverts. This culvert was available at site, having been removed from the downstream end of the spillway at the former Fresh Water Supply Dam. This culvert is expected to have excess hydraulic capacity as compared to the design values, as discussed in the May 11, 2004 nhc memorandum included in Appendix I (nhc 2004b).

Two memoranda were prepared by nhc (May 11, 2004) and BGC (June 11, 2004) to provide commentary on the choice made by D&T and to provide some general guidelines on the installation of the culvert. These memos are attached in Appendix I.

Clifford McCleod Contracting of Ross River, Yukon was selected to provide equipment to complete this project. Additionally, Anvil equipment was used, as required, to supplement the contractor's fleet.

BGC was retained to provide construction monitoring services relative to the NVWID outfall section culvert installation. The information presented in this report documents the construction process for the installation of the new culvert and drainage works, as observed and collected by BGC.

No formal design of the NVWID culvert was prepared prior to initiation of construction. BGC field personnel made decisions related to the installation of the culvert to conform to the general guidelines previously provided by nhc and BGC, memorandum provided in Appendix I. The main considerations for the construction were to:

- straighten the channel upstream of the culvert;
- provide rip-rap protection at the inlet;
- provide a consistent gradient through the culvert;
- provide a well compacted base and general fill around the culvert;
- provide a plunge pool for dissipation of energy as the water exits the culvert;
- provide cover over the culvert and provide a berm on the upstream side to maximize the pool depth at the inlet of the culvert.

Field decisions made in the construction process are reflected in the as-built drawings, provided herein.

During the construction, the following Quality Assurance/Quality Control (QA/QC) testing were performed:

- Confirmation of the grain size of the material used as general fill and for rip rap.
- Measurement of the compacted density of the general fill.
- Measurement of the elevations and grade of the culvert.
- Measurement of the location of the rip rap placement.

2.0 PERSONNEL INVOLVED

The general overview of the culvert installation was under the direction of Mr. Dana Haggar, Anvil's Site Manager. Prior to BGC arriving on site, Anvil equipment was used to transport the culvert and haul and stockpile rip rap material at the working area. Anvil staff was responsible for welding the two culvert pieces to make the culvert the required length. Anvil site personnel and equipment were provided on an as-needed basis to assist with various tasks.

BGC's site personnel consisted of Mr. Gerry Ferris, who was on-site from July 25 to August 4, 2004 and Mr. Mike McCrank, who was on-site from August 3 to 18. Daily construction reports were prepared by BGC; copies of these reports are included in Appendix II. BGC personnel performed daily construction surveys of as-built conditions, as well as grade staking and lay out of the works.

Survey personnel were provided by Yukon Engineering Service (YES) of Whitehorse, YT. They performed a pre-construction topographical survey, prior to construction activities, and another topographic survey following completion of the NVWID culvert installation.

3.0 CONSTRUCTION

3.1 General

This as-built report describes the activities that were undertaken as part of the NVWID culvert installation between August 2 and 11, 2004. The general construction related activities that occurred during this time consisted of the following:

- Install a 2,200 mm diameter culvert through the access road.
- Construct a plunge pool at the culvert outlet.
- Contour and place rip-rap along the culvert intake and outlet zones.
- Remove the two existing culverts and backfill the associated trenches.

No detailed construction specifications were provided for this culvert installation project.

3.2 Construction Materials and Process

The sand and gravel material used as backfill for the culvert installation was sourced from the Haul Road Borrow Area. The rip rap material used in the culvert installation was taken from the Rose Creek Borrow Area. The rip rap consisted of cobble to boulder sized, sub-rounded to rounded shaped particles. The location of the borrow sources are identified in Figure 2.

The following describes the detailed construction sequence during the installation:

- Excavate trench for the new culvert installation (Photo 3).
- Place and compact sand and gravel at base of trench (Photo 4).
- Place culvert in the trench (Photo 5).
- Place and compact sand and gravel in 15 cm lifts along the sides and on top of the culvert to a thickness of 50 cm above the top of the culvert (Photo 6).
- Excavate the plunge pool on the downstream side(Photo 7).
- Place and compact the sand and gravel in 15 cm lifts within the plunge pool.
- Place rip-rap in the plunge pool and along the road embankment beside the culvert (Photo 8).
- Place sand and gravel fill over the top of the culvert (Photo 9).
- Excavate and remove old culverts (Photo 10).
- Place the 1 to 1.5 m diameter boulders in the plunge pool (Photo 11).
- Grade the road area and construct a berm along the upstream edge of the road surface (Photo 12).
- Contour the intake region and place riprap along the banks near the culvert (Photo 13).

- Contour the drainage path upstream of the culvert to redirect the stream into the new culvert.
- Backfill old culvert trenches with sand and gravel and compact in 15 cm lifts.
- Survey of the completed construction, the rip rap surface and the newly formed sideslopes, using the local benchmark and grid.

A topographical plan based on the pre-construction survey of the area is shown in Figure 3. The as-built topography of the completed construction is shown on Figure 4. A profile view through the 2,200 mm diameter culvert, showing final material placement and elevations, is shown in Figure 5.

3.3 Construction Material Testing

The following construction material tests were conducted during the culvert installation:

- Sieve analyses of the sand and gravel materials.
- Split-Net analysis of the rip rap to develop a grain size distribution of the rip rap.
- Standard Proctor Maximum Dry Density (SPMDD) and optimum moisture content of the sand and gravel used as backfill.
- Nuclear densometer testing of compacted backfill materials.
- Moisture content testing of compacted backfill materials.

All laboratory and field testing results are presented in Appendix III.

4.0 POST-CONSTRUCTION MONITORING

Monitoring of the performance of the NVWID culvert will be performed as part of the annual visual inspections for the Faro Mine. The focus of the inspections will be to identify signs of instability, erosion and/or performance issues.

As indicated in the memorandum contained in Appendix I, this culvert installation had the potential to improve the situation with respect to icing of the culverts. In the past, the culverts required intermittent steaming to allow water flow. This situation continued with the newly installed culvert during the winter of 2004/2005. Based on the experience of Anvil site staff during the winter, it appears that the icing in the new culvert was caused by frazil ice development upstream of the culvert where the natural channel met the newly constructed channel bed. Anvil staff, with technical direction from BGC, will likely re-grade this upstream portion of the channel in an attempt to stop the development of ice at this location, in Fall 2005.

5.0 CONCLUSIONS AND RECOMMENDATIONS

A 2,200 mm diameter culvert, having a length of 34 m and a gradient of 3% was installed at the access road crossing of the NVWID outfall section. It replaced a 960 mm CSP and a 600 mm plastic pipe. The creek bed above the culvert was realigned as a straight channel. This culvert is expected to have excess hydraulic capacity as compared to the design values (nhc 2004b).

For a headpond water depth of 1.8 m, the culvert can pass 6.0 m^3/s (nhc 2004b), which is greater than the 500-year peak flood event. Therefore, the installed culvert easily has the capacity to pass the required design flood of the 50 year event. Based on preliminary calculations the capacity of the NVWID outfall section downstream of the culvert can handle the 500 year flood level. However, since the NVWID was constructed in 1980/81, no follow-up capacity check has been performed. It is recommended that the capacity of the NVWID be checked. This capacity check could be scheduled as part of the on-going review of structures at the Faro Mine undertaken in conjunction with the annual geotechnical review.

The NVWID Outfall Section Ditch flows adjacent to the spillway of the Cross Valley Dam. The spillway of the Cross Valley Dam is required by the water license to be able to pass the 500-year peak flood of Rose Creek. The original design of the Down Valley Project (Golder 1980) considered that the NVWID was less critical than the other main elements, such as the Rose Creek Diversion Canal and the spillways at the Intermediate and Cross Valley Dams. The philosophy of the design flood for the NVWID should be re-visited as part of the closure planning for the mine.

6.0 CLOSURE

This report summarizes the construction that was performed for the NVWID culvert installation, which was required to meet design flood capacity. We trust that this report meets your needs at this current time. Should you have any questions or comments concerning the information provided within this report, please contact the undersigned.

Respectively submitted:
BGC Engineering Inc.
Per:

Mike McCrank, E.I.T. (AB)
Geological Engineer-in-Training

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

PROFESSIONAL ENGINEER
YUKON
J.W. CASSIE
TERRITORY

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

PERMIT TO PRACTICE
Signature
Date 28-JUN-05
PERMIT NUMBER: PP092
Association of Professional Engineers of Yukon

REFERENCES

American Iron and Steel Institute, Handbook of Steel Drainage & Highway Construction Products, p.151, Corrugated Steel Pipe Institute, 2002.

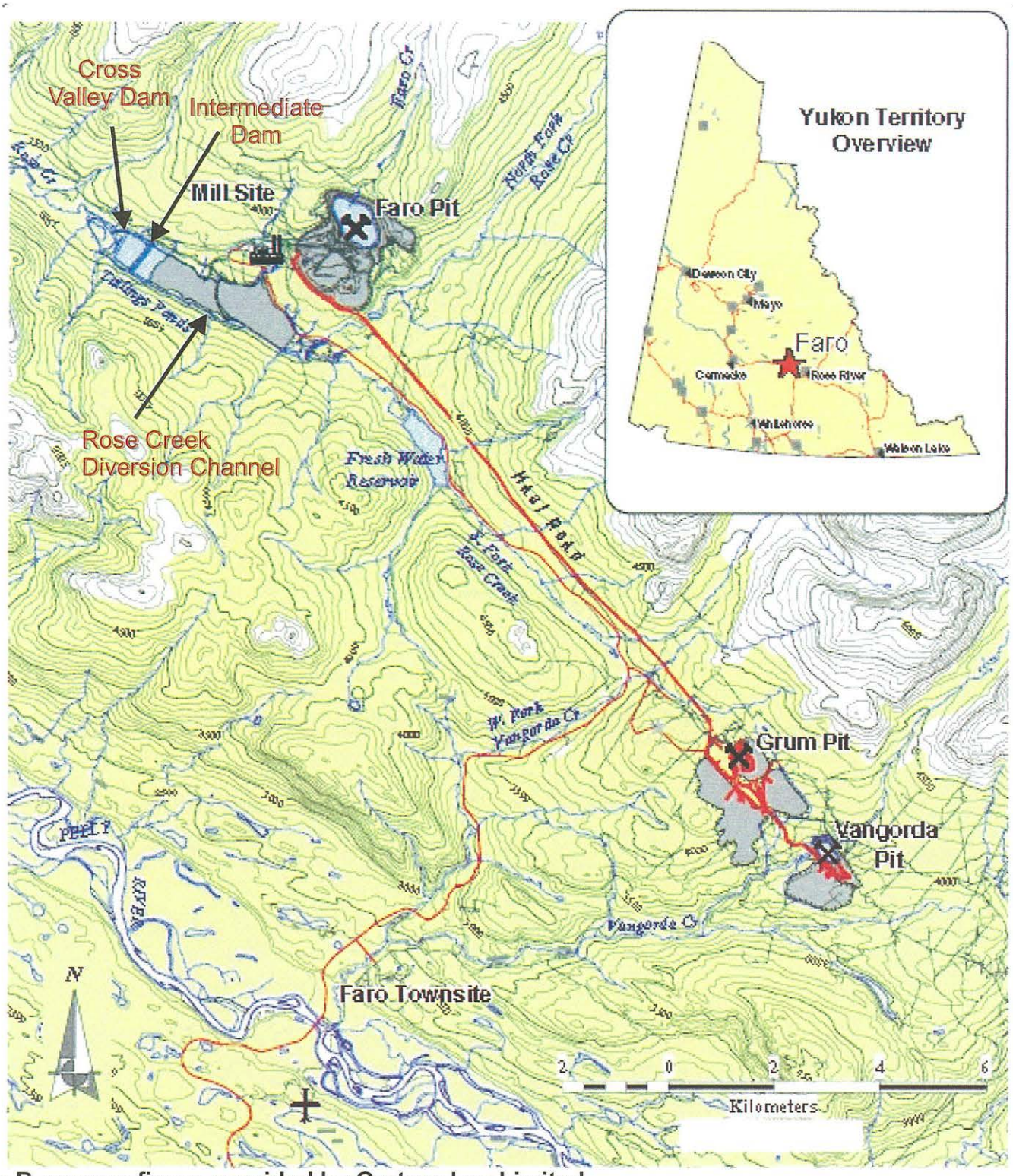
BGC Engineering Inc. 2004 North Valley Wall Interceptor Ditch Culvert Installation. Memorandum prepared for Deloitte & Touche Inc. June 11, 2004 (Included in Appendix I).

Golder Associates Ltd. 1980 Final Design Recommendations for the Down Valley Tailings Disposal Project, Faro, Yukon. Report Prepared for Cyprus Anvil Mining Corporation, June 1980.

Northwest Hydraulic Consultants 2004a Faro Mine Site Area – North Wall Interceptor Ditch culvert Design at Road Crossing. Report prepared for BGC Engineering, April 2, 2004. (Included in Appendix I).

Northwest Hydraulic Consultants 2004b Faro Mine Site Area – North Wall Interceptor Ditch culvert Design at Road Crossing. Report prepared for BGC Engineering, May 11, 2004. (Included in Appendix I).

FIGURES



Note: Base map figure provided by Gartner Lee Limited.

SCALE:	As Shown	DESIGNED:	JMS
DATE:	JUNE 2005	CHECKED:	GWF
DRAWN:	SLF	APPROVED:	JWC

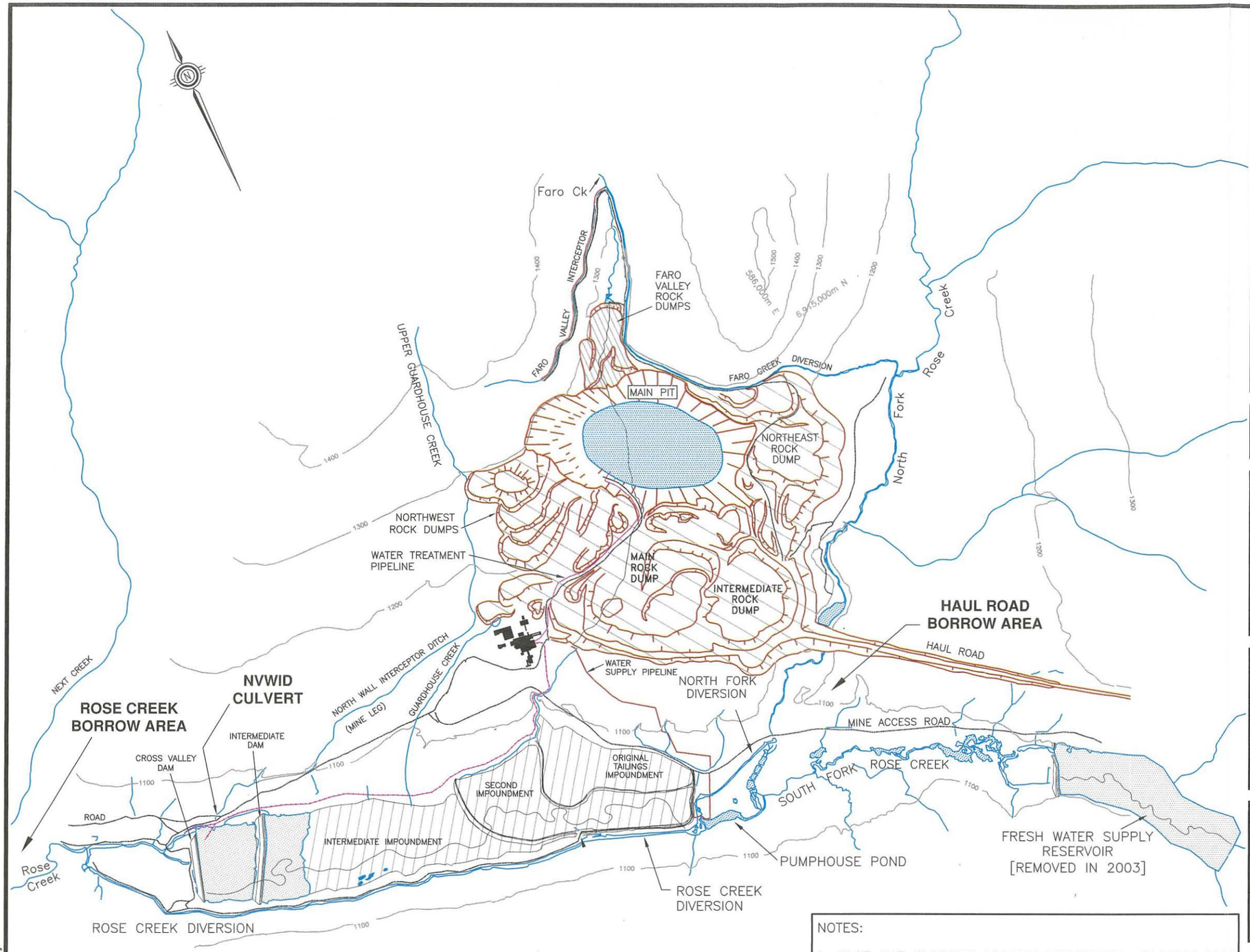
CLIENT: Deloitte & Touche

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

PROJECT: ROSE CREEK DIVERSION CANAL DIKE UPGRADES AS BUILT

TITLE: SITE LOCATION PLAN

PROJECT No.	FIGURE No.	REV.
0257-026-03	1	0



0257-017-01 001 Fig 2.dwg

CLIENT: **Deloitte & Touche**

LEGEND:

- ROADS
- EXISTING DRAINAGE
- ORIGINAL DRAINAGE
- EFFLUENT PIPELINE
- PIPELINE

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED

SCALE:	AS SHOWN
DATE:	JUNE 2005
DRAWN:	CJT
DESIGNED:	JMS
CHECKED:	GWF
APPROVED:	JWC

NOTES:

1. BASE MAP SUPPLIED BY THE ORTHOSHOP, JANUARY 1991
2. NORTH AMERICAN DATUM 1927
3. CONTOUR INTERVAL 100m
4. UNIVERSAL TRANSVERSE MERCATOR PROJECTION
5. MAP IS A COMPOSITE OF 9 BASEMAPS

PROJECT: NVWID OUTFALL SECTION CULVERT AS-BUILT REPORT

TITLE: MINE SITE OVERVIEW

PROJECT No.	FIGURE No.	REV.
0257-026-03	2	0

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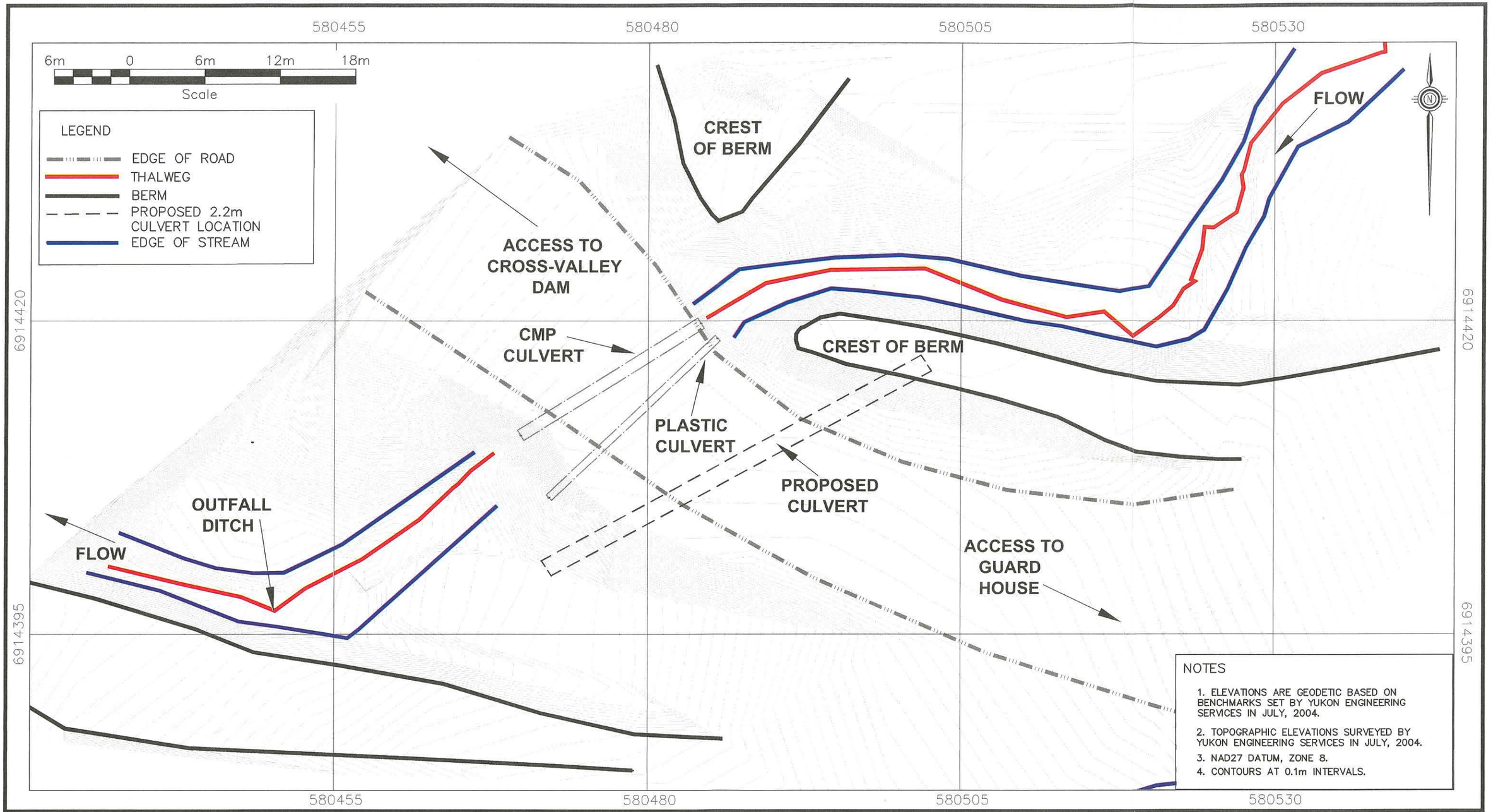
AN APPLIED EARTH SCIENCES COMPANY
Calgary, AB Phone: (403) 250 5185



NOTES

1. ELEVATIONS ARE GEODETIC BASED ON BENCHMARKS SET BY YUKON ENGINEERING SERVICES IN JULY, 2004.
2. TOPOGRAPHIC ELEVATIONS SURVEYED BY YUKON ENGINEERING SERVICES IN JULY, 2004.
3. NAD27 DATUM, ZONE 8.
4. CONTOURS AT 0.1m INTERVALS.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

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

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Calgary, AB Phone: (403) 250 5185

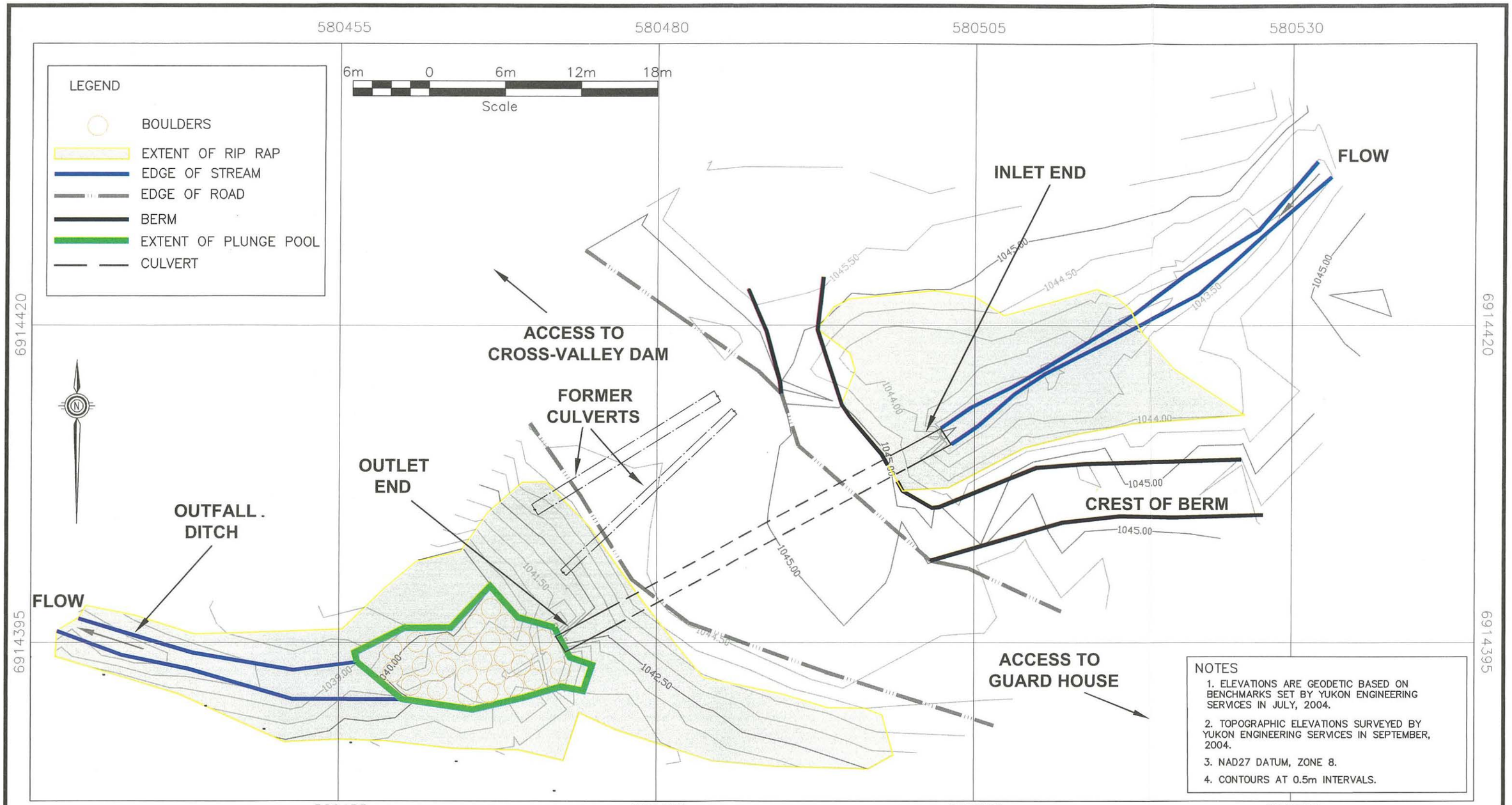
CLIENT Deloitte & Touche

PROJECT NVWID OUTFALL SECTION CULVERT AS-BUILT REPORT

TITLE PLAN VIEW PRE-CONSTRUCTION CONDITIONS

PROJECT No.	FIGURE No.	REV.
0257-026-03	3	0

0257-026-03 NVWID SURVEY FIG 3.dwg



NOTES

1. ELEVATIONS ARE GEODETIC BASED ON BENCHMARKS SET BY YUKON ENGINEERING SERVICES IN JULY, 2004.
2. TOPOGRAPHIC ELEVATIONS SURVEYED BY YUKON ENGINEERING SERVICES IN SEPTEMBER, 2004.
3. NAD27 DATUM, ZONE 8.
4. CONTOURS AT 0.5m INTERVALS.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.
1	28-JUNE-05	AS-BUILT CONDITION	GMT	GWF	JWC

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

BGC ENGINEERING INC.
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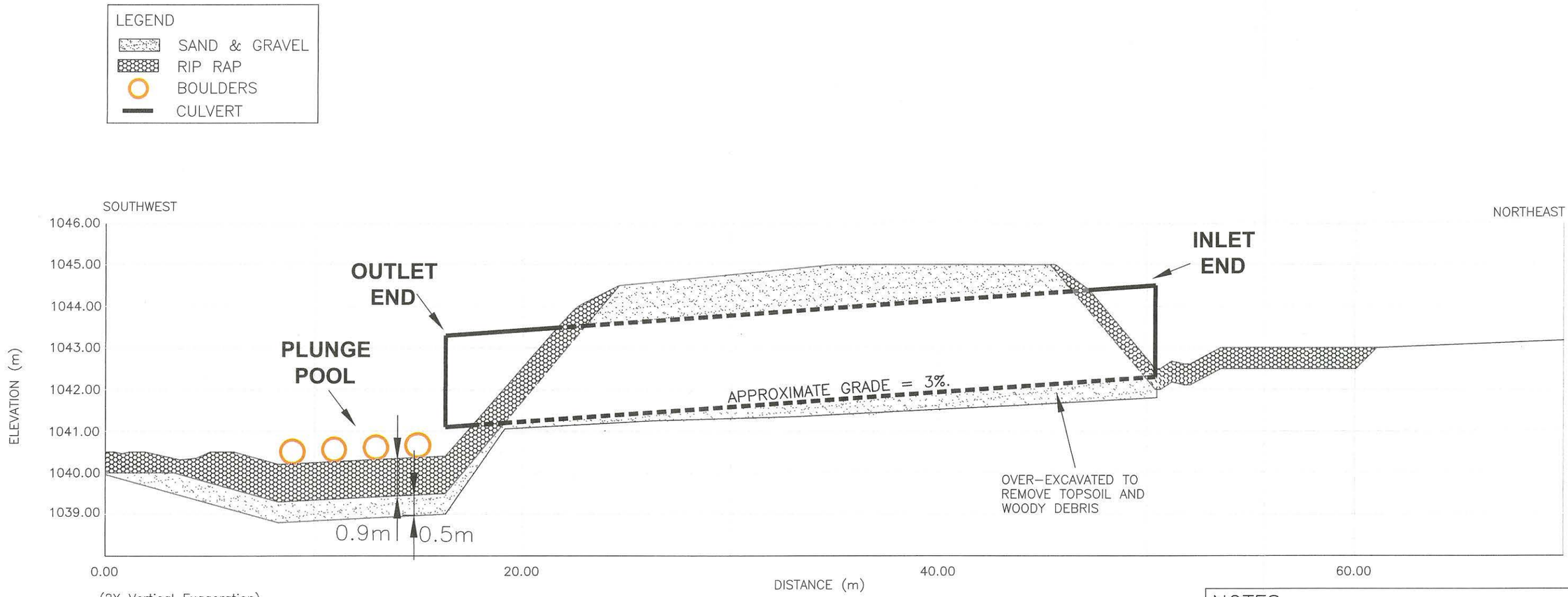
CLIENT Deloitte & Touche

PROJECT
NVWID CULVERT OUTFALL SECTION
AS-BUILT REPORT

TITLE
PLAN VIEW
AS-BUILT CONDITIONS

PROJECT No.	FIGURE No.	REV.
0257-026-03	4	0

0257-026-03 NVWID SURVEY FIG 4.dwg



NOTES

1. ELEVATIONS ARE GEODETIC BASED ON BENCHMARKS SET BY YUKON ENGINEERING SERVICES IN JULY, 2004.
2. BURIED LINES AND GRADES SURVEYED BY BGC DURING CONSTRUCTION.
3. TOPOGRAPHIC ELEVATIONS SURVEYED BY YUKON ENGINEERING SERVICES IN SEPTEMBER, 2004.

REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.
1	28–JUNE–05	AS–BUILT CONDITION	GMT	GWF	JWC

SCALE	AS SHOWN
DATE	JUNE 2005
DRAWN	GMT
DESIGNED	MJM
CHECKED	GWF
APPROVED	JWC

BGC ENGINEERING INC.
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Vancouver, BC Phone: (604) 684 5900

CLIENT Deloitte & Touche

PROJECT NVWID OUTFALL SECTION CULVERT AS–BUILT REPORT

TITLE PROFILE THROUGH 2,200mm CULVERT AS–BUILT

PROJECT No.	FIGURE no.	REV.
0257–026–03	5	0

0257–026–03 NVWID SURVEY CULVERT CX FIG 5.dwg

PHOTOGRAPHS

Photo 1: View of inlet of old culverts prior to construction activities.
(Photo taken September 29, 2002)

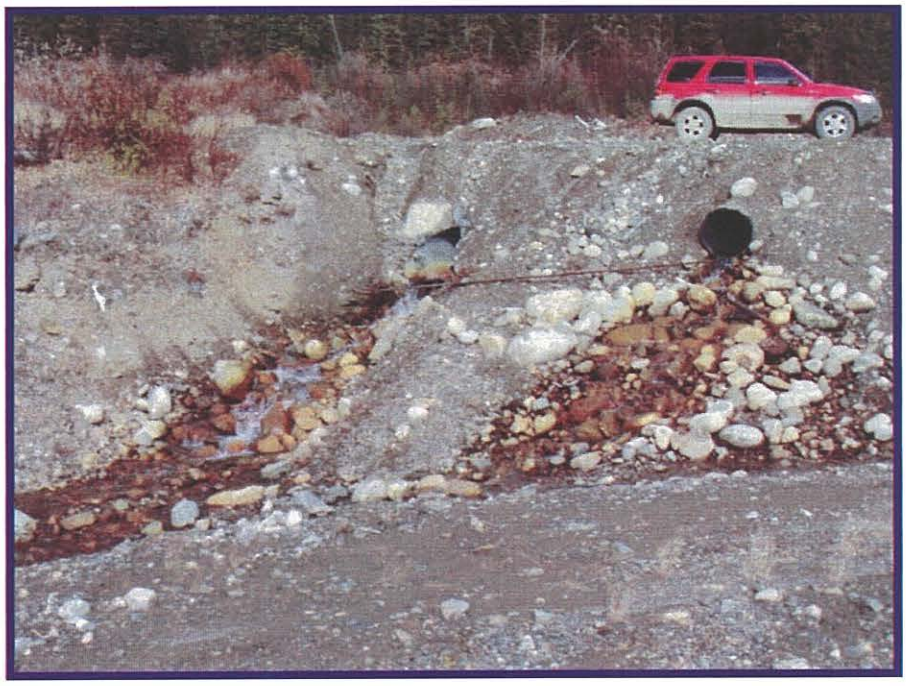

Photo 2: View of outlet of old culverts prior to construction activities.
(Photo taken September 29, 2002).

Photo 3: Starting the excavation for the culvert installation.

Photo 4: Compacting the sand and gravel base prior to culvert placement.

Photo 5: Placing the culvert in the trench.

Photo 6: Placing and compacting sand and gravel along the sides of the culvert.

Photo 7: Excavating the plunge pool.

Photo 8: Placing rip-rap over sand and gravel base in plunge pool.

Photo 9: Placing sand and gravel over top of culvert.

Photo 10: Removing the two old culverts.

Photo 11: Placing large boulders in the plunge pool.

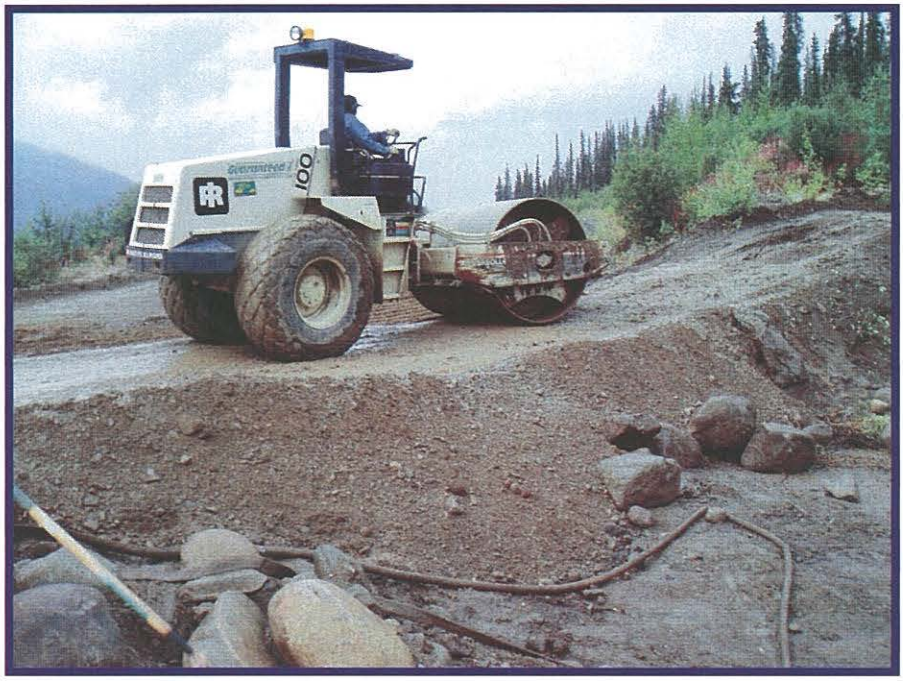

Photo 12: Compacting berm above inlet end of the culvert.

Photo 13: Placing rip-rap around inlet end.

APPENDIX I - BACKGROUND MEMORANDA

Leaders in
• • • •
water resource
• • • •
technology

nhc

6443/4582

April 2, 2004

BGC Engineering Inc.
Suite 1605, 840 - 7th Avenue SW
Calgary, Alberta
T2P 3G2

Attention: J.W. Cassie, P.Eng.

Dear Mr. Cassie:

Re: Faro Mine Site Area - North Wall Interceptor Ditch
Culvert Design at Road Crossing

This letter report addresses the culvert arrangement necessary to safely pass the North Wall Interceptor Ditch (NWID) flood under the road that parallels the north side of the Polishing Pond. The Ditch collects runoff from the north and west of the Faro Mine Site footprint and discharges the flow into the Rose Creek valley downstream of the Cross Valley Dam (see Figure 1).

It has been assumed that fish do not pass upstream of the crossing.

Topics addressed are:

1. Drainage area of the North Wall Interceptor Ditch at the culverts.
2. Estimated 500-year instantaneous peak discharge.
3. Culvert arrangement to convey the estimated 500-year flood.

It should be noted that the current NWID was designed to pass the 50-year flood value plus 0.5 m of freeboard, as designed by Hydrocon[2].

DRAINAGE AREA

Early Estimates. Curragh Resources (1988)[1] gives a drainage area of 6.5 km^2 for the Ditch at the road crossing. The Curragh report also lists a 1980 estimate of 33.6 km^2 by Hydrocon[2], but mentions that this estimate was for an area that extended farther downstream, so these values are not comparable. Excerpts from the Hydrocon report are reproduced in Appendix B of the 1988 Curragh report.

[1] Curragh Resources Inc. June 1988. Review of peak flow estimates for Rose and Vangorda Creeks.

[2] Hydrocon Engineering (Continental) Ltd. May 1980. Hydrologic and hydraulic design of Down Valley Tailings Disposal Project, Cyprus Anvil Mining Corp. Faro, Y.T.

northwest hydraulic consultants

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Curragh Resources delineated the Ditch drainage area boundary on a 1:50 000 scale NTS map 105 K/6, Ed. 1 (100 ft/30 m contour interval). The drainage area measurement is listed as 6.5 km^2 in a table superimposed on copies of the map and in Table 3 of the 1988 report.

Northwest Hydraulic Consultants (**nhc**) measured the drainage area delineated on the Curragh Resources map and obtained a value of 5.6 km^2 as opposed to 6.5 m^3/s . This suggests that the number 5.6 was accidentally transposed to 6.5. The 1988 drainage boundary is shown on Figure 1 for comparison with the present-day boundary estimate.

Present Estimate. A 1:20 000 scale electronic map of the Faro Mine Site area with 2 m contour intervals was used to delineate approximately 90% of the Ditch drainage area[3]. The remaining 10% of the area was delineated from the NTS map 105 K/6 used in the earlier studies. Figure 1 shows the two maps superimposed on one another and the newly delineated drainage area of 5.3 km^2.

It is noted that only the 10 m contours are shown on the Figure 1 copy of the 2003 map. The 2 m contours were switched off to improve visual clarity.

ESTIMATED 500-YEAR INSTANTANEOUS PEAK DISCHARGE

Figure 2 shows extreme flood peak curves for the Faro Mine Site area that were used to estimate flood values. The curves were generated from information in an earlier report (**nhc**, Dec. 2003)[4].

For the North Wall Interceptor Ditch 5.3 km^2 drainage area, instantaneous peak flood discharge estimates are:

50-year	3.0 m^3/s
100-year	3.7 m^3/s
200-year	4.4 m^3/s
500-year	5.4 m^3/s

Due to the reduced watershed areas, these discharges are significantly lower than the Hydrocon design value of 17.7 m^3/s.

[3] Map generated from 1:20 000 scale photography flown on 2003/07/25, and provided by SRK Consulting Inc.

[4] Northwest Hydraulic Consultants (**nhc**) Dec. 2003. Hydrotechnical study for closure planning, Faro Mine Site area, Yukon. DRAFT REPORT.

RECOMMENDED CULVERT ARRANGEMENT

Existing Arrangement

The existing culvert arrangement at the road crossing is:

- 1, 960 mm dia. CSP; and
- 1, 600 mm dia. plastic pipe.

The combined capacity of the two culverts is 1.5 m^3/s, a discharge that is less than the present 50-year flood estimate of 3.0 m^3/s.

On the upstream side of the crossing, the headpond depth is approximately 1.5 m, and on the downstream side the culvert outflow discharges on to a riprap covered slope.[5]

Recommended Arrangement

The culvert arrangement described below is recommended to pass the 500-year peak discharge of 5.4 m^3/s. It has been assumed that the culverts will operate under inlet control with the outlets discharging freely on to a steeply sloped channel.

1. Culverts required:
   - 2, 1200 mm dia. CSP, corrugations - 68x13 mm, wall thickness - 2.8 mm, galvanized; and
   - 1, 960 mm dia CSP (reinstall the existing culvert).

2. Clearance between culverts:
   - 600 mm clearance between adjacent culverts.

3. Culvert entrance conditions:
   - Square, projecting into headpond.

4. Culvert placement:
   - Inverts of all three culverts imbedded 300 mm below the headpond bed level.

At the 500-year design discharge, the headpond water depth will be 1600 mm. A 300 mm hydraulic freeboard should be added to give a hydraulic depth of 1900 mm. The headpond water depth will be 1100 mm for the 100-year flood peak of 3.7 m^3/s.

DISCUSSION

The size of culverts required to pass the 500-year flood has been given, plus some preliminary placement recommendations.

The required culvert lengths, entrance/exit configurations and protection, underlay protection on the upstream face of the embankment, and other final design issues have not been addressed.

[5] Information supplied verbally by Jim Cassie of BGC Engineering Inc. on March 11, 2004.

nhc would be pleased to prepare detailed design recommendations. To carry out detailed design **nhc** would require:

- Topographic information of the headpond area and the upstream Ditch.
- Upstream Ditch perimeter materials.
- Topography of the culvert outlet channel.
- Bed and road embankment materials and existing protection in the outlet channel.

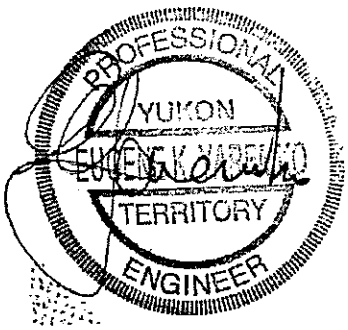
Please contact the undersigned if further information or clarification is required.

Yours sincerely,

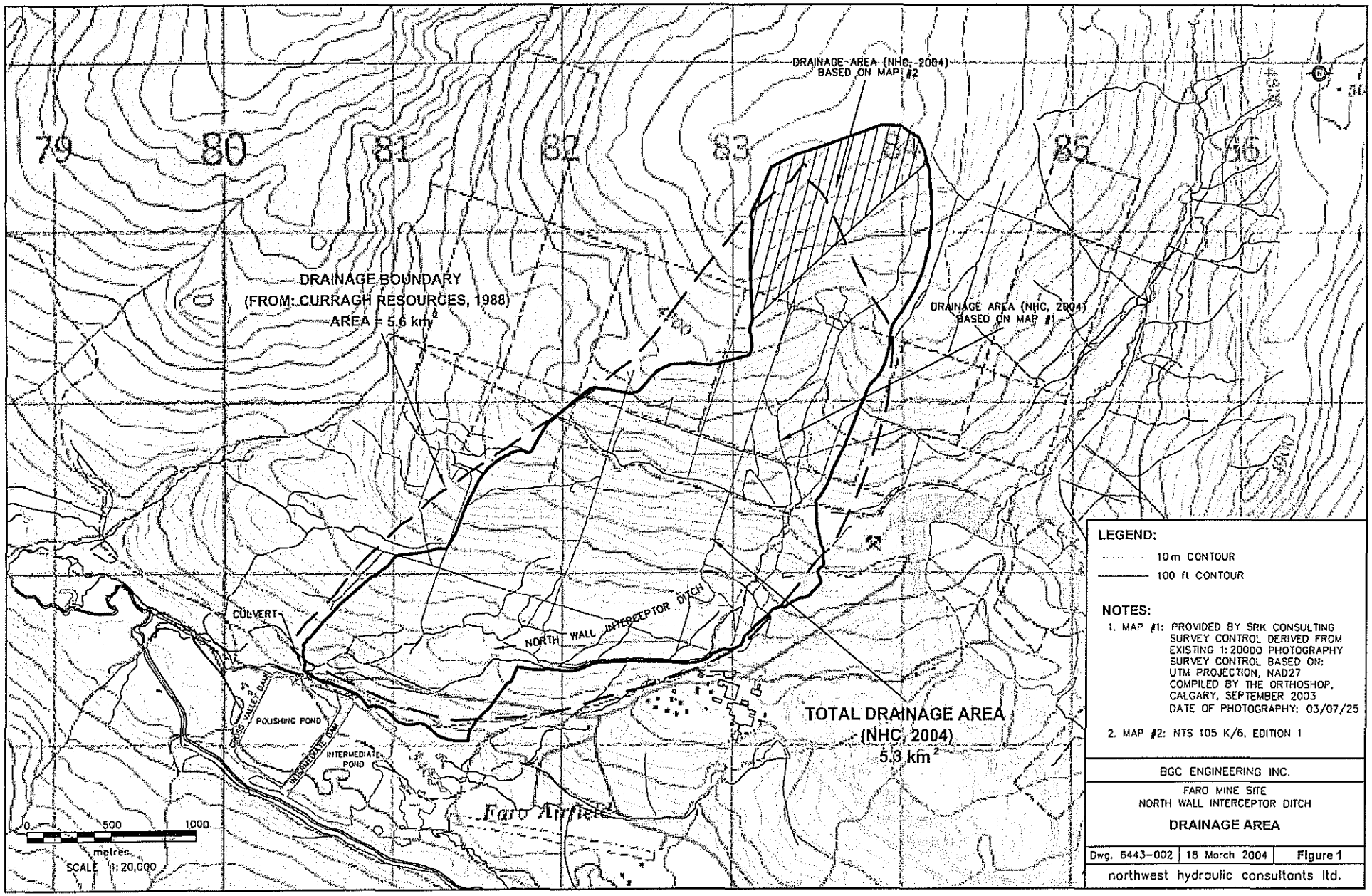
northwest hydraulic consultants ltd.

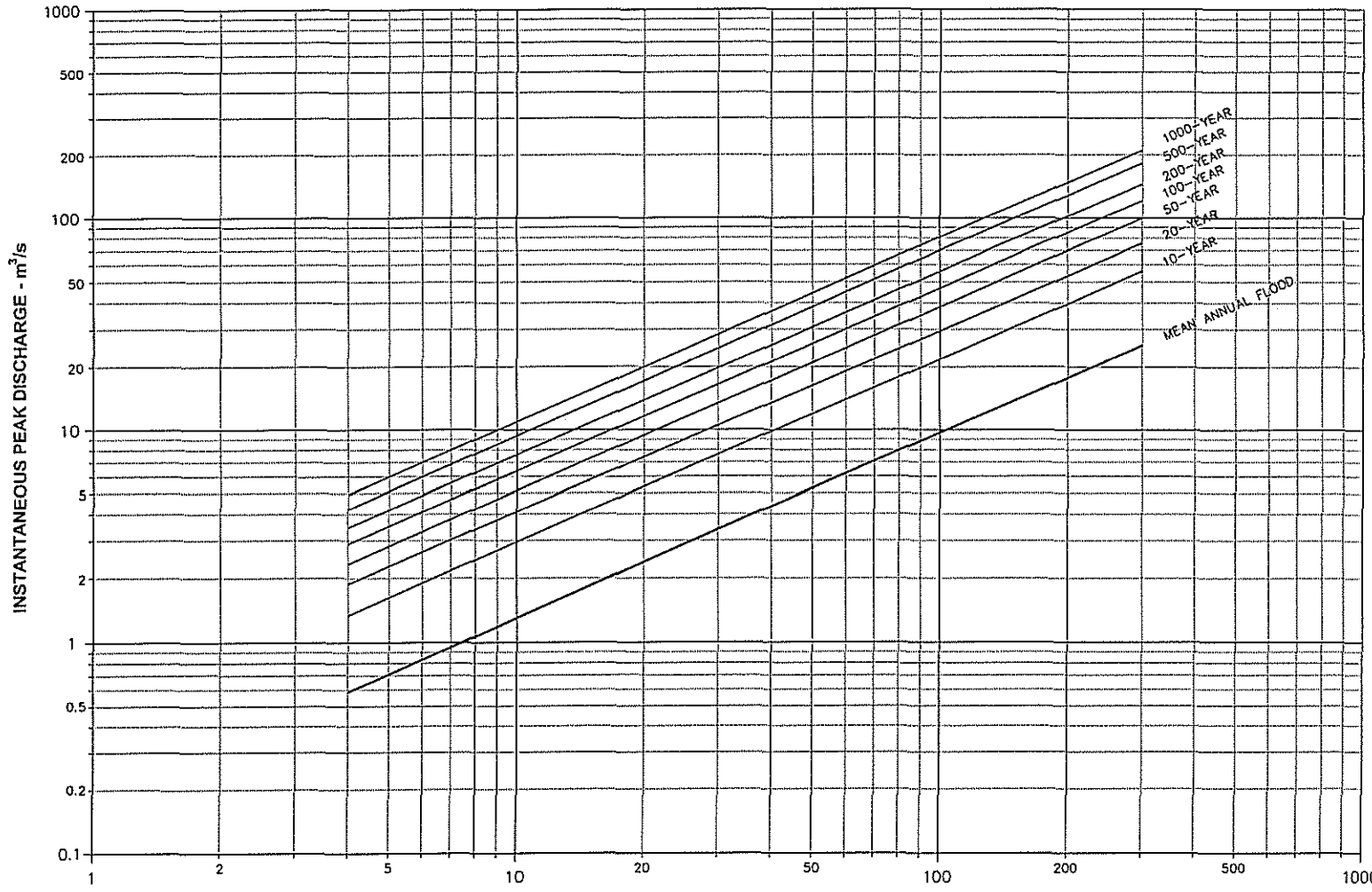
B. J. Evans, P.Eng.
Senior Engineer

Reviewed by:



E.K. Yaremko, P.Eng.
Principal


DRAINAGE AREA (NHC, 2004)
BASED ON MAP #2
DRAINAGE BOUNDARY
(FROM: CURRAGH RESOURCES, 1988)
AREA = 5.6 km²
DRAINAGE AREA (NHC, 2004)
BASED ON MAP #1
CULVERT
NORTH WALL INTERCEPTOR DITCH
CROSS VALLEY DAM
POLISHING POND
INTERMEDIATE DAM
INTERMEDIATE POND
TOTAL DRAINAGE AREA
(NHC, 2004)
5.3 km²
Faro Airfield
0
500
1000
metres
SCALE 1: 20,000
LEGEND:
10 m CONTOUR
100 ft CONTOUR
NOTES:
1. MAP #1: PROVIDED BY SRK CONSULTING
SURVEY CONTROL DERIVED FROM
EXISTING 1:20000 PHOTOGRAPHY
SURVEY CONTROL BASED ON:
UTM PROJECTION, NAD27
COMPILED BY THE ORTHOSHOP,
CALGARY, SEPTEMBER 2003
DATE OF PHOTOGRAPHY: 03/07/25
2. MAP #2: NTS 105 K/6, EDITION 1
BGC ENGINEERING INC.
FARO MINE SITE
NORTH WALL INTERCEPTOR DITCH
DRAINAGE AREA
Dwg. 6443-002
18 March 2004
Figure 1
northwest hydraulic consultants ltd.



NOTE:

FLOOD CURVES BASED ON ESTIMATES IN:
NHC, DEC 2003, HYDROTECHNICAL STUDY FOR CLOSURE PLANNING,
FARO MINE SITE AREA, YUKON. DRAFT REPORT.

BGC ENGINEERING INC.

FARO MINE SITE
NORTH WALL INTERCEPTOR DITCH

EXTREME FLOOD CURVES

Dwg. 6443-001	18 March 2004	Figure 2

northwest hydraulic consultants ltd.

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 Corporation**	**Fax No.:**	**Via e-mail**
Attention:	**Dana Haggar**	**CC:**	**Doug Sedgwick**
From:	**Gerry Ferris, Kris Matusiewicz**	**Date:**	**June 11, 2004**
Subject:	**North Valley Wall Interceptor Ditch Culvert Installation**		
No. of Pages (including this page): 4 plus 2		**Project No:**	**0257-022-07**

The North Valley Wall Interceptor Ditch (NVWID) was constructed in 1980/81 as part of the Down Valley Tailings Project. The design flood for the ditch was the 50 year return period flood (17.7 m^3/s) plus it was designed to have one half (0.5) meter freeboard above the design flood level[1]. Recently, the hydrology for the Faro Mine has been updated[2]. The updated 50 year return period flood for the NVWID has a value of 3.0 m^3/s and the updated 500 year return period flood is 5.4 m^3/s. The flood values were significantly reduced based on the updated drainage area as compared to the original design[2].

The NVWID passes under the main access road above the Polishing Pond via two culverts:

- 960 mm Corrugated Steel Pipe (CSP) and
- 600 mm plastic pipe.

These two culverts have a combined capacity of 1.5 m^3/s, which indicates that the culverts can not pass the required design floods[2]. In addition, each winter these two culverts become ice blocked and require steaming to keep the culverts clear for water to flow.

Following discussions between BGC Engineering Inc. (BGC), Northwest Hydraulic Consultants (nhc) and Deloitte and Touch Inc. (D&T) staff with regards to construction options, D&T decided to install a 2,200 mm diameter culvert in this location. The 2,200 mm diameter culvert is available at site. This larger culvert is expected to have excess hydraulic capacity (see the attached nhc memorandum) and is expected to have better performance with respect to icing. This memorandum provides some guidance related to the installation of this culvert.

[1] Golder Associates Ltd. 1980 Final Design Recommendations for the Down Valley Tailings Disposal Project, Faro, Yukon. Report Prepared for Cyprus Anvil Mining Corporation, June 1980.
[2] Northwest Hydraulic Consultants 2004 Faro Mine Site Area – North Wall Interceptor Ditch culvert Design at Road Crossing. Report prepared for BGC Engineering, April 2, 2004.

INSTALLATION GUIDELINES:

Backfill material around the culvert should preferably be granular to provide good structural performance. In order of decreasing preference, the backfill material could be one of the following three choices:

- well graded sand and gravel (angular if possible),
- uniform sand or gravel and
- mixed soil (not including any organic material).

The backfill should be compacted to a minimum 95% Standard Proctor Maximum Dry Density. (SPMDD). The attached Figure 1 provides a sketch of the proper procedure for placement of backfill around a round culvert. The backfill should be in lifts of not more than 300 mm thickness[3].

The following table provides guidelines for minimum cover required for heavy off-road construction equipment[3].

Table 1 – General Guidelines for Cover

	Minimum Cover (mm) for Indicated Axle Loads (tonnes)			
Pipe Span (mm)	8 – 22	22 – 34	34 - 50	50 - 68
1980 – 3050	900	1050	1200	1200

The above information provides general guidance for the installation of the 2200 mm diameter culvert at the main access road. These guidelines are meant as an aid to Mine Staff for the planning and installation of this culvert and are not detailed design recommendations. Attached to this memorandum are some general hydraulic guidance related to the installation of this culvert, as prepared by nhc. BGC and nhc would be pleased to prepare detailed designs, if so requested.

[3] Corrugated Steel Pipe Institute, June 2002. Handbook of Steel Drainage and Highway Construction, Second Edition. Cambridge, Ontario.

CLOSURE:

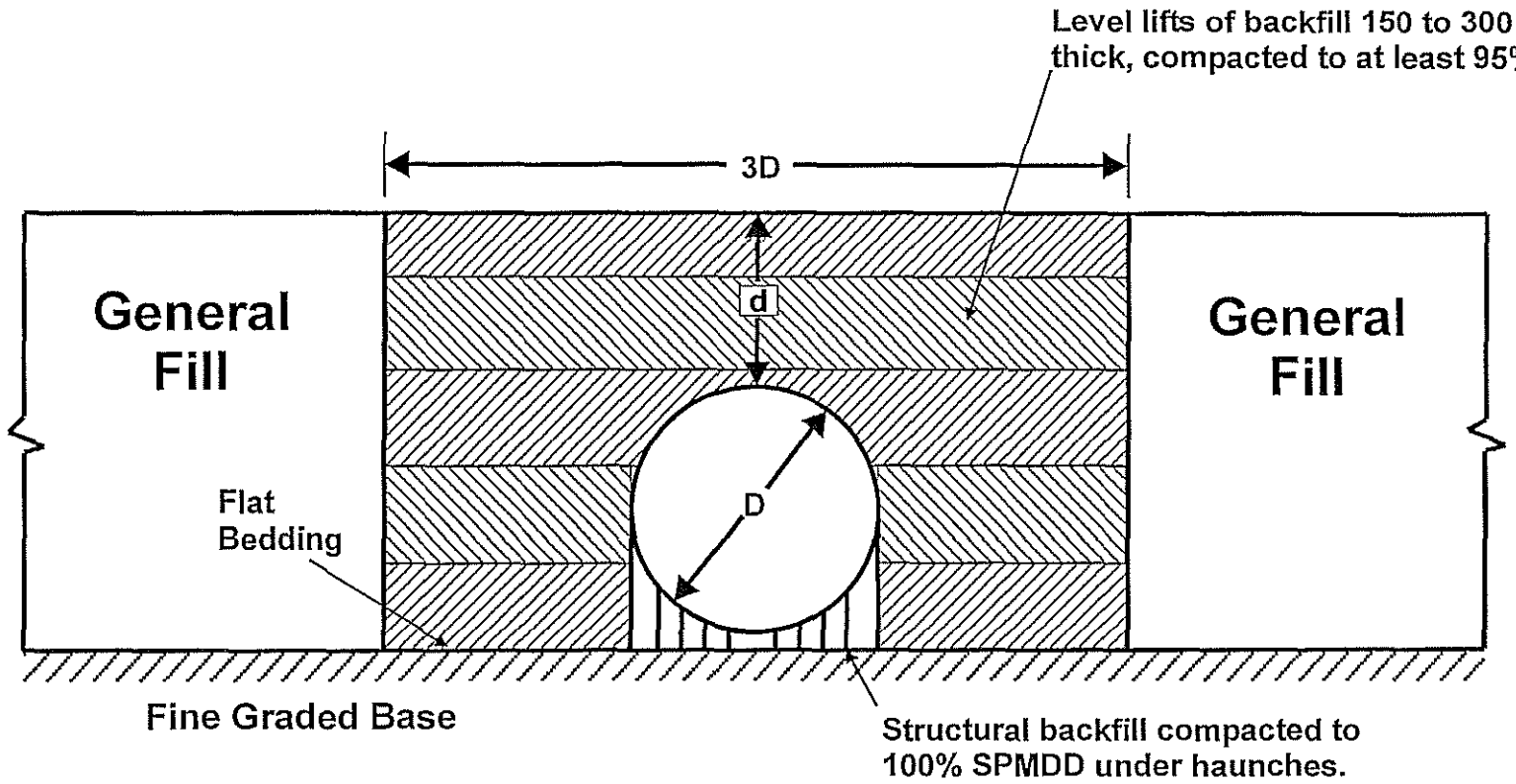
We trust the above meets your present requirements. Thank you for allowing BGC to be of service, once again, to Faro Mine. If you have any questions or require additional details, please contact the undersigned.

Respectfully submitted,
BGC Engineering Inc.
per:

Kris Matusiewicz, E.I.T.
Civil Engineer

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

Attachment: Figure 1
nhc memorandum



SPMDD = Standard Proctor Maximum Dry Density

d = minimum cover of structure backfill is D/6 or 300 mm, whichever is greater.

Source: Figure 7.6, Handbook of Steel Drainage and Highway Construction Products, Corrugated Steel Pipe Institute, 2002.

DATE: JUNE 2004	DRAWN SLF	BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY Calgary, Alberta Phone: (403) 250-5185	PROJECT NVWID CULVERT INSTALLATION
REFERENCED DRAWING DESCRIPTION			TITLE SKETCH GUIDELINES OF CULVERT INSTALLATION
		CLIENT Deloitte & Touche	PROJECT No. 0257-022-07 / DWG. No. 1 / REV. 0

nhc
Memorandum

northwest
hydraulic
consultants

4823 - 99th street
edmonton, alberta T6E 4Y1
tel: (780) 436-5868
fax: (780) 436-1645

to:	Gerry Ferris	*sent:*	by email
company:	BGC Engineering	*date:*	11 May 2004
from:	Barry Evans	*pages:*	2

subject: Faro Mine Site: North Valley Wall Interceptor Ditch Culvert Installation

File: Memo6443_2.doc

A 2.2 m diameter corrugated steel pipe (CSP) is available on site and is to be installed at the main access road/NVWID crossing. This memo provides hydraulic guidance for the culvert installation and has been prepared as an addendum to the BGC Engineering Inc. memorandum.

Design Flood Estimates

Instantaneous peak flood discharge estimates for the NVWD crossing are[1]:

50-year	3.0 m^3/s
100-year	3.7 m^3/s
200-year	4.4 m^3/s
500-year	5.4 m^3/s

The 50-year return period flood of 3.0 m^3/s has been chosen for the design of the current crossing design.

Culvert Capacity

Correctly installed, the 2.2 m CSP can pass the 500-year flood peak and so will easily pass the 50-year flood. For a headpond water depth of 1.8 m the culvert can pass 6.0 m^3/s (this assumes the culvert operates under inlet control with the invert at the headpond bed level and the outlet discharging freely on to a steeply sloped channel).

[1] Northwest Hydraulic Consultants Ltd. Faro Mine Site Area - North Wall Interceptor Ditch Culvert Design at Road Crossing. Report prepared for BGC Engineering Inc., April 2, 2004.

Culvert Installation Guidelines

These are:

- The channel be graded to a constant slope for at least 50 m upstream of the culvert to ensure that water does not pond at the culvert entrance.
- The channel approach to the culvert be straight with no abrupt bends.
- The invert of the culvert be placed at the headpond bed level.
- Appropriate armour protection be placed at the upstream culvert/embankment interface.
- A suitable material be placed around the culvert at the upstream end to prevent piping through the embankment.
- The culvert exit be towards the base of the downstream embankment but sufficiently high so that the culvert always operates under inlet control (the culvert exit is not submerged).
- The culvert discharges into an appropriately armoured exit.

Prepared by:

B.J. Evans, P.Eng.
Senior Engineer

E.K. Yarmko, P.Eng.
Review Principal

APPENDIX II - DAILY CONSTRUCTION REPORTS

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02

Inspection Report No. 8 Page: 1 of 1 Date: Aug 1/04

WEATHER

Temperature: 13 - 21°C Wind: None Sky: Partly cloudy

Precipitation: NONE

Contractor Forces on Site NONE

Clifford McLeod was scheduled to arrive Sunday morning at 8:00 am to start excavation.
Called at 12:00 pm and indicated that they may get the excavator to site by 8:00 am on the morning of Aug 2/04.

Contractor Activities (incl. quantities/volumes):

Unusual Conditions and Remarks:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: NIWID - New Culvert

Location: OUTFALL Section

Inspector: Gerry Ferris

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02

Inspection Report No. 10 Page: 1 of 1 Date: Aug 2/04

WEATHER

Temperature: 20°C Wind: Slight Sky: Overcast / Partly Cloudy

Precipitation: None

Contractor Forces on Site 1 - Foreman, 1 - Labourer, 1 - Excavator (CAT 225), 3 truck drivers (1 - John KRAFT, 2 - Clifford McLeod), 1 - Loader (966 CAT)

TRUCK DRIVERS & LOADER were used between start of Day & 12:00 pm at which point they went to work at BXL Bremtag site.

Contractor Activities (incl. quantities/volumes):

Completed the excavation of the new location for the culvert.

Unusual Conditions and Remarks:

During excavation it was revealed that the original road was placed directly on top of top soil and tree roots.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: NWID - Culvert

Location: Out fall Section

Inspector: Gerry Ferris

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02

Inspection Report No. 12 Page: 1 of 1 Date: Aug 3/04

WEATHER

Temperature: 18°C Wind: Slight Sky:

Precipitation: None

Contractor Forces on Site 1 - Foreman, 1 - Labourer, 1 - Excavator
1 - Small compactor, Small pump for water

8-6:30pm

Contractor Activities (incl. quantities/volumes):

Compacted sand materials in the base of the trench to build up the base due to over excavation for the removal of the topsoil
This was completed in two lifts.
Culvert was set in place (or within the trench)
Site Staff was used to place the culvert in place (Foreman, Loader, two labourers).

Unusual Conditions and Remarks:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: NVWID - Culvert

Location: Outfall Section

Inspector: Gerry Ferris

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02 - Culvert installation

Inspection Report No. M1 **Page:** 1 **of** 1 **Date:** Aug 4, 2004

WEATHER

Temperature: 20°C **Wind:** light **Sky:** clear

Precipitation: —

Contractor Forces on Site One operator (Cliff in morning + Chuck in afternoon), one labourer, 2 truck drivers + 2 trucks, 1 hoe

↳ Clifford Macleod

hours: 8 - 6:00

Contractor Activities (incl. quantities/volumes): - Commence the outlet structure, activities include; excavating base to spec's; hauling sand to place; placing sand (place in two lifts); compact sand; form sand to dimensions specified;

Unusual Conditions and Remarks: - All went good
- water may be infiltrating new excavation

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Installation

Location: Fargo N. fish pond [illegible]

Inspector: [signature]

N:\Administration\Forms\DAILY INSPECTION SUMMARY.doc

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02 - Culvert Installation

Inspection Report No. 113 Page: 1 of 1 Date: Aug 3, 2004

WEATHER

Temperature: ~25°C Wind: — Sky: clear

Precipitation: —

Contractor Forces on Site 1 operator → 1 hoe
3 truck drivers → 3 trucks
1 labourer → operating compactor

Clifford Macleod Contractors
↳ on-site 8:30 → 4:30

Contractor Activities (incl. quantities/volumes): Commence placing riprap in outlet structure; revise weir portion of outlet (needed to be dropped 60cm); placed 2x 6" lifts of sand alongside culvert (both sides); compacted sand as they went; compaction tests passed 95% proctor; EBA ran 4 tests of second lift (all passed); rip rap was hauled from down valley (~4-6 loads); sand was also hauled (~3 loads).

Unusual Conditions and Remarks: hoe sprang a leak in hydraulic hose, had to be shut down @ 4:30 pm. Contractor is to fix tonight.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Installation
Location: Faro Yukon
Inspector: Mike McCrank

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02

Inspection Report No. Aug 6 Culvert Page: 1 of 1 Date: Aug 6, 2004

WEATHER

Temperature: ~20-25°C Wind: light Sky: Clear, some clouds

Precipitation: —

Contractor Forces on Site 1 operator on 1 loader
3 labourers
1 loader, 1 truck (running), 1 compacter

hours 12:00 to 6:00 (6 hrs)

Contractor Activities (incl. quantities/volumes): Continued placing sand beside culvert, and compacting; placed more rip rap in outlet structure; ~4 loads of Rip Rap hauled from source; loader was used to clean up sand piles for excavator.

Unusual Conditions and Remarks: Hoe was under repair until 12:00. No work was done prior to the hoe repairs.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Installation

Location: Faro, Yukon

Inspector: Mike McCrank

DAILY INSPECTION SUMMARY

Project No.: 0247-026-02

Inspection Report No. Aug 7, culvert **Page:** 1 of 1 **Date:** Aug 7, 2004

WEATHER

Temperature: ~20°C **Wind:** light **Sky:** clear

Precipitation: —

Contractor Forces on Site 1 operator → 1 excavator
3 labourers → 1 compactor
→ 1 loader

Contractor on site 8:30 → 5:30 (2 labourers arrived @ 9)

Contractor Activities (incl. quantities/volumes): Continue placing sand beside culvert & including compacting + watering; place some more rip rap in outlet; loader hauled riprap from 1 stockpile to another near outlet; loader used to facilitate excavator's access to materials.

Unusual Conditions and Remarks: 1 labourer slept for 3 hours.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Installation
Location: Faro / Mine, Yukon
Inspector: [signature]

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02

Inspection Report No. Aug 8, Culvert **Page:** 1 of 1 **Date:** Aug 8, 2024

WEATHER

Temperature: 20-25°C **Wind:** light **Sky:** clear

Precipitation: —

Contractor Forces on Site 1 operator + 3 labourers
- 1 loader, 1 excavator, compactor, 2 trucks

Contractor on site 8:15 → 6:00

Contractor Activities (incl. quantities/volumes): Placing sand above culvert; compacting in 6" lifts; Continued placing rip-rap in the outlet structure; hauled more sand from source; started building temporary road over new culvert for haul trucks to use. (finished)

Unusual Conditions and Remarks:

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Installation
Location: Faro Mine, Yukon
Inspector: Mike McCrank

DAILY INSPECTION SUMMARY

Project No.: 0257-026-02

Inspection Report No. Aug 9, Culvert Install Page: 1 of 1 Date: Aug 9, 2001

WEATHER

Temperature: 20-25°C Wind: light Sky: Clear, some cloud

Precipitation: —

Contractor Forces on Site 1 operator + 3 labourers
1 excavator, 2 trucks + 1 loader

Clifford Macleod Contractors on site for ... 10 hours.

Contractor Activities (incl. quantities/volumes): Place rip rap in outlet; haul more rip rap from source; grade a temporary road over new culvert; Dig inlet structure; place rip rap in inlet;

- Faro mine supplied grader and brought in a pump for the diversion during channel excavation (should happen tomorrow)

Unusual Conditions and Remarks: - BGC could not be on hand to supervise today's activities since drilling started in the Faro Pit.

Since this project required lots of rip rap and there was a minimal supply, Tim Moon Contractors left early allowing Clifford Macleod better access. Tim moon was on site for about 3.5 hours identifying zones that need more Rip Rap.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Install
Location: Faro Mine, Yukon
Inspector: Mike McCrank

DAILY INSPECTION SUMMARY

Project No.: 0257-026-07

Inspection Report No. Aug 10, Culvert **Page:** 1 of 1 **Date:** Aug 10, 2014

WEATHER

Temperature: 20-25°C **Wind:** light **Sky:** Smoky

Precipitation: —

Contractor Forces on Site 1 operator x 2 labourers
- 1 excavator, 2 trucks + 1 loader

Contractor on-site: 8:00 AM → 5:00 PM

Contractor Activities (incl. quantities/volumes): Set up sump to divert creek; dig new channel; remove old culverts; finish placing rip-rap in outlet, including oversized boulders; start placing lifts for dyke + old culverts.

Unusual Conditions and Remarks: BGC was not on hand in morning during the digging of new channel.

Will have a roller compactor for tomorrow.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Installation
Location: Faro Mine, Yukon
Inspector: Mike McCrank

DAILY INSPECTION SUMMARY

Project No.: 0254-026-02

Inspection Report No. Aug 11, Culvert Page: 1 of 1 Date: Aug 11, 2004

WEATHER

Temperature: 10-15°C Wind: light Sky: Clouding

Precipitation: light

Contractor Forces on Site 4 people
- 2 trucks + 1 loader, 1 pump
- 1 vibrating compacter (Roller) from Tim Moon

Contractor on-site 8:45 - 3:30

Contractor Activities (incl. quantities/volumes): backfilled all culvert ditch with sand + gravel in 8" lifts; compacted w roller (Tim Moon); built up dyke above inlet structure + compacted it; cosmetic repairs to road surface and final packing of road surface. 24 loads of S+G hauled.

Culvert Install Job Completed,

Unusual Conditions and Remarks: Clifford McLeod rented roller compactor from Tim Moon contractors.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

Project: Culvert Install

Location: Faro Mine Yukon

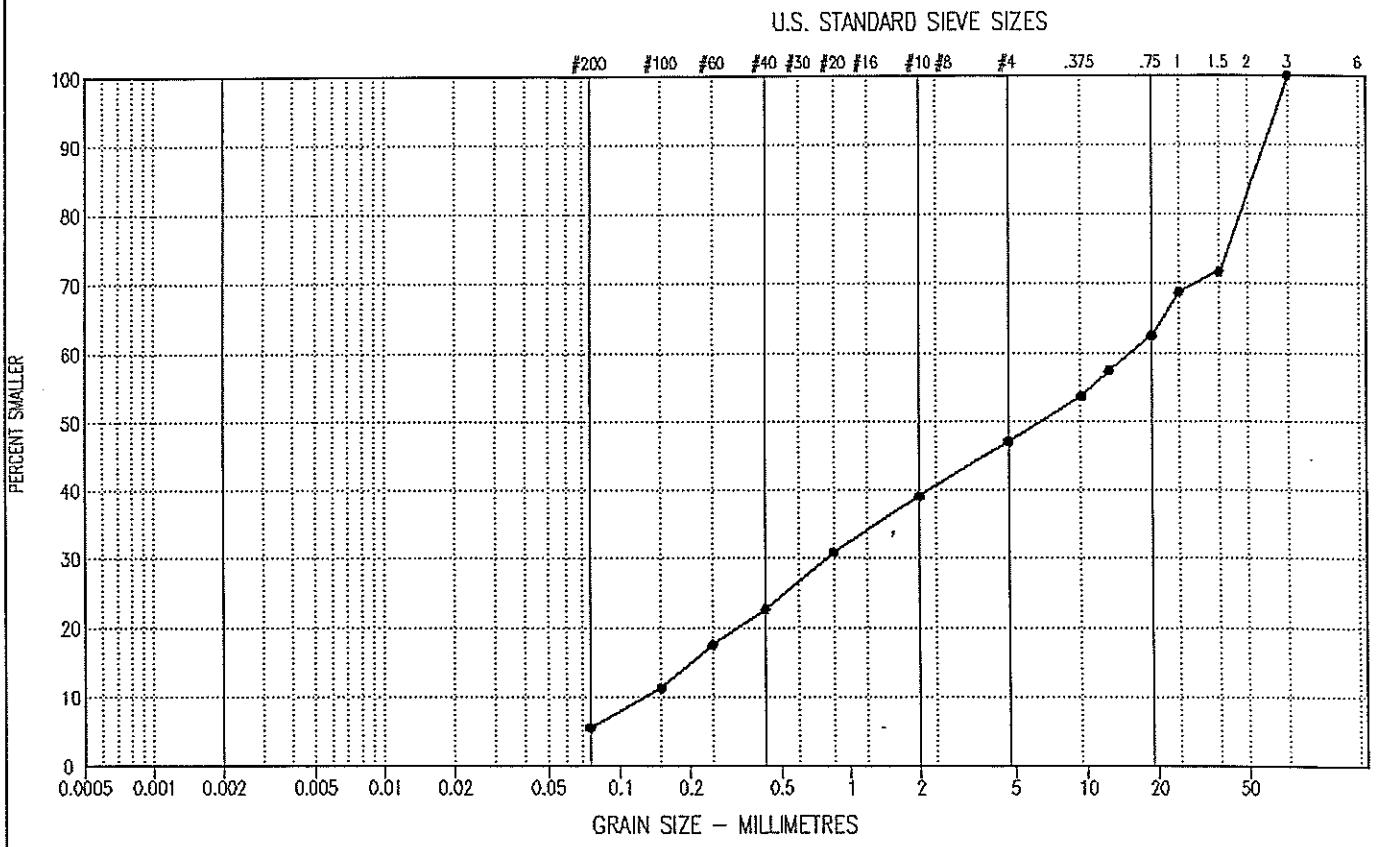
Inspector: Mike McCrank

APPENDIX III - LABORATORY AND FIELD TESTING RESULTS

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●	SA01	0.00	6	42	53	119.0	0.3	GP–GM

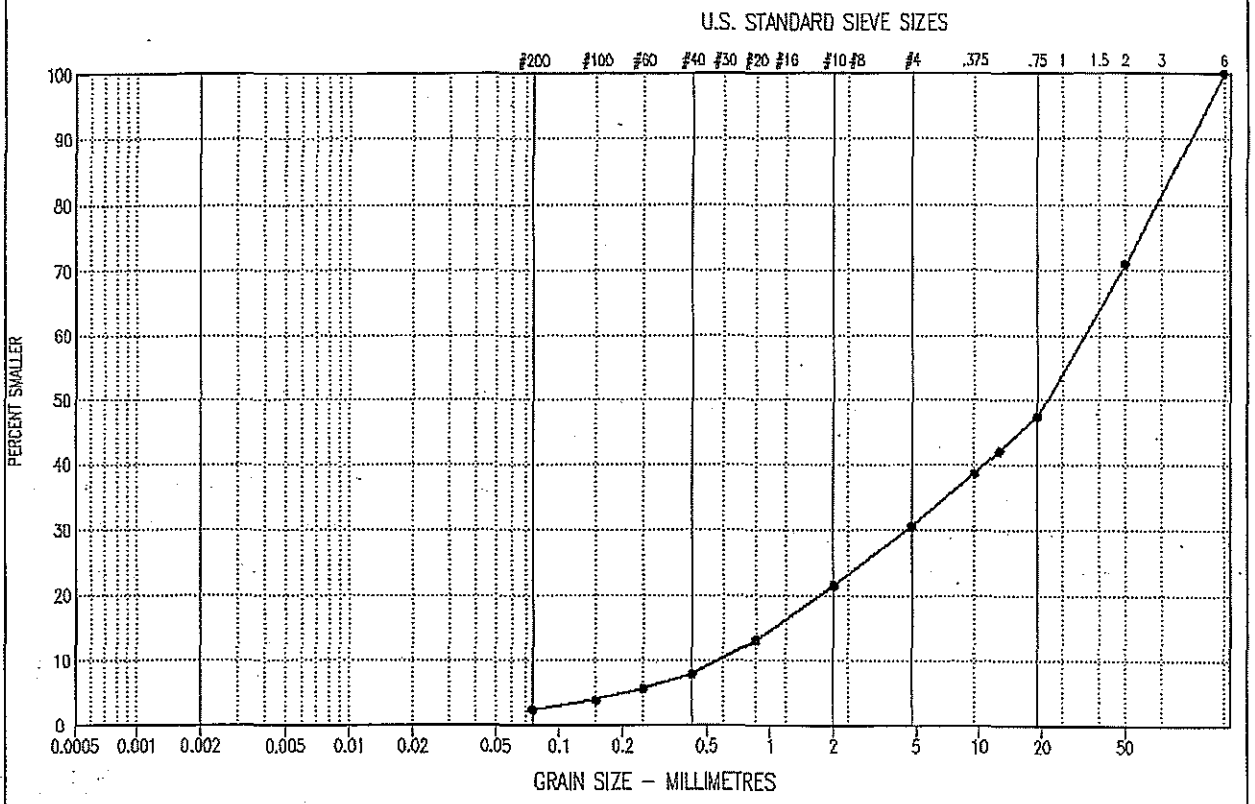
Project: 0201–1200091.015 Date Tested: 04/08/02 BY: TP

Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

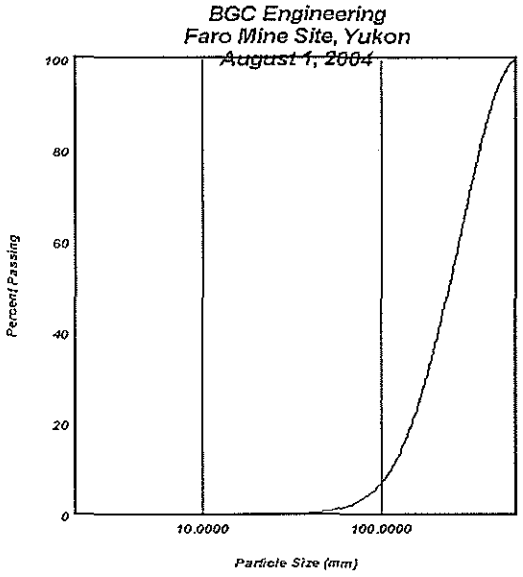
CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●	SA02	0.00	2	28	70	59.7	1.0	GW

Project: 0201-1200091.015 Date Tested: 04/08/18 BY: TP

Tested in accordance with ASTM D422 unless otherwise noted.



size (mm)	%
4000.00	100.00
2000.00	100.00
1000.00	100.00
750.00	100.00
500.00	97.33
250.00	53.25
125.00	12.89
88.00	4.68
63.00	1.62
44.00	0.55
31.00	0.21
22.00	0.09
16.00	0.04
11.00	0.01
7.800	0.00
5.500	0.00
4.000	0.00

P20 Size (mm) 148.99
P50 Size (mm) 239.69
P80 Size (mm) 355.56
Top size (mm) 545.91

SPLIT ENGINEERING

Date: Tue Apr 26 17:50:24 2005

Sieve series: ISO Units: (mm) Number of Images 3

Cumulative Percent Passing Data

Size	All Images	AUG 1 001	AUG 1 002	AUG 1 003
1000	100	100	100	100
750	100	100	100	100
500	97.33	94.37	96.77	99.38
250	53.25	40	60.14	57.14
125	12.89	7.93	16.42	13.97
88	4.68	2.59	6.17	5.2
63	1.62	0.85	2.2	1.81
44	0.55	0.31	0.75	0.58
31	0.21	0.14	0.28	0.21
22	0.09	0.07	0.11	0.09
16	0.04	0.03	0.05	0.04
11	0.01	0.01	0.02	0.01
7.8	0	0	0.01	0
5.5	0	0	0	0
4	0	0	0	0

Following Data in (mm)				
F10	113.86	135.56	103.87	110.27
F20	148.99	178.44	135.39	144.42
F30	179.7	215.66	162.46	173.66
F40	209.53	249.99	189.63	201.27
F50	239.69	285.3	217.91	229.38
F60	272.69	321.74	249.5	258.68
F70	310.11	361.52	288.07	291.46
F80	355.56	409.21	338.62	331.24
F90	418.53	466.99	416.58	384.28
Topsize	545.91	564.45	549.69	508.78

Fines factor:	0

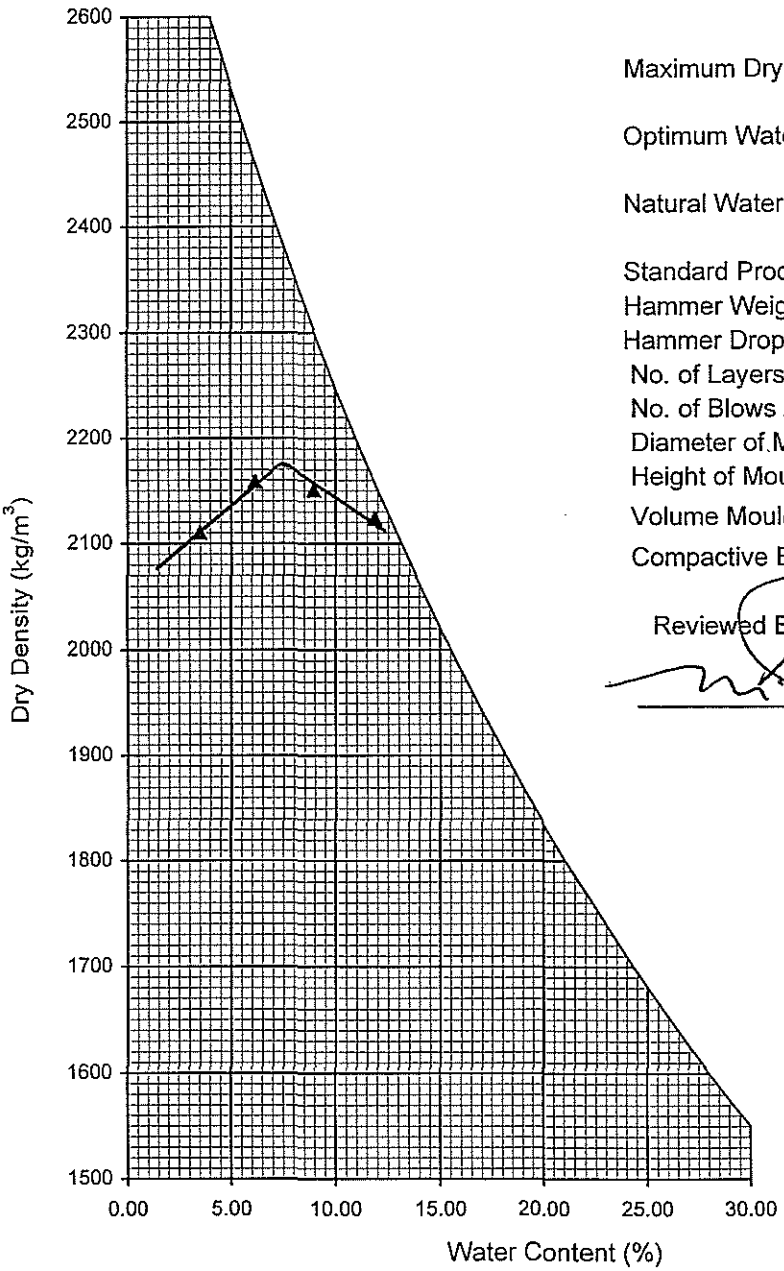
RosRam uniformity:	2.35
RosRam X50:	246.07
R-squared:	0.9966

Schuhmann Slope:	1.65
Schuhmann X50:	267.14
R-squared:	0.9536

EBA Engineering Consultants Ltd.

MOISTURE-DENSITY RELATIONSHIP

Project:	Culvert Install	Sample No.:	SA01
Address:	Anvil Range, Faro, YT	Date Sampled:	28-Jul-04
		Sample Location:	Borrow pit
Project No.:	1200091.015		
Date Tested:	Aug. 2, 2004 By: TP	Sample Description:	gravel
Client:	BGC Engineering Inc.		
Attention:	Mr. Gerry Ferris		



Maximum Dry Density : 2175 kg/m^3

Optimum Water Content: 7.5 %

Natural Water Content: 2.5 %

Standard Proctor (ASTM D 698)

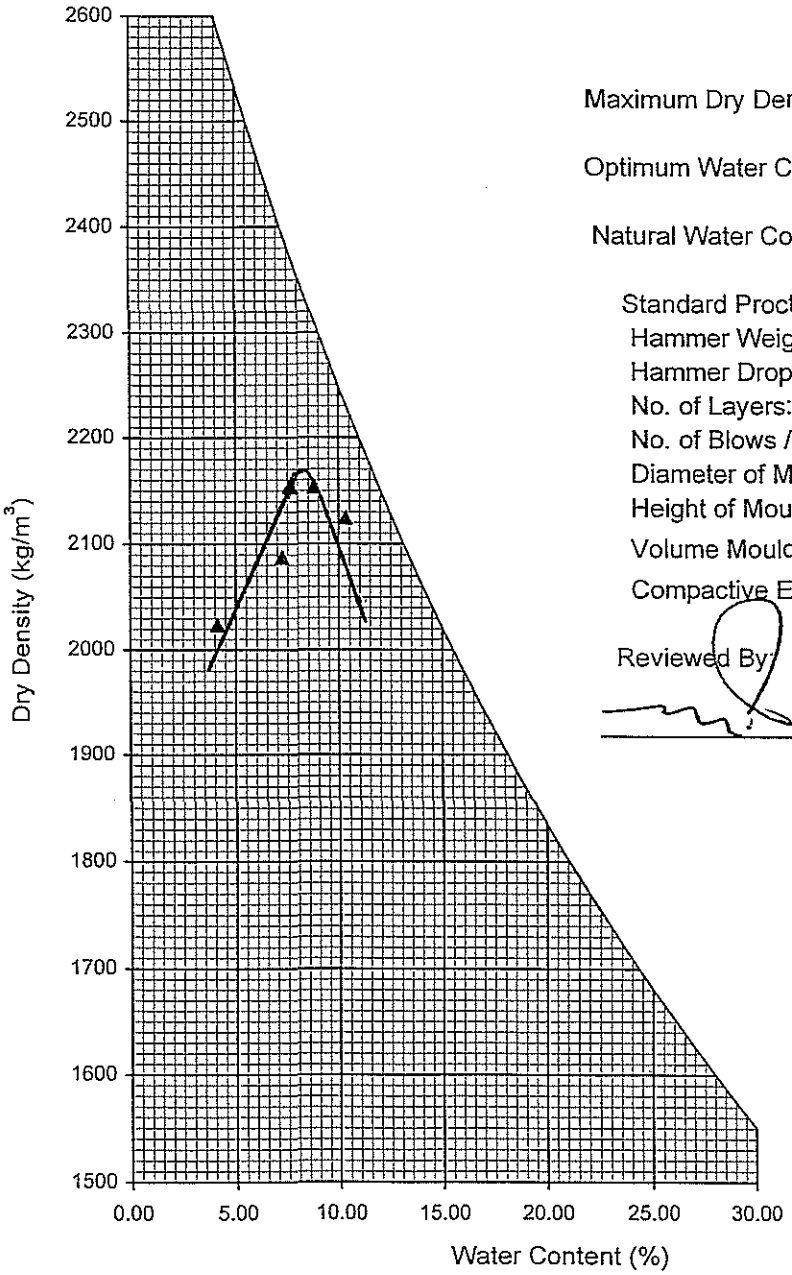
Hammer Weight:	2.5	kg
Hammer Drop:	305	mm
No. of Layers:	3	
No. of Blows / Layer:	56	
Diameter of Mould:	152	mm
Height of Mould:	102	mm
Volume Mould	2.125 x 10^{-3}	m^3
Compactive Effort	600	kJ/m^3

Reviewed By:

EBA Engineering Consultants Ltd.

MOISTURE-DENSITY RELATIONSHIP

Project:	RCDC Fill	Sample No.:	SA01
Address:	Faro, YT	Date Sampled:	14-Jul-04
		Sample Location:	On-site Stockpile
Project No.:	0201-1200091.015		
Date Tested:	16-Jul-04 By: MCP	Sample Description:	20 mm CRUSHED GRAVEL
Client:	BGC Engineering		
Attention:	Jim Cassie, P.Eng		



Maximum Dry Density : 2170 kg/m^3

Optimum Water Content: 8.0 %

Natural Water Content: %

Standard Proctor (ASTM D 698)

Hammer Weight:	2.5	kg
Hammer Drop:	305	mm
No. of Layers:	3	
No. of Blows / Layer:	56	
Diameter of Mould:	116	mm
Height of Mould:	116	mm
Volume Mould	0.002124	m^3
Compactive Effort	600	kJ/m^3

Reviewed By:

P. Eng.

eba

EBA Engineering

DENSITY TEST RESULTS

ASTM Designation D2922 & D3017, or D1556

Project No: **1200091.015**

Project: Anvil Range Mine

Client: **BGC Engineering Inc.**
1605, 840 - 7th Ave. S.W.
Calgary, AB
T2P 3G2

Att'n: **Mr. Gerry Ferris**

Test Apparatus : Nuclear Machine No: 16924

Soil Description: SAND - some gravel

Temperature Air: ____ °C Soil: ____ °C

Specified Compaction: 95.0

Compaction Standard: Standard Proctor

Minimum Dry Density: ____

Maximum Dry Density: 2170

Optimum M.C.: 8.0

Date Tested: 2004.08.03 By: TP

Test No./ Probe Depth	Location	Elevation	% Moisture Content	Dry Density Kg/m^3	% Compaction
79 /100	5.0 m from inlet	-2.5	4.7	2083	96.0
80 /100	15.0 m from inlet	-2.5	4.3	2094	96.5
81 /100	5.0 m from outlet	-2.2	4.5	2084	96.0
82/100	5.0 m from inlet	-2.35	4.5	2093	96.5
83 /100	10.0 m from inlet	-2.2	5.2	2089	96.3

Remarks: ____

Reviewed By: ____

c.c.
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Mr. Gerry Ferris
BGC Engineering Inc.
1605, 840 - 7th Ave. S.W.
Calgary, AB
T2P 3G2

EBA Engineering

DENSITY TEST RESULTS

ASTM Designation D2922 & D3017, or D1556

Project No: **1200091.015**

Project: Anvil Range Mine

Client: **BGC Engineering Inc.**
1605, 840 - 7th Ave. S.W.
Calgary, AB
T2P 3G2

Att'n: **Mr. Gerry Ferris**

Test Apparatus : Nuclear Machine No: 16924

Soil Description: SAND - some gravel

Temperature Air: ____ °C Soil: ____ °C

Specified Compaction: 95.0

Compaction Standard: Standard Proctor

Minimum Dry Density: ____

Maximum Dry Density: 2175

Optimum M.C.: 7.5

Date Tested: **2004.08.04** By: TP

Test No./ Probe Depth	Location	Elevation	% Moisture Content	Dry Density Kg/m^3	% Compaction
84 /100	Outlet structure centre	-0.25	4.8	2081	95.7
85 /100	Outlet structure centre	GR	4.9	2074	95.4

Remarks: ____

Reviewed By: ____

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EBA Engineering

DENSITY TEST RESULTS

ASTM Designation D2922 & D3017, or D1556

Project No: **1200091.015**

Project: Anvil Range Mine

Client: **BGC Engineering Inc.**
1605, 840 - 7th Ave. S.W.
Calgary, AB
T2P 3G2
Att'n: **Mr. Gerry Ferris**

Test Apparatus : Nuclear Machine No: 16924

Soil Description: SAND - some gravel

Temperature Air: ____ °C Soil: ____ °C

Specified Compaction: 95.0

Compaction Standard: Standard Proctor

Minimum Dry Density: ____

Maximum Dry Density: 2175

Optimum M.C.: 7.5

Date Tested: **2004.08.05** By: TP

Test No./ Probe Depth	Location	Elevation	% Moisture Content	Dry Density Kg/m^3	% Compaction
86/100	Left side of pipe, 10.0 m from inlet	-2.0	4.9	2081	95.7
87/100	Left side of pipe, 10.0 m from outlet	-2.0	5.2	2100	96.6
88/100	Right of pipe, 10.0 m from inlet	-2.0	4.6	2080	95.6
89/100	Right of pipe, 10.0 m from outlet	-2.0	5.2	2094	96.3

Remarks: ____

Reviewed By: ____

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Calgary, AB
T2P 3G2

EBA Engineering

DENSITY TEST RESULTS

ASTM Designation D2922 & D3017, or D1556

Project No: **1200091.015**

Project: Anvil Range Mine

Client: **BGC Engineering Inc.**
1605, 840 - 7th Ave. S.W.
Calgary, AB
T2P 3G2

Att'n: **Mr. Gerry Ferris**

Test Apparatus : Nuclear Machine No: 16924

Soil Description: SAND - some gravel

Temperature Air: ____ °C Soil: ____ °C

Specified Compaction: 95.0

Compaction Standard: Standard Proctor

Minimum Dry Density: ____

Maximum Dry Density: 2175

Optimum M.C.: 7.5

Date Tested: 2004.08.06 By: TP

Test No./ Probe Depth	Location	Elevation	% Moisture Content	Dry Density Kg/m^3	% Compaction
90/100	Right of pipe, 10.0 m from inlet	-1.10	4.3	2080	95.6
91/100	Right of pipe, 10.0 m from outlet	-1.10	6.0	2098	96.5

Remarks: ____

Reviewed By: ____

c.c.
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Mr. Gerry Ferris
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Calgary, AB
T2P 3G2

NVWID Moisture Content Testing

Project: NVWID Culvert Installation
Client: Deloitte & Touche Inc.
Project Number: 0257-026-03
Date of Lab Testing: August 7-8, 2004
Sampled by: Mike McCrank
Tested by: Mike McCrank

Location of Sample	Moisture Content (%)
Base of culvert	7.3
Base of culvert	9.4
1.25 m above base	10.5
1.5 m above base	9.8
0.3 m from top of culvert	8.7
0.3 m above top of culvert	7.8
Average	***8.9***