April 2017

MARY RIVER PROJECT

Tote Road Earthworks Execution Plan and Design Report

Submitted to:

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REPORT

Report Number: 1667708 (Rev. 0)

Distribution:

1 e-copy – Baffinland Iron Mines Corporation
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Golder Associates

Executive Summary

This report presents the Tote Road Earthworks Execution Plan (the Plan) for the Baffinland Iron Mines Corporation's (Baffinland) Mary River Project. The primary objectives of this Plan are to prioritize the sites along the Tote Road requiring remediation and to provide remediation designs for Baffinland to implement.

The Mary River Project (Mine Site) is located at approximately latitude 71°19' north, longitude 79°12' west. Operations at this iron ore mine comprise the blasting and excavation of ore and waste rock. Once crushed, the ore is loaded onto B-train haul trucks and transported to the Milne Port facility, via the Tote Road, for shipment to processing facilities offsite. The Tote Road extends from the Milne Port to the Mine Site, a distance of 104 km.

The Plan is required to address Baffinland's commitment to Environment and Climate Change Canada (ECCC) and Indigenous and Northern Affairs (INAC) as stated in the sedimentation mitigation action plan (Golder 2016). To meet the needs for remediation design, the Plan includes culvert replacement, road re-surfacing, and other road improvements in consideration of the design prepared by Hatch Ltd. (Hatch). Golder was retained by Baffinland to develop the Tote Road Earthworks Execution Plan for use in the upcoming construction season(s). The Plan included:

- Collaborating with Baffinland to prioritize the culvert sites requiring remediation;
- Preparing detailed designs for several culvert sites; and,
- Preparing and submitting a design report.

Golder prepared detailed designs for 14 individual culvert sites. The remaining sites were not included because there was not enough information for design and/ or their need for remediation was not as urgent as those chosen. Design elements used in developing individual site detailed design comprised:

- Designing road to match with existing alignment or requested realignment based on Baffinland's needs;
- Prescribing materials to be used for: embankment, pavement, culvert pipe bedding, trench backfill, and erosion protection;
- Detailing installation requirements, based on a desktop study (not supported by field study); and
- Providing an inventory on the number and diameter(s) of culvert pipes, drainage crossing fish bearing status, and embedment depth of pipes where fish passage is required.

Baffinland plans to carry out the work prior to the spring freshet and post-summer. The works are planned to be carried out with minimal impact during the open water season. Golder will provide offsite engineering during the duration of this project. It is recommended that inspections of the culvert sites to be remediated in the future be carried out in 2017. Routine inspections should also be carried out by Baffinland throughout the year.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Baffinland Iron Mines Corporation (Baffinland) to develop a Tote Road earthworks execution plan (the Plan) for the Mary River Project in Nunavut. The Plan is required to address Baffinland's commitment to Environment and Climate Change Canada (ECCC) and Indigenous and Northern Affairs (INAC) as stated in the sedimentation mitigation action plan (Golder 2016). The Plan is to include culvert replacement, road re-surfacing, and other road improvements in consideration of the design prepared by Hatch Ltd. (Hatch).

Baffinland owns and operates the Mary River Project, an open pit iron ore mine located on northern Baffin Island, in Nunavut at approximately latitude 71°19' north, longitude 79°12' west. Operations comprise the blasting and excavation of ore and waste rock with the ore hauled from the open pit to a crusher. Following crushing, the ore is loaded onto B-train haul trucks and hauled to the Milne Port facility, via the Tote Road, for shipment to processing facilities offsite. The Tote Road extends from the Milne Port to the Mine Site, a distance of 104 km.

Construction drawings were prepared for Baffinland by Hatch for the Tote Road Upgrade in 2013. Earthwork upgrades to the Tote Road have been ongoing including the completion of the bridge construction in 2014 (Hatch 2014b) and those activities outlined in the sedimentation mitigation action plan (Golder 2016).

The primary objectives of this Plan are to prioritize the sites requiring remediation and to provide remediation designs for Baffinland to implement.

The report summarizes the Plan, and presents drawings and specifications prepared by Golder, as follows:

- A description of the background information used to develop the earthworks execution plan and designs is provided in Section 2.0;
- A description of the methodology, design considerations, design elements and construction considerations are provided in Sections 3.0, 0, 5.0, and 6.0, respectively;
- Inspection requirements are provided in Section 7.0; and
- The path forward is described in Section 8.0.

Environmental aspects of the works were excluded from Golder's scope of work as Baffinland stated that it would be responsible for these items. Baffinland's Environmental Protection Plan will be followed during the prescribed work and culvert installations.

The Reader is instructed to read the entire report, including appendices.

2.0 BACKGROUND INFORMATION

2.1 Sedimentation Mitigation Action Plan Site Visit

Golder carried out a site visit in August 2016 as part of the scope for the development of the Sedimentation Mitigation Action Plan (Golder 2016). Through site observations and input from Baffinland's staff, a preliminary list of sites that require remediation was developed. Approximately 55 sites were identified and observations on the condition and possible remedial actions were noted. This complete list of sites is provided in Table 1 (following the text of the report).

2.2 Available Background Information

The reports and data provided by Baffinland and listed in the following sections were reviewed as part of the desktop study for the Plan.

Previous Reports & Design Drawings

- Baffinland (Baffinland Iron Mines Corporation). 2013. DFO Culvert Package (Re: Changes to culverts along the Tote Road). Prepared for Fisheries and Oceans Canada (DFO). Prescott, Ontario. , August 29, 2013. 521 p.
- Golder (Golder Associates Limited). 2016. Mary River Project, Sedimentation Mitigation Action Plan, Rev. 1. Prepared for Baffinland Iron Mines. Project No. 1661774 (5000). September 29, 2016.
- Hatch (Hatch Limited). 2013a. Mary River Project, Project Wide Civil Standard Drawing, Typical Culvert Details Dwg. No. H349000-1000-10-041-0003. Prepared for Baffinland Iron Mines. Oakville, ON. June 7, 2013. 1 p.
- Hatch (Hatch Limited). 2013b. Tote Road Design Criteria. Prepared for Baffinland Iron Mines Corporation. Oakville ON: Hatch Ltd. 15 p. April 2, 2013.
- Hatch (Hatch Limited). 2013c. Tote Road Culvert Design Summary. Prepared for Baffinland Iron Mines Corporation. Oakville ON: Hatch Ltd. August 27, 2013.
- Hatch (Hatch Limited). 2014a. Mary River Project, Tote Road Culvert Data, Sheets 1 through 5, January 23, 2014. Prepared for Baffinland Iron Mines. Dwg. No. H349000-3000-10-088-0030 through H349000-3000-10-088-034. 5 p.
- Hatch (Hatch Limited). 2014b. Construction Summary Report: Tote Road Upgrade Package – Bridge Crossings, December 4, 2014. Prepared for Baffinland Iron Mines. 53 p. File No. H349000-3130-10-124-0005.
- Knight Piésold (Knight Piésold Consulting). 2007. Tote Road Alignment: Reissuing Updated Figures 1 to 43. Prepared for Baffinland Iron Mines. Oakville, ON. 48 p. (Ref. No. NB07-00698). August 17, 2007.
- Knight Piésold (Knight Piésold Consulting). 2007. Table 1: Mary River Project, Bulk Sampling Program – Road Upgrade, Summary of Water Crossings – Sorted by Chainage, August 21, 2007. Prepared for Baffinland Iron Mines. Oakville, ON. 3 p.
- Tetra Tech EBA (Tetra Tech EBA Engineering Consultants Limited). 2014. Inspection of the Milne Inlet Tote Road and Associated Borrow Sources, November 2014. Prepared for Baffinland Iron Mines. 50 p. File No. E14103210-01.

Satellite Imagery

- Worldview (satellite imagery from Worldview 2 and Worldview 3 satellites, by DigitalGlobe). 2012, 2015, & 2016. Provided by Baffinland Iron Mines.

Photogrammetry/Grid & DEM

- Derived from satellite imagery, the following were provided:
  - PhotoSat. 2015. “Thinned” point cloud (gridded) data from photogrammetric grid development, November 4, 2016. Prepared for Baffinland Iron Mines. PhotoSat Transmittal Ref. 3697.
  - PhotoSat. 2016. “Thinned” point cloud data (gridded), December 2016. Prepared for Baffinland Iron Mines.

GPS & Map Data

- Baffinland (Baffinland Iron Mines Corporation). 2015. Tote Road Culverts GPS points (*.gpx file), October 3, 2015.
- NRC ESS (Natural Resources Canada, Earth Sciences Sector). 1965. CanMatrix Provisional Map 47 H09, Nunavut, Edition 1 MCE, Series A 713. Accessed December 2016.

AutoCAD

- Baffinland (Baffinland Iron Mines Corporation). 2017. (Railway Centreline) Mary River Track Centreline with laydowns, quarries and water sources (AutoCAD File), January 16, 2017.
- Knight Piésold (Knight Piésold Consulting). 2009. (As-built) Road Upgrades, Plan and Profile (AutoCAD File), October 9, 2009. Prepared for Baffinland Iron Mines.

2.3 Limitations on Background Information Review

The Plan is based on a desktop review and relies on the accuracy of the data provided. The background data provided by Baffinland was used to infer the existing conditions and develop the designs, however, it was noted that the “as-built” information (Knight Piésold 2009) was not up-to-date. In some instances the as-built alignment did not match the most recent satellite imagery (Worldview 2016), specifically where upgrade work was carried out (as described in Section 1.0). Therefore numerous sources of information were used to infer the actual conditions.

The locations of the culvert sites were inferred from a combination of the “as-built” information (Knight Piésold 2009), the Hatch design information (Hatch 2014a), GPS coordinates provided by Baffinland (Baffinland 2015) and the satellite imagery (Worldview 2016).

The site conditions, including the condition of the culverts and sedimentation issues, were inferred from the available photographs, notes and satellite imagery. The existing roadway dimensions (i.e. side slope, road widths, and embankment heights) were derived from the processed satellite data (Worldview 2016).

3.0 METHODS

The Plan was developed as follows:

- Identify areas of the Tote Road that require remediation/ improvements;
  - As described in Section 2.1, as part of the sedimentation mitigation action plan development, approximately 55 sites were identified along the Tote Road with potential sedimentation issues (Figure 1).

- Prioritize the sites for remediation;
  - As it is not feasible to remediate all the sites in one construction season, it was necessary to select the sites to be remediated first. A ranking system described in Appendix A was developed together with Baffinland staff to prioritize the remediation projects. With the aid of the ranking system, Baffinland identified 19 sites for the initial remediation efforts. The 19 sites were reviewed in detail to develop a design for remediation for each site. Of the 19 sites, 5 sites were identified to have insufficient information to develop a detailed design.
  - These 5 sites are noted to have permafrost degradation and ditch erosion issues. Therefore it was determined that these sites would be inspected in the summer of 2017 and remediation plans would be developed after site inspections were carried out and additional information was collected. The 14 remaining sites are identified in Table 1. The remaining sites will be inspected in the summer of 2017 and remediation plans will be developed for future years, as required.
- Establish the design basis for the various sites;
  - Once the selected sites were determined the design basis was established. Hatch design criteria documents (listed in Section 2.0) were used as a reference. A description of the design basis is provided in Section 4.0.
- Complete the design for the selected sites;
  - The Hatch design (2014a) of the culvert crossings was referenced as it is the permitted construction plan for the Tote Road. Environmental and hydrological studies were not part of this scope of work, therefore no changes to the Hatch design for the number of culverts, size of the culverts or embedment depth of the culverts were proposed.
  - The design of the road sections along the culvert crossings was completed using RoadEng software. RoadEng is a software tool designed by Softree, which is specifically used for haul road design. This program serves as an efficient tool for road alignment design, including geometric design (grades and curves) and earthwork volume estimation.
  - Site remediation designs were developed on a site-by-site basis with site specific notes and design considerations developed in conjunction with the road design models. The design elements are described in Section 5.0 and the construction drawings and specifications are provided in Appendices B and C.
- Provide inspection requirements;
  - Inspection of sites with that have been remediated as well as those without remediation designs is required. Details on the inspection requirements are provided in Section 7.0.

4.0 DESIGN BASIS

The objectives driving the design are described as follows:

- Reduce the sediment loading of watercourses caused by the Tote Road;
  - The sedimentation of the affected watercourse crossings is a result of several issues including erosion upstream of the culvert crossings, impedance of flow due to damaged or buried culverts or poorly aligned culverts, and inadequate erosion protection at the culvert locations;
- Improve position, alignment, and invert elevations of the fish-bearing culverts to foster fish passage;
- Improve the safety of the Tote Road;
  - At several of the existing culvert sites the Tote Road is narrow with a width less than 10 m. As part of the design, widening the existing road driving surface is a key requirement.
  - Safety berms are required where the road embankment drop-off is 3.0 m or greater.
- Limit interruptions to the active Tote Road traffic during construction;

The objectives are to be met under the over-riding constraint that not all culvert sites identified as needing rehabilitation or reconstruction can be dealt with in a single construction season.

4.1 Design Criteria and Assumptions

The following criteria and assumptions were used for the design of the earthworks at the culvert sites:

- Minimum road width of 10 m (as per Hatch 2013b);
- Maximum embankment slope of 1.5 : 1 (horizontal : vertical) (as per Hatch 2013b);
- Pavement structure of 200 mm of surface material and 300 mm of base material (as per Hatch 2013b). It was not part of the project scope to confirm the pavement design;
- Road design parameters (as presented in Table 2; derived from road geometry calculations and assumptions listed in Table 3) including:
  - Design speed;
  - Stopping sight distance (TAC 1999);
  - Horizontal curves;
    - Minimum radius for rollover model (Douglas 2016)
    - Minimum radius for sliding model (TAC 1999)
  - Vertical Curves; and
    - Crest curve k (TAC 1999)
    - Sag curve k (TAC 1999)

- Pavement structure.
  - Pavement design (from Hatch 2013b)
  - The values for the parameters adopted in each road section design were selected based on fitting the new alignment smoothly to the existing road or an improved alignment and/or minimizing earthworks materials. The design speed was reduced from the standard of 65 km/hr (associated with a posted speed limit of 55 km/hr) if the specific arrangement of the site made it absolutely necessary. Any stretches of road not built to fit the design standard (i.e. not using a 65 km/hr design speed) must be posted with the corresponding reduced speed limit. For any given design speed (used for geometric road design), the posted speed is generally 10 km/hr less (i.e. for a design speed of 50 km/hr, the posted speed limit shall be 40 km/hr). The details of the designs are discussed in Section 5.0 and the site specific design speeds and speed limits are presented in Table 4.

- Culvert pipe design details from Hatch (2014a). It was not part of the project scope to complete any hydrology or environmental studies for the culverts;
- Baffinland will inspect the culverts in the field for opportunity to repair and/or extend the existing culverts rather than replace them; however, for the purposes of the design, full replacement was assumed;
- In recognition of the active use of the Tote Road, the designs can be constructed while maintaining a minimum of one lane of traffic;
- No consideration was given to the proposed rail line or new/ expanded borrow sources as per Baffinland's request. Because the Tote Road will be realigned/ upgraded as part of the rail construction, the rail requirements were not considered;
- Granular materials readily available/ produced on-site (if suitable) were used in the design for backfill and erosion protection. Baffinland currently produces several material types onsite for road maintenance (from approved quarry locations) and construction, which include:
  - Screened material consisting of 32 mm minus material;
  - Jaw run material consisting of 150 mm minus material; and
  - Run of quarry material consisting of various rock sizes.
- No geotechnical data was available and no geotechnical investigations were carried out.

5.0 DESCRIPTION OF DESIGN ELEMENTS

The design elements of the earthworks are described in the following section. The construction drawings are presented in Appendix B and the specifications are presented in Appendix C.

Culvert design details are provided on the construction drawings in Appendix B. The number of culverts, diameter and embedment depth (for fish passage crossings) were taken from the Hatch Tote Road Culvert Data (2014a) as no hydrological, hydraulic, or environmental studies were carried out. The culvert locations, slopes, lengths, and invert elevations were designed to best fit the streambed in the road design models. The actual locations will need to be field fit to match the site conditions.

The typical installation details for the culverts are shown in the drawings in Appendix B. To replace an existing culvert, a trench will need to be excavated or blasted. The culvert trench will be backfilled with granular fill and compacted. Bedding and embedment material will consist of Screened Material (Type 5). Compaction requirements will be performance-based. Backfill on top of the embedment material will consist of Jaw Run Material (Type 8).

The designed roadway alignments best fit the existing roadway alignments wherever possible considering the design criteria described in Section 4.1. Where the addition of the embankment height increase by about 1 m or more, the road embankment was offset to the left or right side of the existing road to maintain traffic during construction. Two realignment designs (for BG04 and CV186) were developed, as requested by Baffinland, to improve the truck safety and efficiency on the roadway. The roadway alignments, cross-sections and layout points are provided in the construction drawings in Appendix B. The design speeds for each site are provided in Table 4.

The roadway embankment fill will consist of Jaw Run Material (Type 8) or Run of Quarry Material (Type 12) depending on the required fill thickness. The pavement will consist of 200 mm of Screened Material (Type 5) as surfacing on 300 mm of Jaw Run (Type 8) base material. Where embankment heights exceed 3 m, safety berms are required. Safety berms are required to be a minimum of 1.05 m high based on 55 inch diameter tires on the B-train haul trucks. The safety berms are to be constructed of Jaw Run Material (Type 8).

6.0 CONSTRUCTION CONSIDERATIONS

A phased construction approach is required to complete this work as it is not feasible to remediate all the sites in 2017. Therefore 14 sites were selected for the initial phase of remediation. Subsequent phases of remediation will be developed in 2017 upon completion of the inspection and based on updated site condition data (as described in Section 7.0).

It is important to note that field fitting of the culverts will be required. A review of the existing individual culvert conditions including structural integrity and installation inverts (i.e. perched, or embedded) will need to be carried out by Baffinland to determine if the existing culvert can be extended and/ or repaired, or if it needs to be replaced.

It is expected that if constructed pre-freshet, some settlement may occur post-freshet and the road surface may need to be topped up with fill and re-graded.

Golder will provide offsite engineering support for the duration of the project.

7.0 INSPECTION REQUIREMENTS

It is a requirement of the Plan that inspection (and maintenance, as required) be carried out. The following inspection schedule, tasks, and group(s) responsible for the inspections are as follows:

- During freshet 2017:
  - Performance of completed construction sites – Baffinland.
- After freshet 2017:
  - Performance of completed construction sites – Baffinland;

- As-built condition of completed construction sites – Geotechnical Engineer accompanied by Baffinland; and
- Condition of sites to be inspected (remainder from Table 1) – Geotechnical Engineer accompanied by Baffinland.

Additionally, regular inspections are to be carried out by Baffinland immediately before, during and after each freshet as well as after any significant precipitation event throughout the mine operating period. Inspections of culvert crossings are required to evaluate performance and identify areas of concern. Example inspection forms are attached in Appendix D for culvert crossings.

8.0 PATH FORWARD

Baffinland will carry out the earthworks with off-site geotechnical engineering support by Golder.

An inspection of the remaining sites will be carried out by an engineer in 2017 to identify remedial requirements and information that are pertinent to the design.

A plan similar to this Plan will be developed to include the remaining sites to be remediated.

STUDY LIMITATIONS

Golder Associates Ltd. (Golder) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warrant, expressed or implied, is made.

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Report Signature Page

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Hatch (Hatch Limited). 2013b. Tote Road Design Criteria. Prepared for Baffinland Iron Mines Corporation. Oakville ON: Hatch Ltd. 15 p. April 2, 2013.

Hatch (Hatch Limited). 2013c. Tote Road Culvert Design Summary. Prepared for Baffinland Iron Mines Corporation. Oakville ON: Hatch Ltd. August 27, 2013.

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TAC (Transportation Association of Canada). 1999. *Geometric design guide for Canadian roads*. Ottawa: TAC.

Worldview (satellite imagery from Worldview 2 and Worldview 3 satellites, by DigitalGlobe). 2012, 2015, & 2016. Provided by Baffinland Iron Mines.

TABLES

Table 1: Remediation sites identified during sedimentation mitigation action plan (prioritized sites for initial phase are identified with an asterisk (*))

Culvert ID	Station	Culvert ID (Cont'd)	Station (Continued)	Culvert ID (Cont'd)	Station (Continued)	Culvert ID (Cont'd)	Station (Continued)
BG01*	099+480	BG28	086+130	CV58	059+780	CV187*	102+860
BG03	095+590	BG29*	084+710	CV059*	059+220	CV212 (A&B)	074+250
BG04*	094+000	BG31	082+020	CV60	058+110	CV212 (C&D)	074+500
BG10	-	BG32*	078+130	CV091 and CV092	042+450	CV213	078+400
BG11	091+430	BG33	077+000	CV094	041+120	CV214 (A)	078+400
BG11-B&C	-	CV001*	094+350	CV099*	037+340	CV214 (B)	078+840
BG14-B	090+520	CV030	077+440	CV104	033+600	CV215	079+530
BG14-C	090+730	CV031	-	CV106*	032+680	CV216*	080+580
BG17	090+030	CV032	-	CV112*	030+800	CV217	079+830
BG19	89+680	CV033	075+640	CV114	029+220	CV222 (prev. labelled CV001-D)	095+080
BG19-B-DS	089+780	CV033-A-US	076+510	CV115	027+200	CV223 A-E (2 sites)	096+980 & 097+070
BG19-C-DS	090+110	CV040	072+070	CV129	015+310	CV224*	097+570
BG25 (A&B)	086+940	CV046 A & B*	065+740	CV165	006+750	CV225	098+840
BG27	086+500	CV049	062+540	CV186*	102+580	-	-

Table 2: Parameters used for roadway design

Parameter	Design Speed (km/hr)			
	65	**50**	**40**	**30**
Stopping sight distance (m)	100	65	45	30
R_{min} for Rollover Model (m)	220	130	85	45
R_{min} for sliding model (m)	175	104	66	37
Crest k (m/%)	20	9	4	2
Sag k (m/%)	21	12	7	4

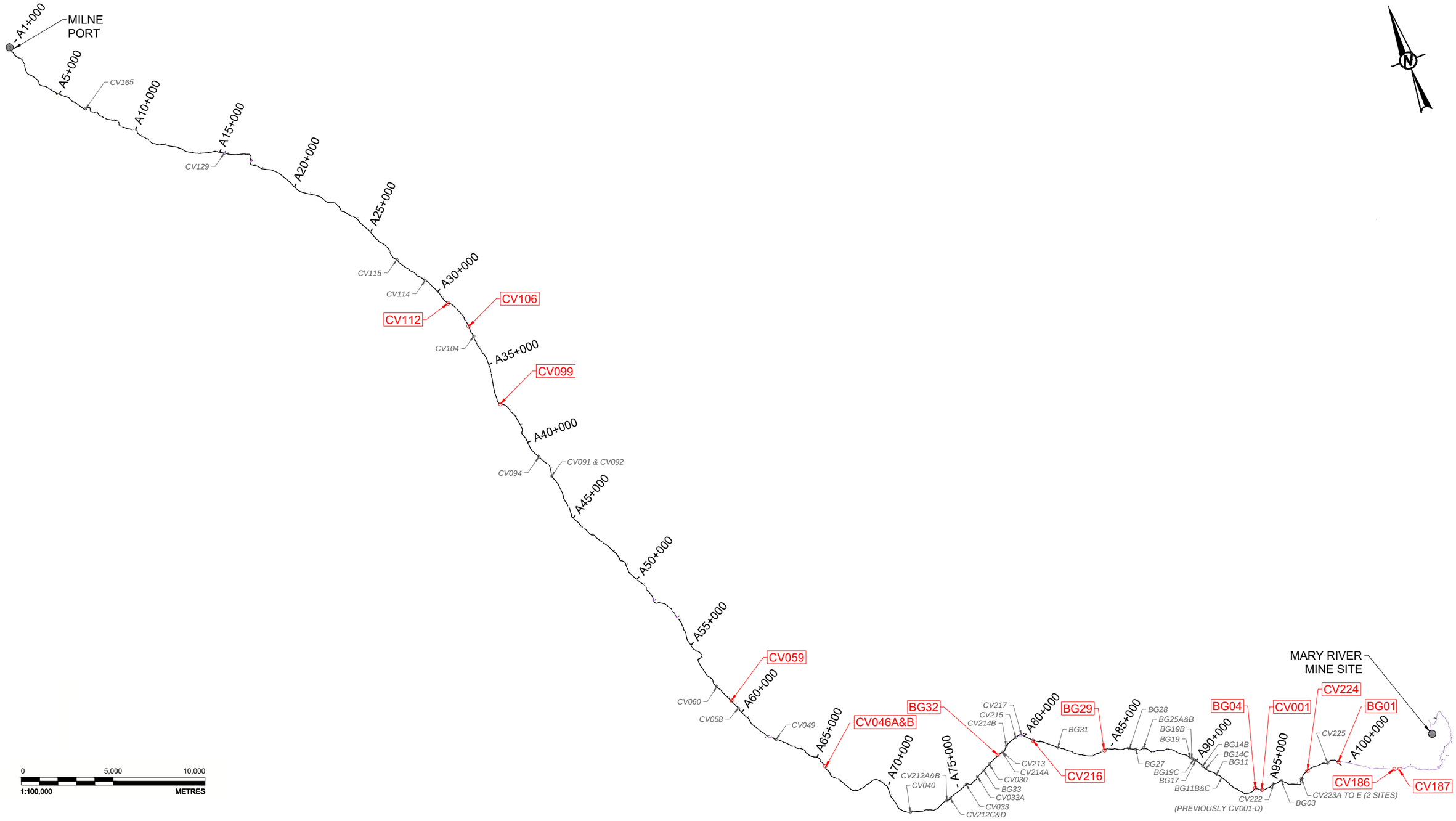
Table 3: Assumptions used for Parameters in Table 2

Assumptions	Value
Stopping sight distance	
Brake reaction time (sec)	2.5
Coefficient of friction	0.33 to 0.40
Horizontal curve radius	
Lateral coefficient of friction	0.15
Superelevation in circular curve, e_{max} (ft/ft)	0.4
Crest curve k	
Driver's eye height, h_1 (m)	1.05
Obstacle height, h_2 (m)	0.3
Sag curve k	
Headlight height, h_3 (m)	0.6
Upward angle of lit area, α (deg)	1

Table 4: Road design speeds

Culvert Site ID	Station	Road Design Speed (km/hr) (for model development)	Posted Speed Limit (km/hr)
BG01	099+480	40	30
BG04	094+000	65	55
BG29	084+710	40	30
BG32	078+130	65	55
CV001	094+350	50	40
CV046 A&B	065+740	50	40
CV059	059+220	65	55
CV099	037+340	65	55
CV106	032+680	50	40
CV112	030+800	50	40
CV186	102+580	50	40
CV187	102+860	50	40
CV216	080+580	50	40
CV224	097+570	50	40

FIGURES



LEGEND

- A100+000 —	TOTE ROAD STATIONING AT CENTRELINE
BG01	PRIORITY CULVERT SITE
CV040	INSPECTION CULVERT SITE

NOTES

1. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
2. CULVERT SITE LOCATIONS, AND AS-BUILT ROAD ALIGNMENT AND STATIONING FROM FILE "ACAD-330 - 359_r1 - 2015-02-20.dwg" PROVIDED BY CLIENT.
3. CULVERT SITE LOCATIONS FOR BG10, CV031, AND CV032 WERE NOT PROVIDED AND THEREFORE ARE NOT SHOWN ON THIS FIGURE.

CLIENT
Baffinland

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-04-03
DESIGNED	CK
PREPARED	SEC
REVIEWED	MJT
APPROVED	MJT

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS EXECUTION PLAN

TITLE
GENERAL ARRANGEMENT PLAN & CULVERT SITES

PROJECT NO.	PHASE	REV.	FIGURE
1667708	2000	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

Path: \\golder.gds\gal\mississauga\skm\Client\Baffinland_Iron_Mines_Corp\Baffin_Island\99_PROJ\1667708_Tote_Road_Earthworks\40_PROD\0016_Tote_Road_Culvert_Sites\ | File Name: 1667708-0016-CM-0001.dwg

APPENDIX A

Prioritization of Sites

A1.0 EARTHWORKS PRIORITIZATION

The objectives of the Tote Road earthworks execution plan were to develop a prioritized list of culvert sites to be remediated in the upcoming construction season(s) and to produce detailed designs for these sites. The process used to rank the sites in order of priority is presented in this Appendix. It should be noted that the list of sites determined from this ranking process is not definitive but an objective means to rate sites based on their relative need of remediation; the rating and subsequent ranking was used as a starting point for prioritization of remediation earthworks in discussion with Baffinland.

The selection of factors chosen to develop the ratings was driven by the availability of recent data, and if the individual factor would be unbiased considering overall project impacts, project history, and/or the interdependency of site works. The process used to determine the “priority sites” is illustrated in Figure A1.

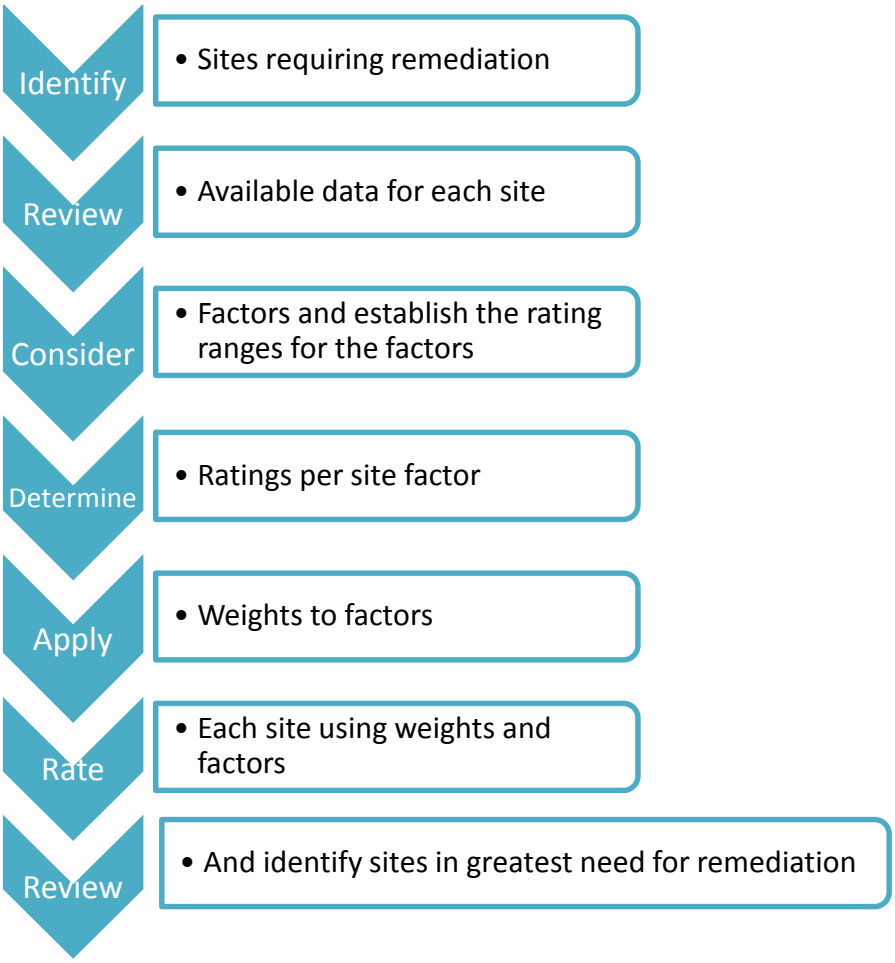


Figure A1: Overview of prioritization process.

A1.1 Identify the Sites

The potential sites that require remediation were identified previously during the development of the sedimentation mitigation action plan (Golder 2016) as well as through input from Baffinland’s routine inspections. As part of the sedimentation mitigation action plan (Golder 2016) a Golder engineer carried out a site visit and drove the Tote

Road with Baffinland staff, collaboratively identifying a preliminary list of sites needing remediation. This list provided the starting point for the prioritization process.

Baffinland later added sites with potential fish passage issues, resulting in 55 sites identified as potential sites for remediation. This complete list of culvert sites is provided in Table 1 of the report.

A1.2 Consider Factors and Rating Ranges

The factors used to rate the sites and the associated ratings are listed in Table A1. The factors and ratings were agreed upon with Baffinland during the prioritization process.

Table A1: Factors and Ratings

Factor	Importance of Factor in Decision Matrix	Rating	Definition
Fish passage status	Location that impacts a fish-bearing stream – the likelihood of fish not being able to pass through is a high priority.	3	Yes
		1	Potential
		0	Not applicable
Fish bearing status	Location that impacts a fish-bearing stream – a high priority for environmental reasons.	3	Yes
		1	Potential/ Marginal
		0	No
Observed Sedimentation	Area where sedimentation problems have been observed – the severity of the sedimentation problems has a high priority.	3	High
		1	Low
		0	None
Culvert Integrity	Area where drainage is blocked – a high priority for sedimentation reasons.	3	Full blockage
		1	Minor blockage
		0	None
Top Width of Road	Area where the road width is narrow – a high priority for safety reasons.	3	≤ 5 m
		2	5< x ≤ 7 m
		1	7< x ≤ 9 m
		0	>9 m (9.2 Hatch design, our values rounded to nearest whole number)

Factor	Importance of Factor in Decision Matrix	Rating	Definition
Embankment Height	Area where the embankment height is low – a priority for culvert structural integrity and thermal cover reasons.	3	x < 2 m for low coverage
		2	2 ≤ x <3 m
		1	3 ≤ x < 4
		0	≥ 4 m
Drainage Basin	Area with a large drainage basin – a priority due to the potential for sedimentation.	3	x ≥ 125 km^2
		2	25 ≤ x < 125 km^2
		1	2 ≤ x < 25 km^2
		0	0 ≤ x < 2 km^2
Embankment Slopes	Area with steep side slopes – a priority due to embankment instability & is a possible source of sedimentation.	3	>45° (1H:1V)
		2	34 < x ≤ 45°
		0	≤ 34° (Hatch Design 1.5H:1V)
Back Slope	Area with steep back slopes – could be problematic due to slope instability, contributing to sedimentation	1	2H:1V Slope, x ≥ 20 °
		0	x < 20 °

A1.3 Determine the Ratings per Site Factor

The site rating factors were chosen through a data review at each site by means of a desktop study. No field work was conducted to support this scope. Based on the information reviewed a rating was applied to each factor, per site, using the factors and ratings in Table A1. Then a weight was applied to each factor to determine the relative importance of each factor. The weighted factors were summed to result in a composite site rating. This is described further in Section A1.5.

Baffinland and Golder staffs collaborated in the review of the individual ratings of each site. During the process, Baffinland staff provided additional information on several sites where background information was insufficient for the rating. Data from several sources (Table A2) was reviewed to determine the individual site ratings. A description of the various sources and their use in the factor and rating development, is provided in the following subsections.

Table A2: Sources of Data

Factor	Type of Data Source
Fish Passage Status	Photographs
Fish Bearing Status	Typical Culvert Details (Hatch 2013a)
Observed Sedimentation	Photographs, DEM, and satellite imagery
Culvert Integrity	Photographs
Top Width of Road	DEM and satellite imagery
Embankment Height	DEM

Factor	Type of Data Source
Drainage Basin Area	DFO Culvert Package (Baffinland 2013)
Embankment Slopes (angle)	DEM
Back Slope (angle of back slope adjacent to site)	DEM

A1.3.1 Digital Elevation Model (DEM)

A digital elevation model (DEM) was generated using point cloud information provided by PhotoSat (2016). The DEM was a triangular irregular network (TIN) created by connecting proximal points in the point cloud to create a three-dimensional (3D) surface. The 3D surface was used for geometrical measurements at the culvert crossing such as embankment height, top width of road, embankment slope, back slope, and culvert cover.

A1.3.2 Satellite Imagery

Satellite imagery (Worldview 2015 & 2016) was used to identify crossings, adjacent culverts, and changes in roadway alignments (over time). In some instances the satellite imagery was used to identify sedimentation and/or ponding at crossings.

A1.3.3 Photographs

Geotagged photographs obtained by Golder (taken during the 2016 site visit) provided information on the existing structural condition of culverts and qualitative information on the cover over the culverts, and sedimentation at the drainage outlet. These images were spatially placed in the 3D model, and were used during the rating of individual sites where available.

A1.3.4 Reports

The drainage basin area and the fish bearing status of the culverts was obtained from Baffinland (2013) and Hatch (2013a), respectively. No hydrology or environmental studies were carried out as part of this work.

A1.3.5 Limitations

Where the information was insufficient for a site rating factor, an average rating was applied.

A1.4 Apply Weight to factors

A weight of 1 or 3 was applied to each factor, for low and high contribution to the potential for sedimentation, respectively.

The weights for each factor are provided in Table A3.

Table A3: Weight of Factors

Factor	Weight
Fish Passage Status	3
Fish Bearing Status	3
Observed Sedimentation	3

Factor	Weight
Culvert Integrity	3
Top Width of Road	3
Embankment Height	1
Drainage Basin Area	3
Embankment Slopes (angle)	1
Back Slope (angle of back slope adjacent to site)	1

A1.5 Rating the Individual Sites

The sites were rated based on the factors and weights, Equation A1:

$$Site\ Rating = \frac{\sum_{i=1}^{9} R_i w_i}{\sum_{i=1}^{9} w_i} \qquad \text{Eq A1}$$

where:

R = rating from 0 to 3 for the factor

w = weight of 1 or 3 for the factor

i = counter for the factor (there are 9 factors)

The site rating was then converted to a percent, Equation A2:

$$Rating\ Percent = \frac{Site\ Rating}{Maximum\ Rating} * 100 \qquad \text{Eq A2}$$

where:

Maximum Rating = 3.

Using the site rating, the sites were ranked in decreasing order where the highest rated sites had the highest ranking, indicating the highest potential for negative impact and the highest need for rehabilitation.

The objective of the prioritization process was to objectively rate the sites to obtain a ranked list of potential sites to be remediated in the upcoming construction season(s). Upon completion of the ranking, the sites were reviewed and sites that would be remediated in the upcoming construction season(s) were carried forward into detailed design.

A1.6 Review Sites and Identify those for Remediation

Once the ranked site list was established, Baffinland reviewed and revised the order of the priority sites based on their detailed knowledge of existing site conditions. Although the number of sites to be remediated in the 2017 construction season is unknown, Baffinland selected 19 sites as priority sites and requested a detailed design for each. Golder individually reviewed the 19 sites, and found only 14 of the 19 sites had sufficient information for detailed design.

The remaining sites will be inspected in 2017 to develop future plans for remediation. Table A4 lists the sites considered in the earthworks execution plan.

Table A4: Tote Road Earthwork Sites

Priority Sites	Remaining Sites	Remaining Sites (cont.)
Sites based on ranking	*Sites removed from Priority Sites list due to insufficient information for detailed design*	BG25 (A&B)
BG01	BG17	BG27
BG04	CV040	BG28
BG32	CV165	BG33
CV001	CV223 (A-C)	CV030
CV059	CV223 (D&E)	CV031
CV106	*Sites removed from priority list based on Baffinland's detailed knowledge of the site.*	CV032
CV112	BG11	CV033
CV216	BG31	CV033-A
CV224	CV001 D	CV58
Unranked sites added to list based on Baffinland's knowledge of the site	CV049	CV60
BG29	CV094	CV091 and CV092
CV046 A&B	CV217	CV104
CV099	*Lower ranked sites not considered for this phase*	CV114
CV186	BG03	CV115
CV187	BG11 (B&C)	CV129
	BG14-B	CV212 (C&D)
	BG14-C	CV213CV214 (A)
	BG19	CV214 (B)
	BG19-B	CV215
	BG19-C	CV222 (previously CV001-D)
		CV225

APPENDIX B

Construction Drawings

Reduced Size
NOT TO SCALE

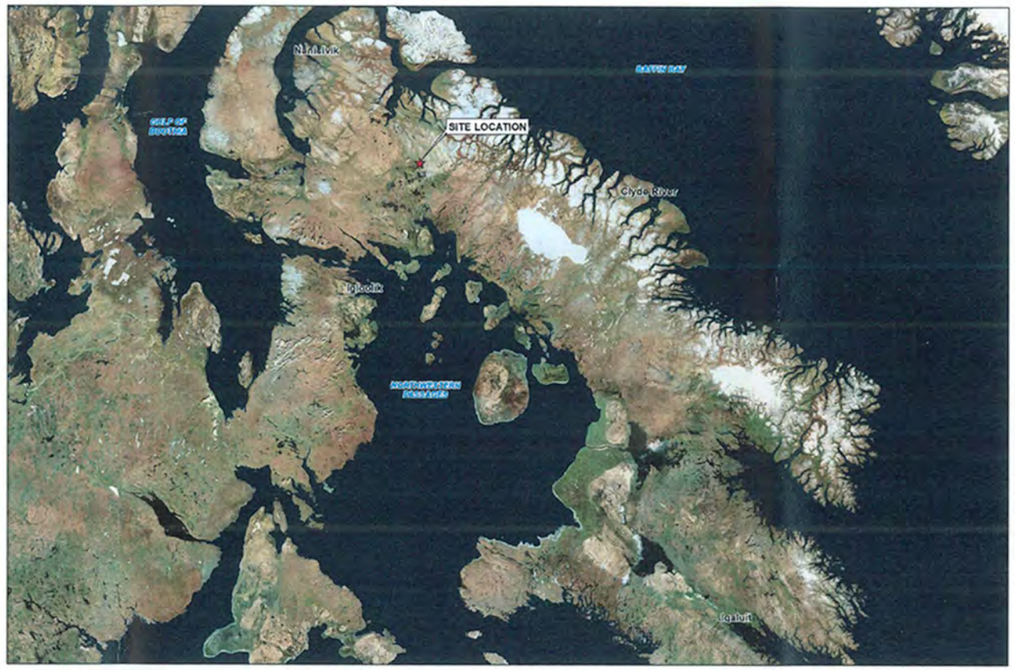
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
BG01

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - BG01	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - BG01	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG01	2
004	ROAD PLAN, PROFILE AND SECTIONS - BG01	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



KEY PLAN
NOT TO SCALE

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-02	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A.
LICENCE
2017-04-03
NUNAVUT

Baffinland
CONSULTANT
Golder Associates

MISSISSAUGA OFFICE
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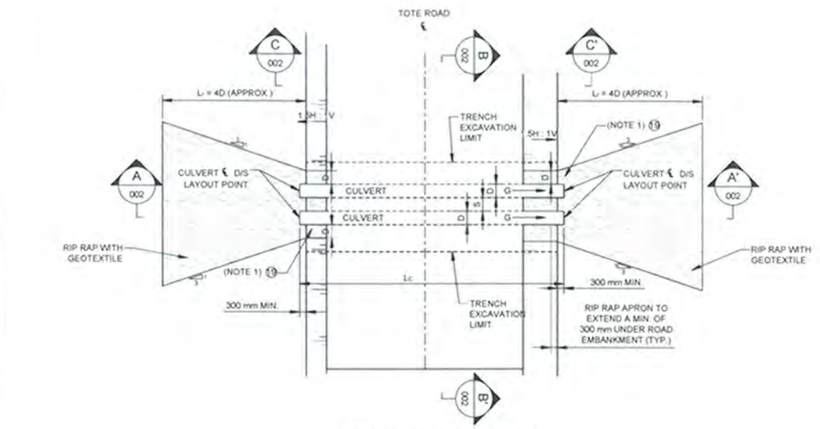
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

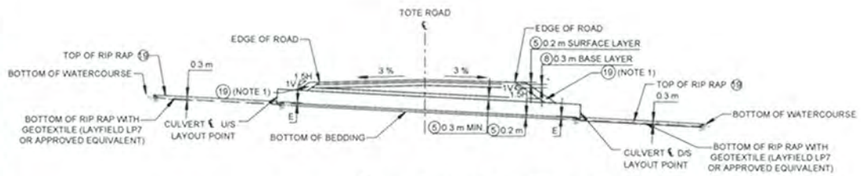
TITLE
TITLE SHEET - BG01

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

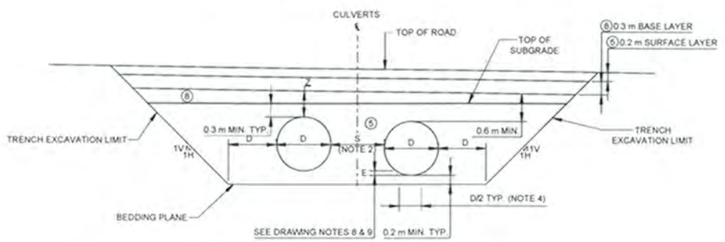
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A / 002) PIPE CROSSING TYPICAL PROFILE



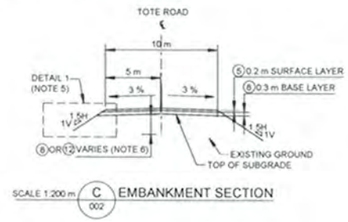
SCALE 1:50 m (B / 002) PIPE CROSSING TYPICAL SECTION

LEGEND

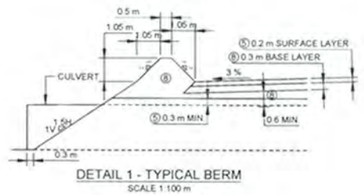
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED; FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C / 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS, CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG.002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG.001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-02	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 2017-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - BG01

PROJECT NO	PHASE	REV	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS1

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (G) (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+159.0	YES	1200	18		120	48	5.4	558004.8	7914938.4	160.3	159.3	2	95	N	Y	4.8
0+172.7	YES	1200	18	3.73	120	48	5.5	558015.4	7914929.8	160.3	159.3	2	113	N	Y	4.8
0+175.4	YES	1200	18		120	48	5.7	558017.4	7914928.1	160.2	159.2	2	113	N	Y	4.8

*CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 11 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT BG01

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **RAISE ROAD EMBANKMENT TO REDUCE ROAD APPROACH GRADIENTS, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL) AND THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
2. CONSTRUCT A NEW ROAD EMBANKMENT TO THE LEFT SIDE OF THE EXISTING EMBANKMENT TO FACILITATE THE MAINTENANCE OF TRAFFIC DURING CONSTRUCTION OF THE NEW EMBANKMENT.
3. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
4. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
5. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
6. THE EXISTING CULVERT MAY BE PERCHED. REINSTALL CULVERTS TO DESIGN. THE CULVERT END(S) MAY BE DAMAGED. REPLACE CULVERTS IF REQUIRED.
7. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	557877.3	7915029.5	171.7	-0.2	5.1	5.2	-3.5
0+020.0	557889.3	7915013.5	171	-0.3	6.3	16.5	-3.5
0+024.4	557892	7915010	170.8	-0.4	6.4	14.3	-3.5
0+040.0	557902.2	7914998.3	170.3	-0.5	6.6	15.0	-3.5
0+060.0	557917.9	7914985.8	169.6	-0.6	7.9	7.2	-3.5
0+066.5	557923.5	7914982.5	169.3	-0.6	7.0	7.2	-3.5
0+080.0	557935.3	7914975.9	168.9	-0.8	6.8	7.6	
0+100.0	557952.7	7914966.2	168	-1.2	6.6	8.7	-4.1
0+120.0	557970.5	7914957	167.2	-2.5	6.3	14.1	-4.1
0+127.1	557976.7	7914953.7	166.9	-2.6	7.0	14.2	-3.2
0+140.0	557988.2	7914947.8	166.5	-1.7	10.8	14.1	-1.7
0+148.0	557995.3	7914944.2	166.4	-2.9	13.1	13.9	-0.4
0+159.0	558004.8	7914938.5	166.3	-6.2	17.8	9.9	0.5
0+160.0	558005.6	7914937.9	166.3	-6.2	18.9	9.9	1.2
0+168.8	558012.5	7914932.4	166.4	-6.2	19.4	9.9	2.1
0+172.7	558015.4	7914929.9	166.5	-5.9	19.7	9.8	2.6
0+175.4	558017.4	7914928.1	166.6	-5.4	20.0	9.6	3.1
0+180.0	558020.9	7914925	166.7	-5.3	20.1	9.5	4.9
0+200.0	558035.9	7914911.8	167.7	-3.7	21.5	8.3	7.7
0+220.0	558050.9	7914898.6	169.3	-1.2	24.3	7.3	9.6
0+226.2	558055.6	7914894.5	169.9	-1	25.3	7.0	10.0
0+229.4	558057.9	7914892.4	170.2	-1	25.6	7.0	8.7
0+240.0	558065.9	7914885.4	171.1	-0.3	18.9	6.4	6.9
0+244.0	558069	7914882.7	171.4	-0.3	15.1	6.4	4.4
0+260.0	558081.5	7914872.8	172.1	-0.3	5.8	6.3	1.3
0+268.3	558088.4	7914868.3	172.2	-0.2	5.8	6.3	0.3
0+280.0	558098.5	7914862.4	172.2	-0.2	6.0	6.2	0.3
0+287.2	558105	7914859.2	172.2	-0.2	6.1	6.3	0.3
0+300.0	558116.6	7914853.9	172.3	-0.3	6.3	6.1	0.3
0+320.0	558134.7	7914845.4	172.3	-0.3	5.5	5.3	0.3
0+325.2	558139.4	7914843.3	172.4	-0.4	5.6	5.2	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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0	2017-03-09	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-02	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-04-25
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

Baffinland
CONSULTANT

Golder Associates

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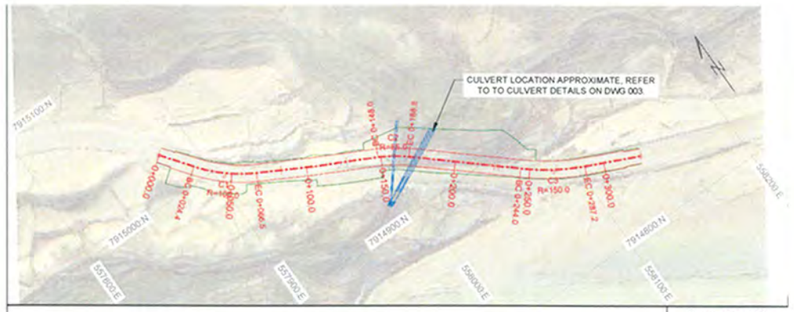
CANADA
905-567-4444
www.golder.com

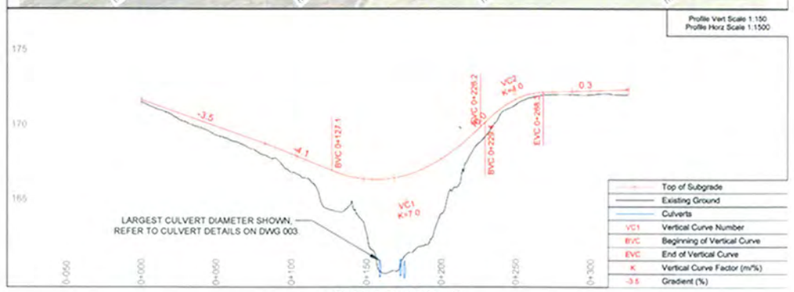
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG01

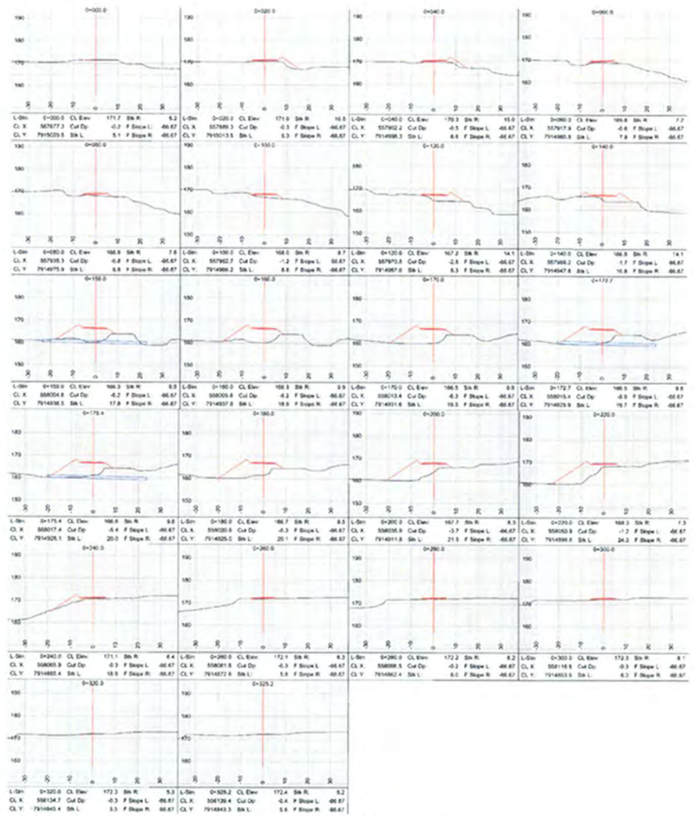
PROJECT NO.	PHASE	REV		DRAWING
1667708	3000	2	3 of 4	003

Reduced Size
NOT TO SCALE





PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - BG01

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
BG04

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - BG04	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - BG04	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG04	2
004	ROAD PLAN, PROFILE AND SECTIONS - BG04	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0

KEY PLAN
NOT TO SCALE

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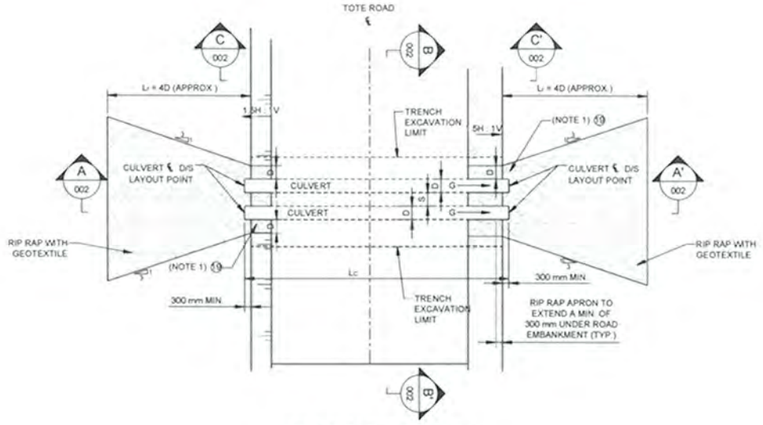
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

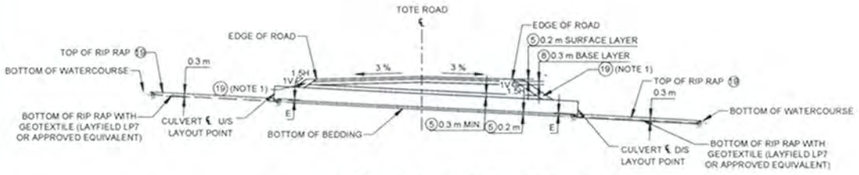
TITLE
TITLE SHEET - BG04

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

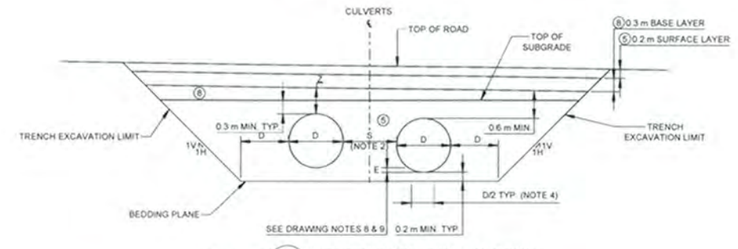
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A, 002) PIPE CROSSING TYPICAL PROFILE



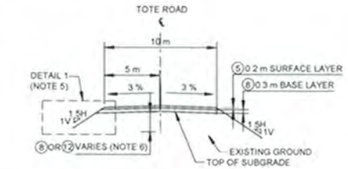
SCALE 1:50 m (B, 002) PIPE CROSSING TYPICAL SECTION

LEGEND

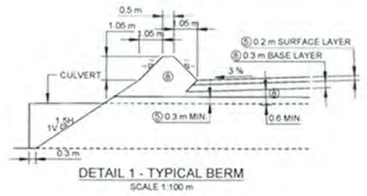
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED; FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C, 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS, CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT, A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS. USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG.001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

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PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT: Baffinland

CONSULTANT: Golder Associates

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CANADA
905-567-4444
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - BG04

PROJECT NO.	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†																
STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+160.2	YES	1200	15	0.91		30.5	1.9	553254.3	7915076.7	164	163.7	1	76	N	N	
0+164.2	YES	1200	15	0.71	120	30.5	1.8	553258.3	7915076.3	164.1	163.8	1	76	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT BG04

AS INDICATED IN THE GENERAL NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE, BUT IS NOT ALL-INCLUSIVE.

1. CONSTRUCT THE ROAD ALONG THE REALIGNMENT (SEE DWG.004).
2. REMOVE THE EXISTING ROAD EMBANKMENT WITHIN THE LIMITS OF STREAMBED TO REINSTATE THE STREAMBED TO THE APPROVAL OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
3. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
4. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 M ABOVE EXISTING GROUND SURFACE (SEE TYPICAL SECTION ON DWG. 002).
5. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
6. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS							
STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	553102.7	7915036.6	168.4	-0.1	5.4	5	0.1
0+016.2	553116.5	7915045.1	168.5	-0.1	6.3	5.9	0.1
0+017.7	553117.8	7915045.9	168.5	-0.1	6.3	5.9	0
0+020.0	553119.7	7915047.1	168.5	-0.1	6.3	5.8	-0.3
0+029.0	553127.6	7915051.6	168.4	-0.2	6.5	5.8	-0.5
0+040.0	553137.4	7915056.5	168.4	-0.2	6.4	5.9	-0.5
0+055.3	553151.4	7915062.6	168.3	-0.1	6.2	5.8	-0.6
0+060.0	553155.8	7915064.3	168.3	-0.1	6.1	5.9	-1.2
0+080.0	553174.8	7915070.4	168	-0.2	6	5.9	-1.8
0+083.2	553177.9	7915071.2	168	-0.1	6	5.9	-1.9
0+100.0	553194.4	7915074.7	167.7	-0.2	6.1	5.9	-1.9
0+117.1	553211.3	7915077	167.3	-0.1	6.1	5.8	-1.8
0+120.0	553214.2	7915077.2	167.3	-0.1	6.1	5.8	-1.3
0+140.0	553234.2	7915077.9	167	-0.9	7.4	6.7	-0.3
0+160.0	553254.1	7915076.8	167	-3	14.8	14.2	0.2
0+160.2	553254.3	7915076.8	167	-3	14.8	14.2	0.3
0+164.2	553258.3	7915076.3	167	-3	14.8	14.3	0.7
0+179.6	553273.5	7915074	167.1	-0.5	11.1	11.2	1.1
0+180.0	553273.9	7915073.9	167.1	-0.5	11.1	11.1	1.1
0+192.6	553286.2	7915071.1	167.2	-0.2	6.3	5.8	0.9
0+200.0	553293.3	7915069.2	167.3	-0.3	6.4	6.2	0.7
0+203.8	553297	7915068.1	167.3	-0.4	6.4	6.2	0.6
0+220.0	553312.3	7915062.8	167.4	-0.2	6.1	6	
0+240.0	553330.5	7915054.6	167.5	-0.1	6.1	5.9	0.4
0+260.0	553348	7915044.9	167.6	-0.1	6.1	5.9	0.4
0+274.4	553360	7915036.9	167.7	-0.1	6	5.9	0.4
0+280.0	553364.5	7915033.6	167.7	-0.1	6	5.8	0.4
0+289.9	553372.6	7915027.8	167.7	-0.1	5.2	5.1	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG04

PROJECT NO	PHASE	REV	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
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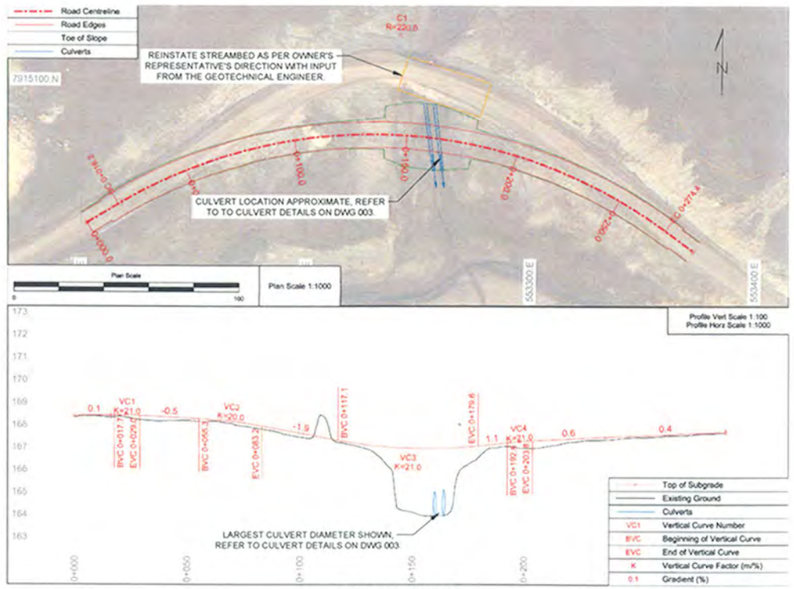
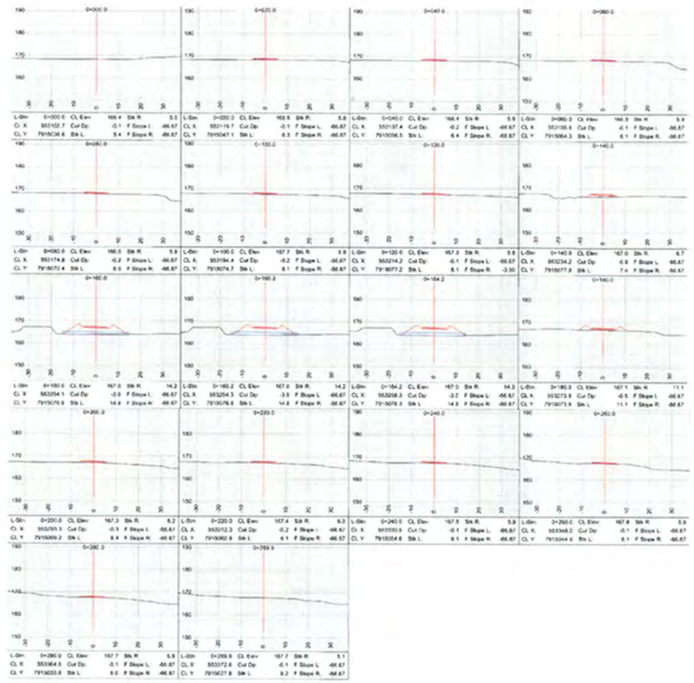


PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
B	2017-02-22	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD
A	2017-02-10	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 13-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CONSULTANT
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CLIENT
Baffinland

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6925 CENTURY AVENUE, SUITE 100
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - BG04

PROJECT NO	PHASE	REV		DRAWING
1667708	3000	2	4 of 4	004

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
BG29

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - BG29	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - BG29	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG29	2
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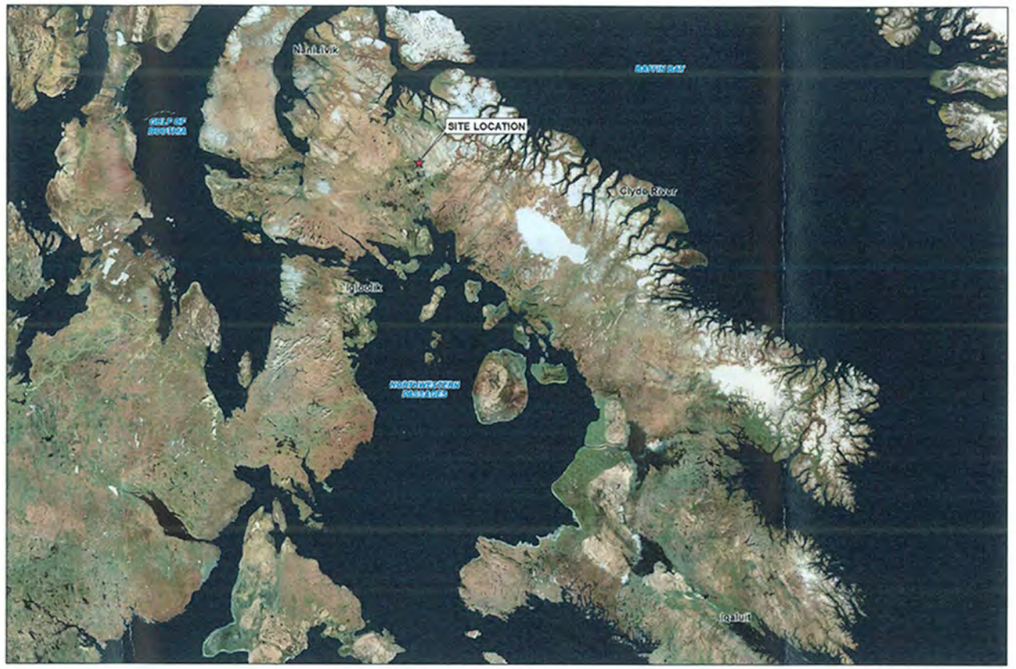
SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



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PROJECT NO.	PHASE	REV.	1 of 4	DRAWING
1667708	3000	2		001

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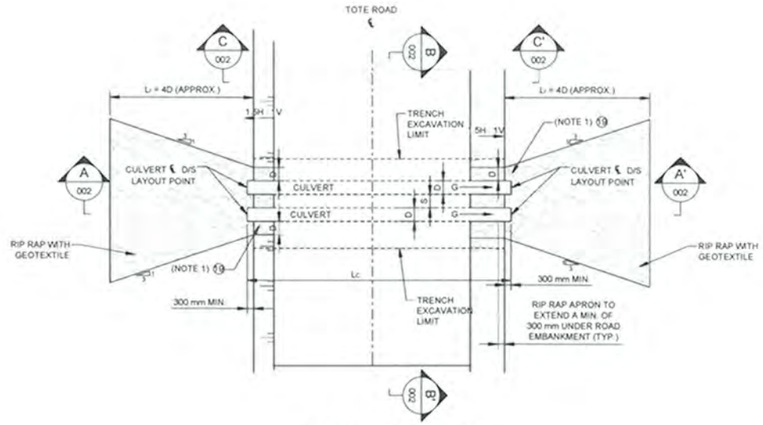
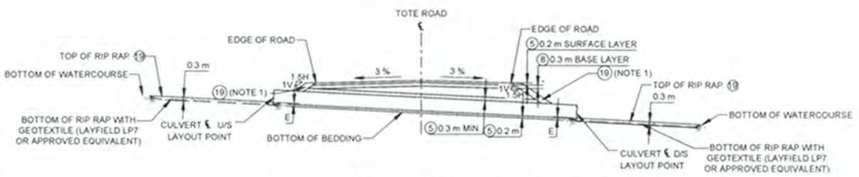


PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A / 002) PIPE CROSSING TYPICAL PROFILE

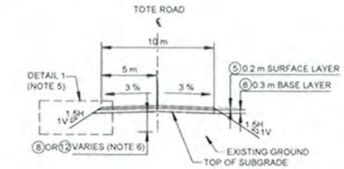
SCALE 1:50 m (B / 002) PIPE CROSSING TYPICAL SECTION

LEGEND

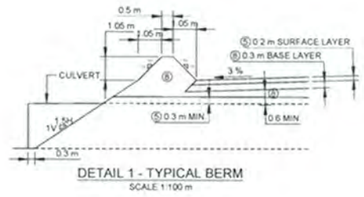
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C / 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG.002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG.001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

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PROJECT
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TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - BG29

PROJECT NO	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

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CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+061.5	POTENTIAL	1000	15	0.31		42.5	4.3	546216.3	7919878.3	152.8	152.0	2	63	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT BG29

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **CUT THE EXISTING ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
2. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE CULVERT PIPE COVER, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL) AND THE ROAD RUNNING SURFACE A MINIMUM WIDTH OF 10 m.**
3. CONSTRUCT THE NEW ROAD EMBANKMENT TO THE LEFT SIDE OF THE EXISTING EMBANKMENT TO FACILITATE THE MAINTENANCE OF TRAFFIC DURING CONSTRUCTION OF THE NEW EMBANKMENT.
4. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002)
5. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
6. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
7. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	546142.8	7919848.1	159.9	-0.1	5.0	5.2	0.7
0+000.0	546142.9	7919848.1	159.9	-0.1	5.0	5.2	
0+020.0	546162.7	7919849.9	160	-0.1	5.9	6.2	0.0
0+025.5	546168.1	7919851.1	160	-0.2	5.9	6.2	-1.8
0+040.0	546181.8	7919855.6	159.8	-0.5	6.5	6.7	-4.5
0+047.1	546188.3	7919858.5	159.4	-0.5	6.3	6.8	-5.4
0+060.0	546199.4	7919865	158.7	-0.5	20.2	6.5	-5.4
0+070.0	546207.4	7919871	158.2	-4.8	18.9	8.3	-5.4
0+070.7	546208	7919871.4	158.2	-5	18.9	8.4	-4.7
0+080.0	546215.1	7919877.4	157.7	-5.3	17.8	8.7	-4.0
0+081.5	546216.3	7919878.3	157.7	-5.3	17.4	8.7	-3.8
0+082.8	546217.3	7919879.2	157.6	-5.3	16.9	8.8	-2.4
0+100.0	546231.2	7919889.3	157.2	-1.9	11.6	8.4	-1.0
0+102.6	546233.4	7919890.8	157.2	-1.7	7.7	8.2	0.4
0+120.0	546248.1	7919900	157.2	-1.2	6.8	7.6	3.1
0+140.0	546265.1	7919910.6	157.9	-0.7	6.7	6.2	5.0
0+146.4	546270.5	7919914	158.2	-0.6	6.4	5.9	5.5
0+147.2	546271.1	7919914.4	158.2	-0.5	6.1	5.9	5.5
0+151.2	546274.7	7919916.4	158.4	-0.3	5.8	6.0	4.9
0+160.0	546282.5	7919920.2	158.9	0	5.8	5.9	2.9
0+180.0	546301.7	7919925.8	159.4	-0.1	6.0	5.9	1.2
0+182.9	546304.5	7919926.2	159.5	-0.1	6.0	5.9	1.0
0+192.0	546313.7	7919926.9	159.6	-0.1	5.9	5.9	1.1
0+200.0	546321.6	7919926.7	159.7	-0.1	6.1	5.9	1.4
0+210.5	546332.1	7919925.3	159.8	-0.2	6.3	5.9	1.5
0+218.1	546339.4	7919923.5	159.9	-0.2	6.4	5.8	1.5
0+220.0	546341.2	7919922.9	160	-0.2	6.4	5.8	1.2
0+230.7	546351.2	7919919.1	160.1	-0.1	6.0	5.8	0.9
0+233.0	546353.3	7919918.1	160.1	-0.1	5.3	5.0	0.8
0+240.0	546359.7	7919915.2	160.2	-0.2	5.3	5.1	0.8
0+242.5	546361.9	7919914.1	160.2	-0.2	5.3	5.1	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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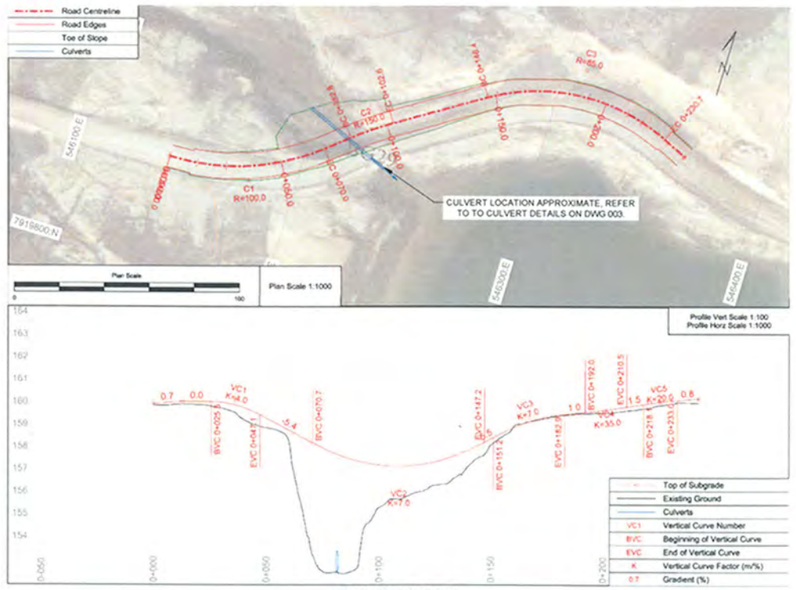
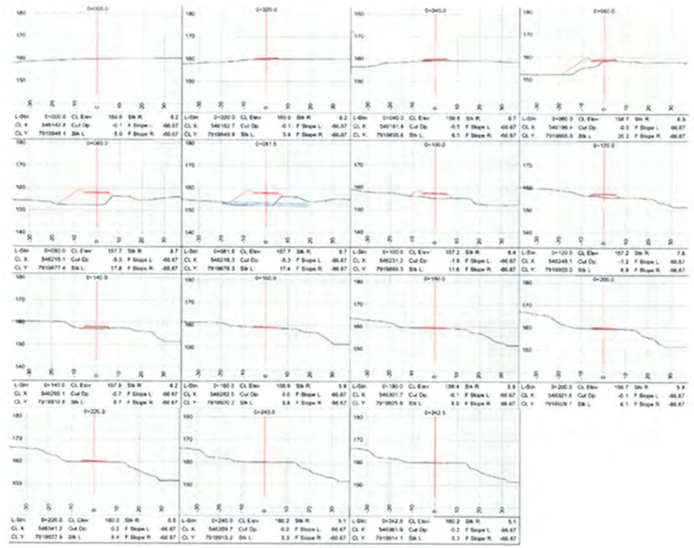


PLAN AND PROFILE



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2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

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Signature
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PERMIT NUMBER: P 049
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REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
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CONSULTANT
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MISSISSAUGA, ON
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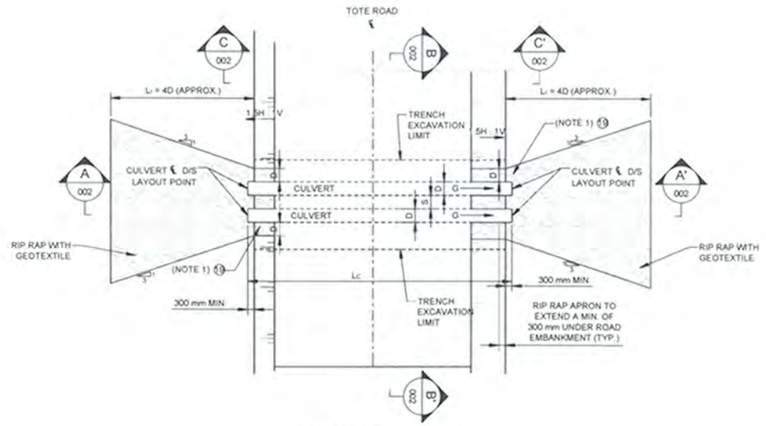
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

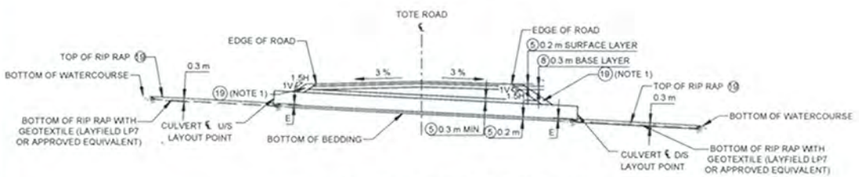
TITLE
TITLE SHEET - BG32

PROJECT NO.	PHASE	REV.	1 of 4	DRAWING
1667708	3000	2		001

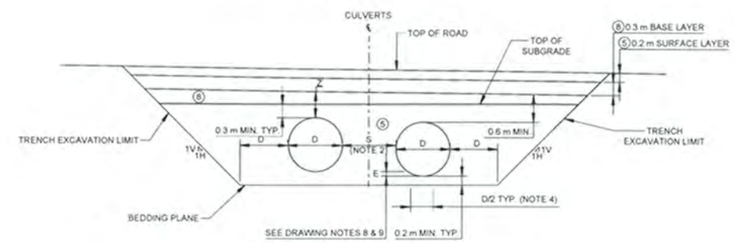
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A / 002) PIPE CROSSING TYPICAL PROFILE



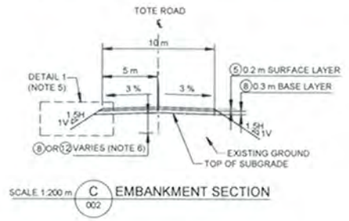
SCALE 1:50 m (B / 002) PIPE CROSSING TYPICAL SECTION

LEGEND

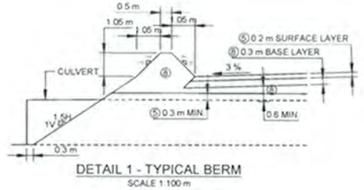
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,L_T, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003) FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C / 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG.002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG.001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

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Date 19-04-23
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - BG32

PROJECT NO.	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+097.5	YES	2000	17.5	0.37		30	0.9	540720.1	7921602.8	143.3	142.7	2	58	N	N	
0+101.5	YES	2000	17.5	0.63		30	0.7	540723.8	7921604.4	143.5	142.9	2	58	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT BG32

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **CUT THE EXISTING ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
4. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
5. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
6. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
7. THE EXISTING CULVERT MAY BE PERCHED. REINSTALL CULVERTS TO DESIGN.
8. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	540633.1	7921558.9	146.4	-0.1	5.2	5.1	-0.8
0+020.0	540650.9	7921567.9	146.2	-0.2	6.7	5.8	
0+040.0	540668.8	7921577	146.1	-0.6	7.1	6.3	-0.4
0+060.0	540686.6	7921586	146	-0.6	8.2	6.5	-0.4
0+080.0	540704.5	7921595	145.9	-0.5	13.1	6.1	-0.4
0+087.5	540711.2	7921598.4	145.9	-0.4	14.0	6.1	-0.4
0+097.5	540720.1	7921602.8	145.9	-0.3	14.1	5.8	-0.4
0+100.0	540722.4	7921603.8	145.8	-0.2	13.9	5.9	-0.4
0+101.5	540723.8	7921604.4	145.8	-0.2	13.8	5.9	
0+120.0	540740.9	7921611.5	145.8	-0.2	9.2	5.9	-0.2
0+132.5	540752.7	7921615.7	145.8	-0.4	8.7	6.0	-0.2
0+140.0	540759.8	7921618	145.8	-0.6	8.4	6.5	-0.2
0+160.0	540778.8	7921624.3	145.7	-0.6	7.2	6.4	-0.2
0+180.0	540797.8	7921630.5	145.7	-0.5	6.5	6.4	
0+200.0	540816.8	7921636.8	145.7	-0.3	6.1	6.3	0.4
0+220.0	540835.9	7921642.8	145.8	-0.3	5.9	6.2	0.4
0+231.9	540847.3	7921646.3	145.9	-0.2	5.0	5.2	

* NEGATIVE CUT DEPTH DENOTES FILL.
** MEASURED ON GROUND SURFACE

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PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 19-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
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NWT/NU

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG32

PROJECT NO.	PHASE	REV		DRAWING
1667708	3000	2	3 of 4	003

Reduced Size
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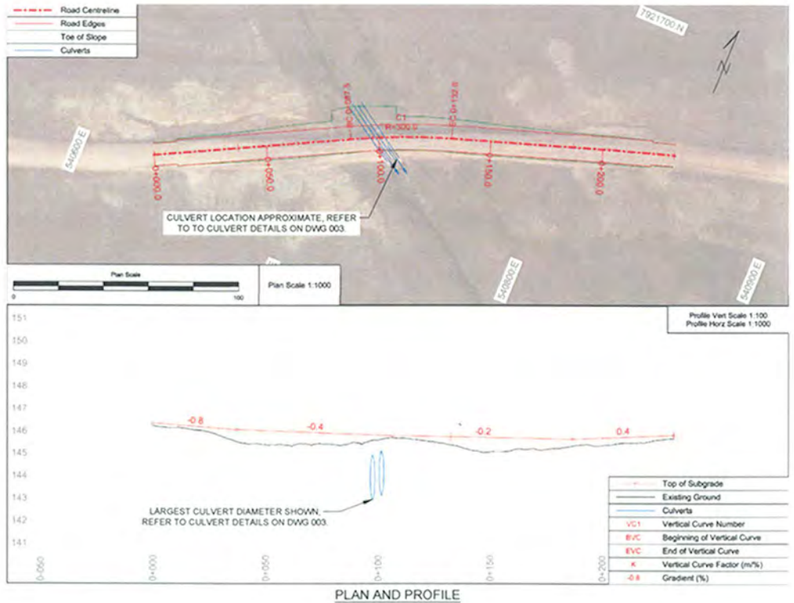
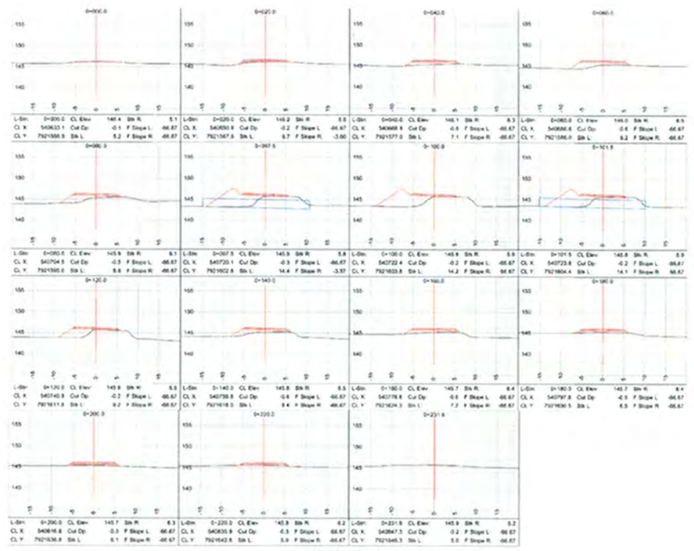


PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

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GOLDER ASSOCIATES LTD.
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Date 17-04-03
PERMIT NUMBER: P 549
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LICENSEE
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - BG32

PROJECT NO	PHASE	REV		DRAWING
1667708	3000	2	4 of 4	004

Reduced Size
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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV001

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV001	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV001	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV001	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV001	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0

KEY PLAN
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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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LICENSEE
2017-03-03
NWT/NU

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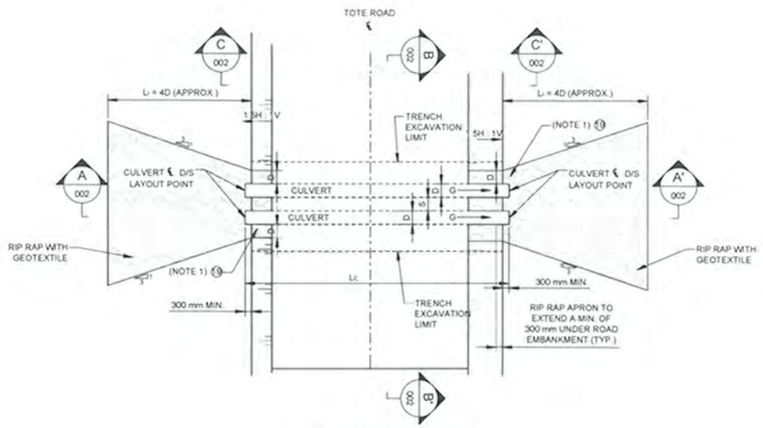
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

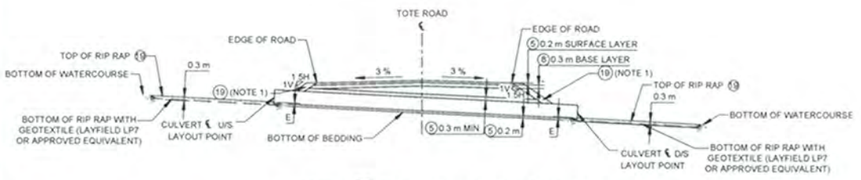
TITLE
TITLE SHEET - CV001

PROJECT NO.	PHASE	REV.	1 of 4	DRAWING
1667708	3000	2		001

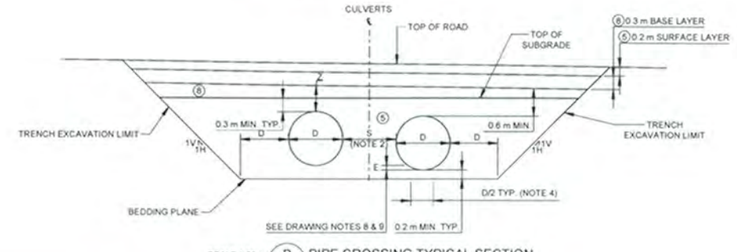
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A 002) PIPE CROSSING TYPICAL PROFILE



SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

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(8)	JAW RUN	(19)	EROSION PROTECTION

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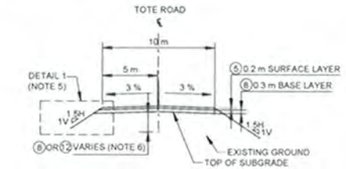
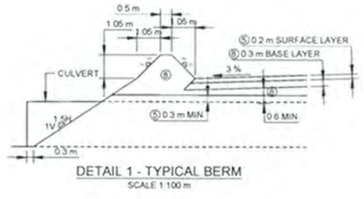


SCALE 1:200 m (C 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG. 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG. 001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NUNAVUT

Baffinland
CONSULTANT

Golder Associates

MISSISSAUGA OFFICE:
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV001

PROJECT NO	PHASE	REV	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+087.4	POTENTIAL	1000	15	1.16	100	18.5	0.8	553539.1	7914904.2	167.3	167.1	1	115	N	N	
0+089.9	POTENTIAL	500	15	1.61	50	18.5	1.4	553542.4	7914902.5	167.3	167.1	1	115	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV001

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE COVER. WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
3. EXTEND OR REPLACE CULVERTS (REFER TO GENERAL CONSTRUCTION NOTE 11). IF EXTENDING, CLEAR SEDIMENT FROM EXISTING CULVERTS.
4. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
5. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	553469.8	7914955.5	167.7	-0.1	5.2	5.1	-0.1
0+013.5	553480.4	7914947.1	167.7	-0.2	6.0	7.3	0.2
0+020.0	553485.5	7914943.1	167.7	-0.3	6.0	6.7	1.3
0+040.0	553501.8	7914931.4	168	-0.6	6.6	6.8	2.4
0+046.8	553507.3	7914927.4	168.1	-0.8	6.8	7.2	2.7
0+060.0	553518	7914919.7	168.5	-1.2	7.4	7.7	2.7
0+069.1	553525.3	7914914.4	168.7	-1.3	7.8	7.9	2.1
0+079.6	553533.8	7914908.3	169	-1.1	8.2	8.2	1.5
0+080.0	553534.2	7914908	169	-1.1	8.2	8.2	1.1
0+085.9	553539.1	7914904.7	169	-0.9	8.2	7.6	0.7
0+087.4	553540.3	7914903.9	169	-0.9	8.1	7.6	0.5
0+089.9	553542.4	7914902.5	169.1	-1	8.3	7.5	-0.2
0+100.0	553550.9	7914897	169	-1	8.3	7.6	-1.3
0+109.7	553559	7914891.7	168.9	-1	7.8	7.6	-1.8
0+113.3	553562	7914889.8	168.8	-1	7.5	7.6	-1.8
0+120.0	553567.7	7914886.2	168.7	-0.9	7.4	7.5	-1.8
0+140.0	553585.7	7914877.6	168.4	-0.4	6.3	6.9	-1.8
0+143.4	553588.9	7914876.4	168.3	-0.3	6.2	6.7	-1.1
0+160.0	553604.9	7914871.8	168.1	-0.2	5.8	6.5	0.0
0+169.6	553614.3	7914870.1	168.1	-0.1	5.9	6.4	0.4
0+180.0	553624.6	7914869	168.1	-0.2	5.9	6.4	0.4
0+200.0	553644.6	7914869.2	168.2	-0.2	5.9	6.2	0.4
0+200.1	553644.7	7914869.3	168.2	-0.2	5.9	6.2	0.4
0+216.2	553660.7	7914870.7	168.3	-0.1	5.2	5.3	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 2017-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
17-04-03
NWT/NU

CLIENT: Baffinland
CONSULTANT: Golder Associates

MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
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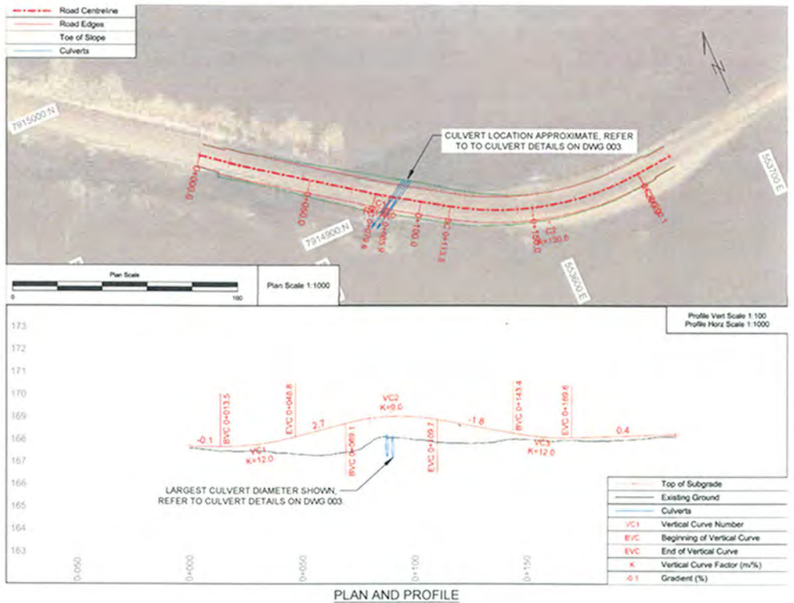
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

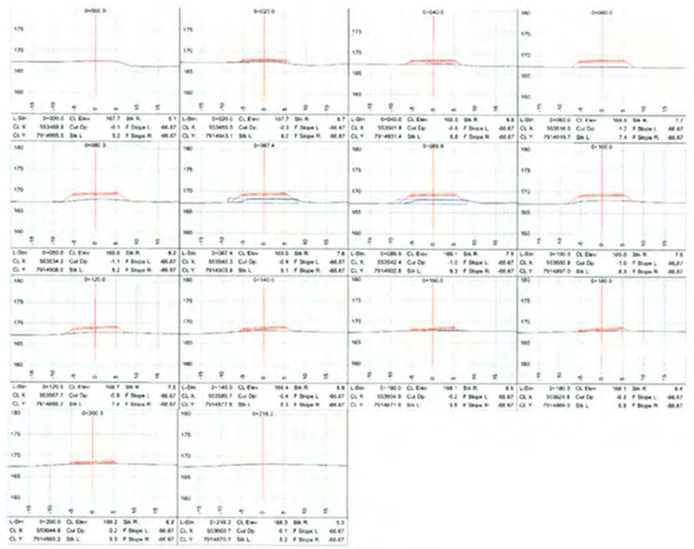
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV001

PROJECT NO	PHASE	REV	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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2017-04-03
NORTHWEST TERRITORIES AND NUNAVUT

Baffinland

Golder Associates

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CANADA
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www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV001

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

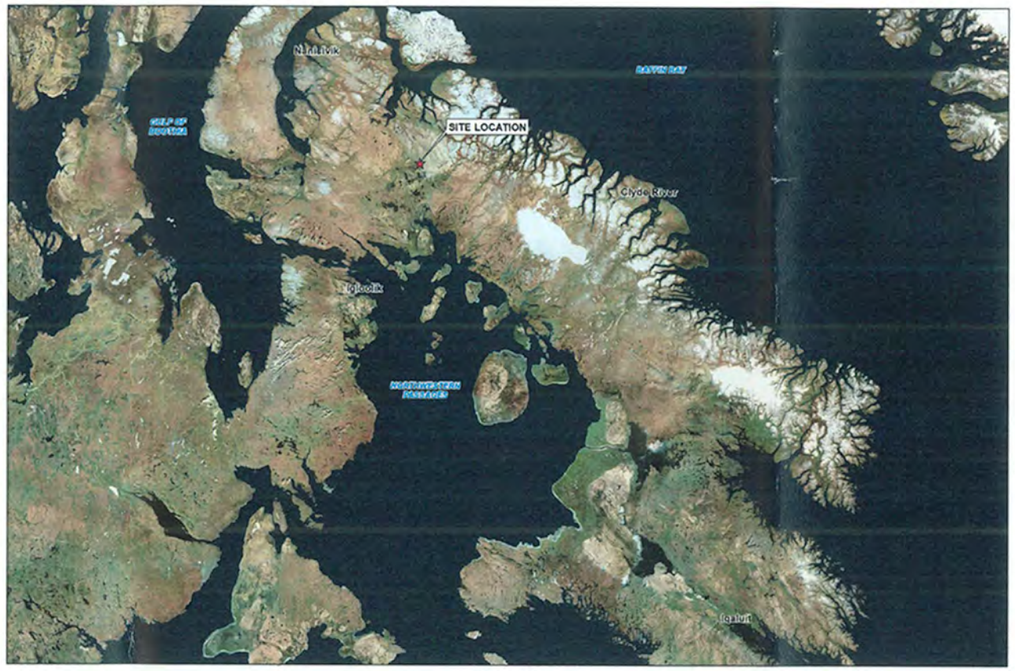
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV046 A&B

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV046 A&B	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV046 A&B	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV046 A&B	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV046 A&B	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



KEY PLAN
NOT TO SCALE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

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PROJECT
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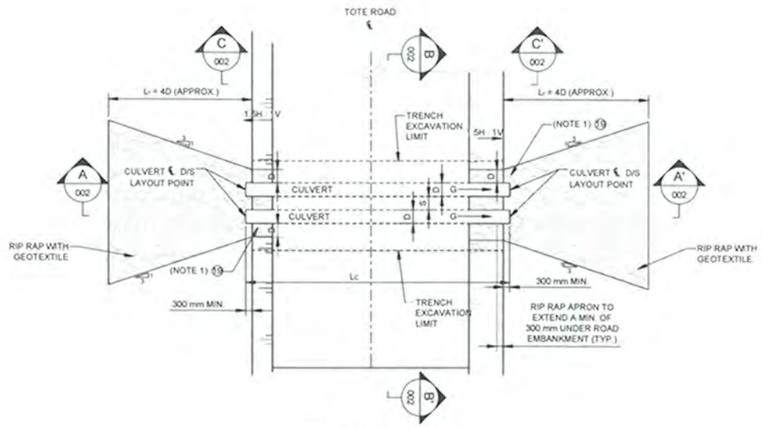
TOTE ROAD EARTHWORKS

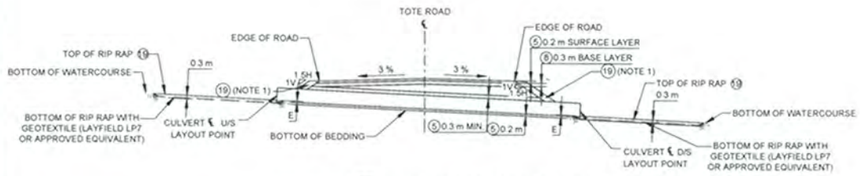
TITLE
TITLE SHEET - CV046 A&B

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

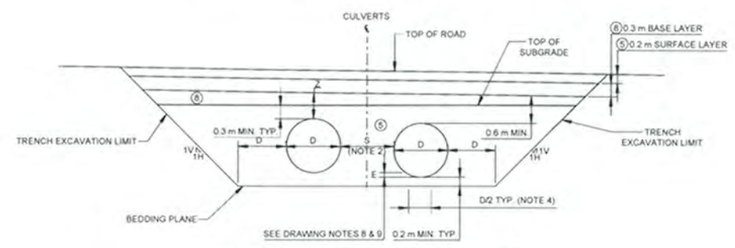
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A 002) PIPE CROSSING TYPICAL PROFILE



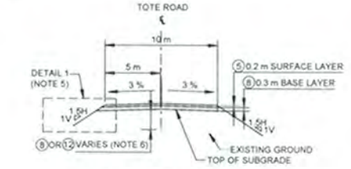
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

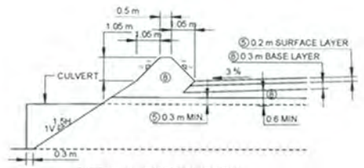
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

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1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
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6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS. USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
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18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG 001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
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2017-04-03
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV046 A&B

PROJECT NO.	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+103.3	POTENTIAL	500	15	4.39		49	1.2	531695.1	7924264.4	236.0	235.1	2	142	N	N	
0+107.3	POTENTIAL	500	15	5.32	50	49	1.4	531695.0	7924260.4	236.0	235.1	2	141	N	Y	2
0+111.3	POTENTIAL	1000	15	8.63	100	49	1	531694.9	7924256.4	236.0	235.1	2	140	N	Y	4
0+115.3	POTENTIAL	500	15	5.26	50	49	1.7	531694.6	7924252.4	236.1	235.1	2	139	N	Y	2
0+119.3	POTENTIAL	500	15	4.97	50	49	1.9	531694.3	7924248.4	236.1	235.1	2	139	N	Y	2

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002).

SITE SPECIFIC NOTES FOR CULVERT CV046 A&B

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
2. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE COVER, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
4. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
5. THE CULVERT MAY BE PERCHED. REINSTALL CULVERT.
6. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	531656.3	7924357.8	233.7	-0.4	5.2	5.3	1.3
0+008.8	531661.5	7924350.8	233.8	-0.3	5.3	5.3	1.7
0+020.0	531668.2	7924341.7	234	-0.3	6.3	6	2.3
0+022.2	531669.6	7924339.9	234.1	-0.4	6.4	6	3.1
0+040.0	531679.1	7924325	234.6	-0.7	7.1	6.2	4.6
0+058.2	531686.7	7924308.4	235.5	-0.4	8.1	6	5.4
0+060.0	531687.3	7924306.8	235.6	-0.4	8.1	6	5.4
0+060.2	531687.4	7924306.6	235.6	-0.4	8.1	6	4.5
0+076.6	531692	7924290.8	236.3	-0.3	6.7	6	3.6
0+080.0	531692.7	7924287.5	236.5	-0.3	6.2	6.1	3.6
0+100.0	531695	7924267.7	237.2	-0.4	6.4	6	3.6
0+101.0	531695	7924266.7	237.2	-0.4	6.4	6.1	3.7
0+103.3	531695.1	7924264.4	237.3	-0.4	6.5	6.1	3.9
0+107.3	531695.1	7924260.4	237.4	-0.5	6.5	6.2	4.3
0+111.3	531694.9	7924256.4	237.6	-0.5	6.6	6.4	4.6
0+115.3	531694.7	7924252.4	237.8	-0.6	6.7	6.5	4.8
0+115.9	531694.6	7924251.8	237.8	-0.6	6.7	6.5	4.9
0+119.3	531694.4	7924248.4	238	-0.6	6.7	6.7	5.1
0+120.0	531694.3	7924247.7	238	-0.7	6.7	6.8	5.5
0+127.3	531693.7	7924240.5	238.4	-0.7	6.4	7.6	6.3
0+140.0	531693.3	7924227.7	239.2	-0.5	6.3	7.3	7
0+144.6	531693.4	7924223.1	239.5	-0.5	6.2	6.9	7.2
0+160.0	531695.1	7924207.8	240.7	-0.5	6.9	6.1	7.2
0+160.7	531695.2	7924207.2	240.7	-0.5	6.9	6.1	7.2
0+180.0	531698.6	7924188.1	242.1	-0.2	5.9	6	
0+200.0	531702	7924168.4	243.6	-0.5	6.3	6.1	
0+211.2	531704	7924157.4	244.3	-0.5	5.5	5	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature: [signature]
Date: 17-04-03
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LICENSEE
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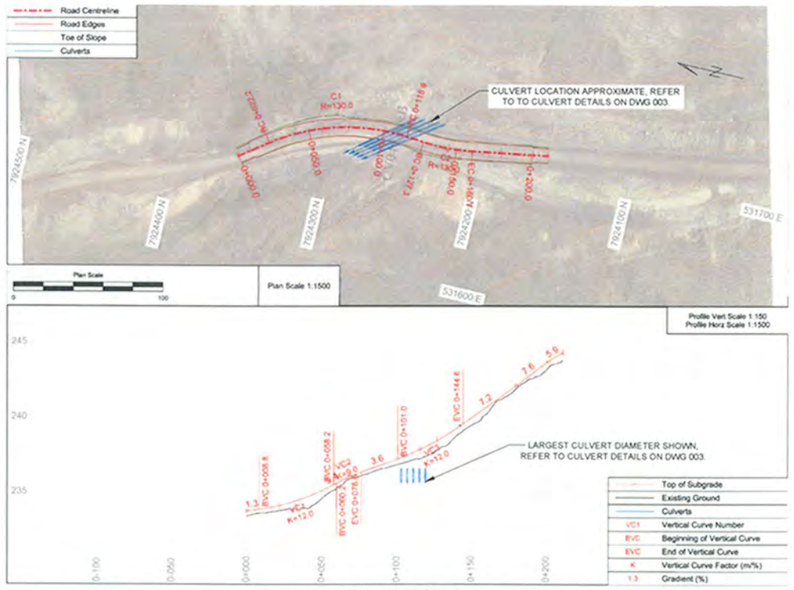
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

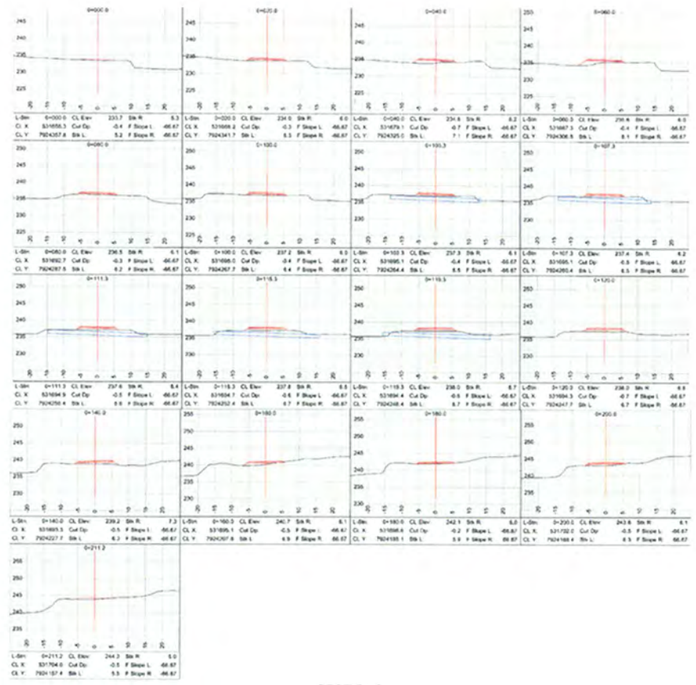
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV046 A&B

PROJECT NO	PHASE	REV	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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CLIENT
Baffinland

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV046 A&B

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

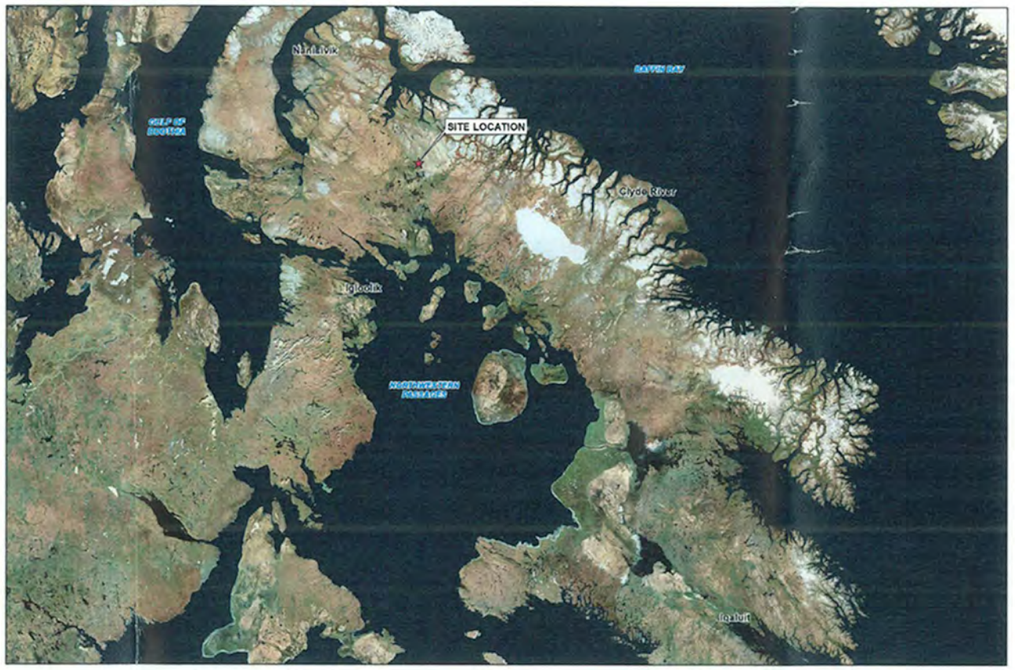
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV059

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV059	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV059	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV059	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV059	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667706	TOTE ROAD EARTHWORKS	0



KEY PLAN
NOT TO SCALE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
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0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-08	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

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PROJECT
MARY RIVER PROJECT
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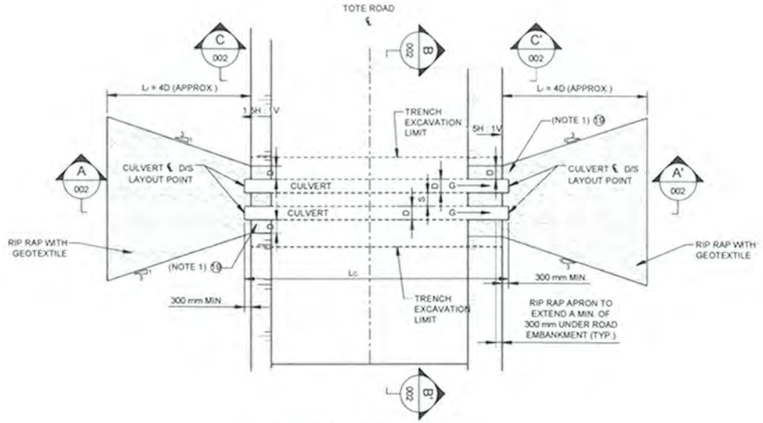
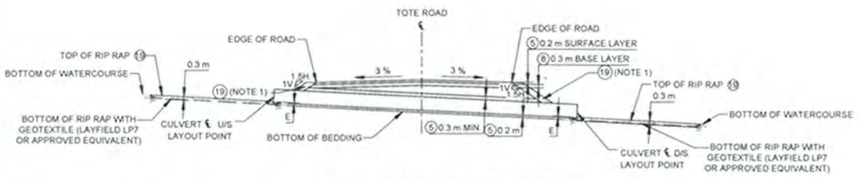
TITLE
TITLE SHEET - CV059

PROJECT NO	PHASE	REV		DRAWING
1667708	3000	2	1 of 4	001

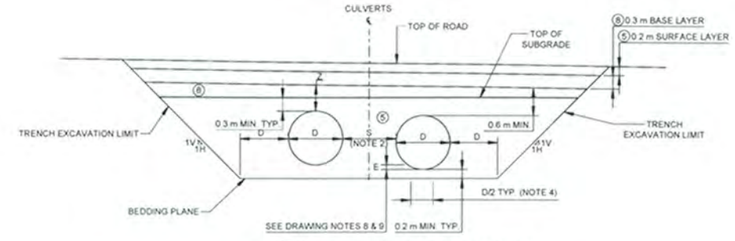
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m A 002 PIPE CROSSING TYPICAL PROFILE



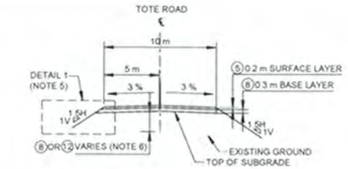
SCALE 1:50 m B 002 PIPE CROSSING TYPICAL SECTION

LEGEND

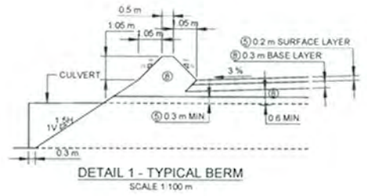
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,L_c,L_r, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m C 002 EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS. USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
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TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV059

PROJECT NO.	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+099.0	POTENTIAL	500	12	2.44		17	1	528094.4	7929360.7	162.2	161.8	2	70	N	N	
0+101.0	POTENTIAL	500	12	3.23	50	17	1	528095.3	7929358.9	162.2	161.8	2	70	N	N	
0+103.0	POTENTIAL	500	12	1.65	50	17	1	528096.1	7929357.1	162.2	161.8	2	70	N	N	
0+105.0	POTENTIAL	500	12	2.32	50	17	1	528097.0	7929355.3	162.2	161.8	2	70	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV059

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
4. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
5. EXTEND OR REPLACE CULVERTS (REFER TO GENERAL CONSTRUCTION NOTE 11). IF EXTENDING, CLEAR SEDIMENTS FROM EXISTING CULVERT.
6. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
7. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	528050.3	7929449.3	163.7	-0.1	5.1	5.3	-0.6
0+002.4	528051.3	7929447.1	163.7	0	5	5.3	-0.6
0+020.0	528058.5	7929431.1	163.6	-0.2	5.8	6.4	-0.6
0+034.6	528064.8	7929417.9	163.5	-0.2	5.8	6.4	-0.5
0+040.0	528067.2	7929413.1	163.5	-0.2	5.8	6.4	-0.3
0+057.3	528075.1	7929397.6	163.4	-0.2	5.8	6.3	0
0+060.0	528076.3	7929395.3	163.4	-0.2	5.8	6.2	0.1
0+068.3	528080.2	7929388	163.4	-0.2	5.9	6.2	0.2
0+080.0	528085.6	7929377.6	163.5	-0.2	6.2	6	0.2
0+092.9	528091.6	7929366.1	163.5	-0.2	7	5.9	0.2
0+099.0	528094.4	7929360.7	163.5	-0.3	8.1	6.3	0.2
0+100.0	528094.8	7929359.8	163.5	-0.3	8.1	6.1	0.2
0+101.0	528095.3	7929358.9	163.5	-0.3	8	6	0.2
0+103.0	528096.2	7929357.1	163.5	-0.2	7.8	5.9	0.2
0+105.0	528097	7929355.3	163.5	-0.2	7.6	5.9	
0+115.3	528101.3	7929346	163.5	-0.3	7	6	0.2
0+120.0	528103.1	7929341.6	163.5	-0.3	6.7	6.1	0.2
0+140.0	528111.1	7929323.3	163.6	-0.2	6.1	5.9	0.2
0+157.5	528118.1	7929307.2	163.6	-0.2	5.1	5.1	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-08	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NORTHWEST TERRITORIES AND NUNAVUT

CLIENT: Baffinland

CONSULTANT: Golder Associates

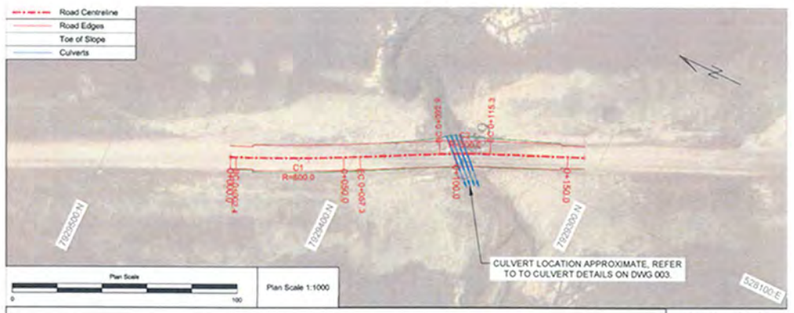
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

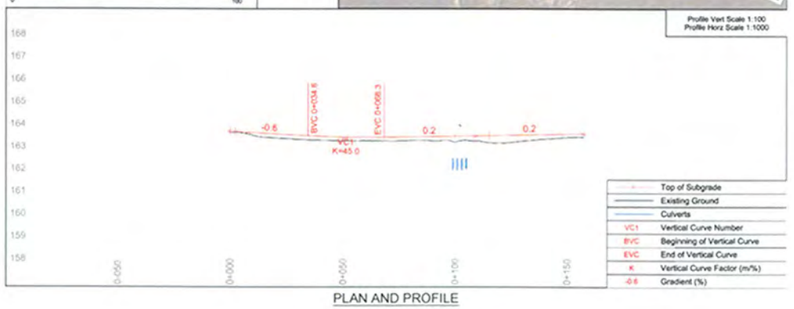
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV059

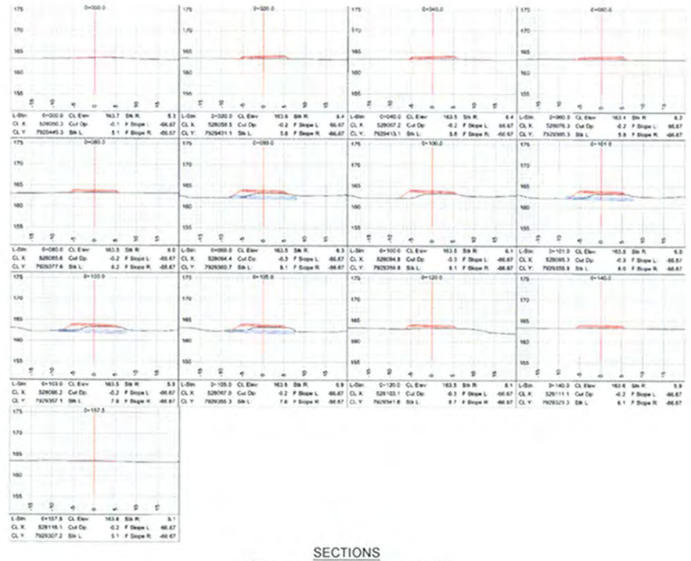
PROJECT NO.	PHASE	REV.	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE





PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
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0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-08	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV059

PROJECT NO	PHASE	REV.	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV099

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV099	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV099	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV099	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV099	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0

KEY PLAN
NOT TO SCALE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
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2017-09-03
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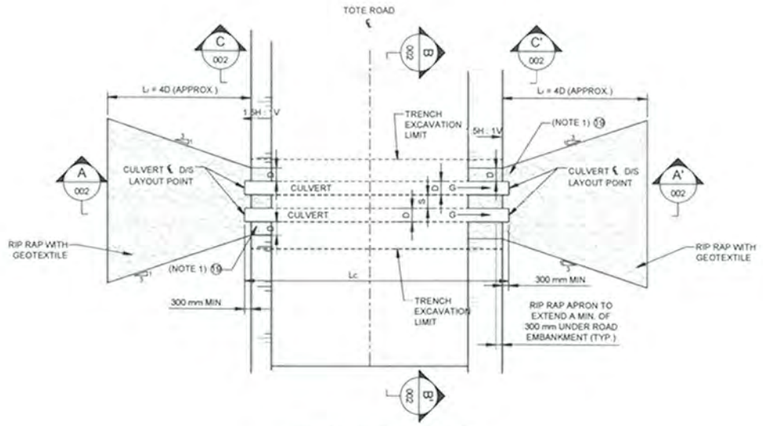
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

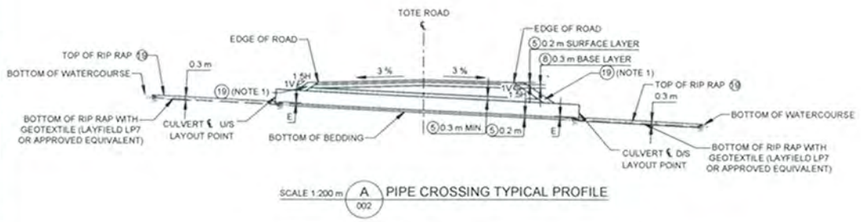
TITLE
TITLE SHEET - CV099

PROJECT NO.	PHASE	REV.	1 of 4	DRAWING
1667708	3000	2		001

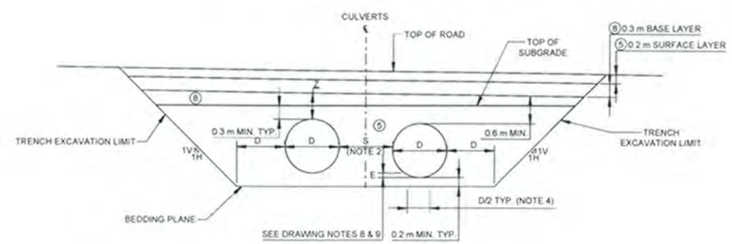
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A 002) PIPE CROSSING TYPICAL PROFILE



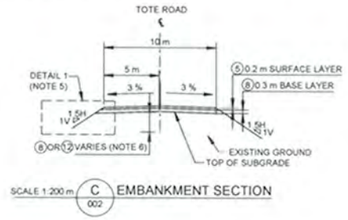
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

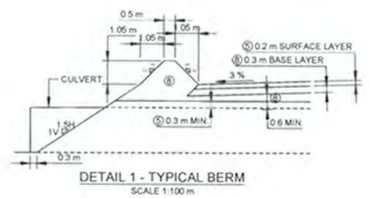
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(6)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED; FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG.002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG.001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

1:50 0 2 4 METRES
1:100 0 5 10 METRES
1:200 0 10 20 METRES

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1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW.	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 19-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-21
NWT/NU

CLIENT: Baffinland
CONSULTANT: Golder Associates
MISSISSAUGA OFFICE
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MISSISSAUGA, ON
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905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV099

PROJECT NO.	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+074.0	YES	1200	21	2.43	120	57	3.8	521890.8	7948843.9	124.2	123.1	2	110	N	Y	4.8
0+078.0	YES	2000	21	1.76	200	57	3.1	521893.4	7948840.8	124.2	123.1	2	110	N	Y	8

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 001)

SITE SPECIFIC NOTES FOR CULVERT CV099

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
2. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
3. THE CULVERT MAY BE PERCHED. REINSTALL CULVERT.
4. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	521848.1	7948904.2	126.9	-0.1	5	5.3	1
0+008.8	521852.8	7948896.8	126.9	-0.2	5.1	5.4	1.1
0+013.5	521855.3	7948892.7	127	-0.2	5.8	6.2	1.3
0+020.0	521858.6	7948887.3	127.1	-0.2	5.8	6.3	2
0+040.0	521870.1	7948870.8	127.5	-0.4	6	6.7	2.9
0+060.0	521882.2	7948854.9	128.1	-0.5	6.4	6.7	3.5
0+063.3	521884.3	7948852.3	128.2	-0.6	6.4	6.8	3.8
0+074.0	521891	7948843.9	128.6	-0.7	6.6	7	4.2
0+078.0	521893.5	7948840.8	128.8	-0.8	6.7	7	4.3
0+080.0	521894.7	7948839.3	128.8	-0.8	6.8	7	4.8
0+100.0	521907.3	7948823.7	129.8	-0.7	6.6	6.7	5.8
0+120.0	521919.8	7948808.1	131	-0.6	6.4	6.5	6.7
0+140.0	521932.3	7948792.5	132.3	-0.1	6	6.2	7.3
0+142.8	521934.1	7948790.4	132.5	-0.1	5.2	5.3	7.3
0+152.0	521939.8	7948783.2	133.2	-0.2	5.1	5.2	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTISE
GOLDER ASSOCIATES LTD.
Signature
Date 2017-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT: Baffinland

CONSULTANT: Golder Associates

MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
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905-567-4444
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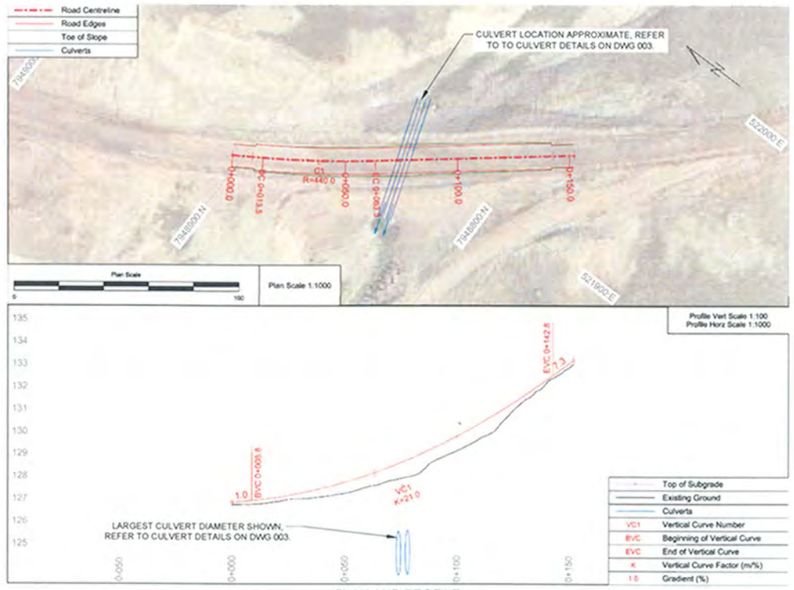
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

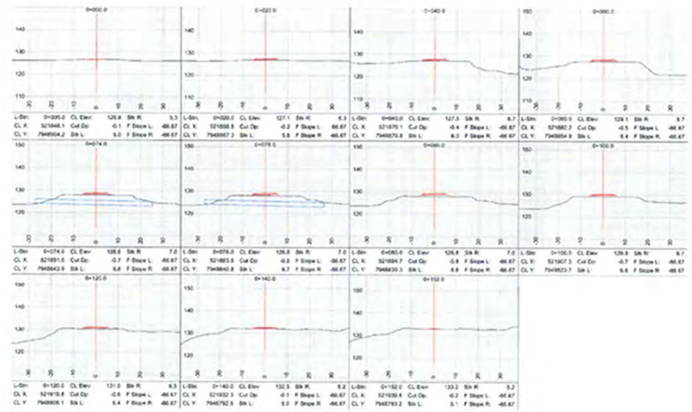
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV099

PROJECT NO.	PHASE	REV.	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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2017-04-05
NORTHWEST TERRITORIES AND NUNAVUT

Baffinland

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV099

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
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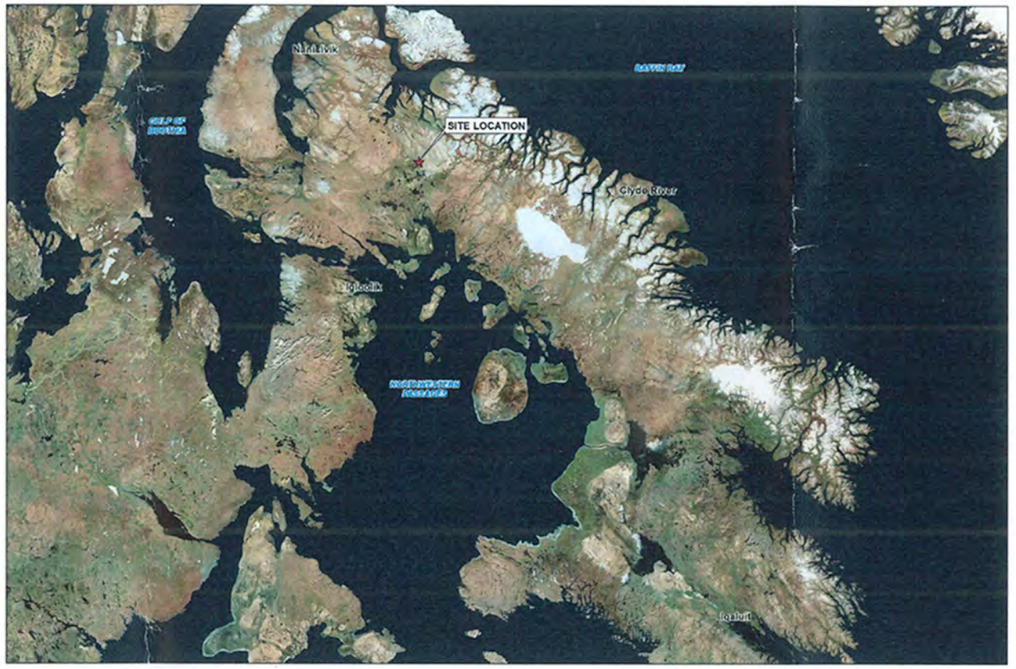
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV106

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV106	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV106	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV106	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV106	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



KEY PLAN
NOT TO SCALE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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LICENSEE
2017-04-03
NWT/NU

Baffinland
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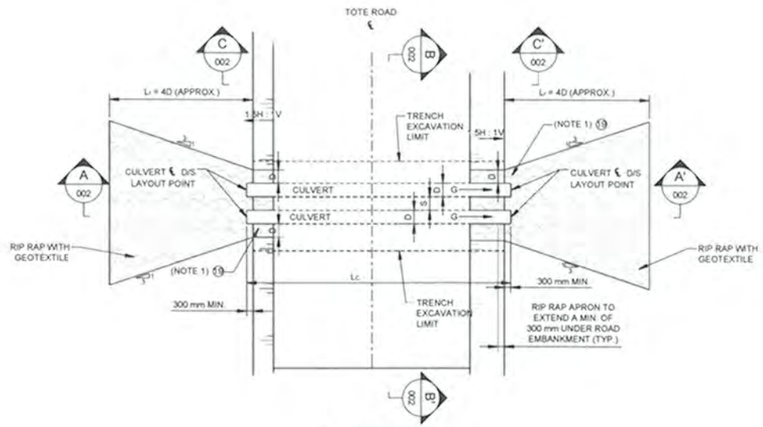
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

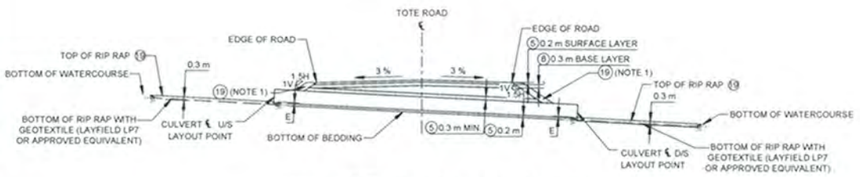
TITLE
TITLE SHEET - CV106

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

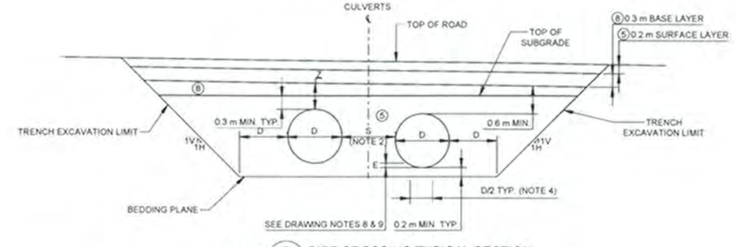
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A / 002) PIPE CROSSING TYPICAL PROFILE



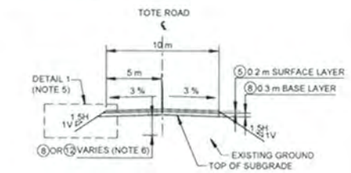
SCALE 1:50 m (B / 002) PIPE CROSSING TYPICAL SECTION

LEGEND

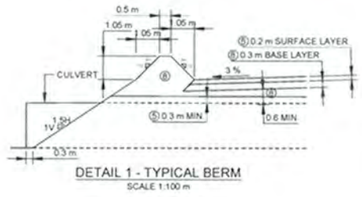
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C / 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS. USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG.002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG.001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

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A	2017-03-06	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMISSION TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NORTHWEST TERRITORIES AND NUNAVUT

CONSULTANT
Golder Associates
MISSISSAUGA OFFICE:
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
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CLIENT
Baffinland

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV106

PROJECT NO	PHASE	REV	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+076.5	POTENTIAL	1000	15	2.21		25	0.6	521670.5	7953387.9	113.4	113.1	1	135	N	Y	4

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV106

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE CULVERT PIPE COVER, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL) AND THE ROAD RUNNING SURFACE A MINIMUM OF 10 m.**
2. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
3. THE EXISTING CULVERT MAY BE PERCHED. REINSTALL CULVERTS TO DESIGN. THE EXISTING CULVERT MAY BE DAMAGED. REPLACE CULVERTS IF REQUIRED.
4. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
5. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	521658.5	7953463.2	112.3	-0.1	5.7	5.5	
0+020.0	521663.2	7953443.8	113.2	-0.2	6.3	6.1	3.7
0+023.8	521664.2	7953440.1	113.4	-0.3	6.6	6.3	3.7
0+040.0	521667.5	7953424.2	114	-0.8	7.7	6.6	3.7
0+048.5	521668.7	7953415.8	114.3	-1.1	7.9	7.2	3.0
0+060.0	521669.9	7953404.4	114.6	-1.3	7.9	7.8	1.5
0+076.5	521670.6	7953387.9	114.9	-1.4	8.2	8.0	0.4
0+080.0	521670.5	7953384.4	114.9	-1.4	8.4	8.0	-0.2
0+086.5	521670.4	7953378	114.9	-1.3	8.1	7.7	-1.0
0+095.0	521670	7953369.4	114.8	-1.1	7.7	7.3	-1.5
0+100.0	521669.8	7953364.4	114.7	-0.9	7.4	7.0	-1.5
0+120.0	521668.9	7953344.4	114.4	-0.4	6.1	6.4	
0+140.0	521668.1	7953324.5	114.1	-0.2	5.1	5.1	-2.3
0+141.3	521668	7953323.2	114.1	-0.1	5.0	5.0	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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2017-04-03
NUNAVUT

CLIENT: Baffinland

CONSULTANT: Golder Associates

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV106

PROJECT NO.	PHASE	REV.	3 of 4	DRAWING
1667708	3000	2		003

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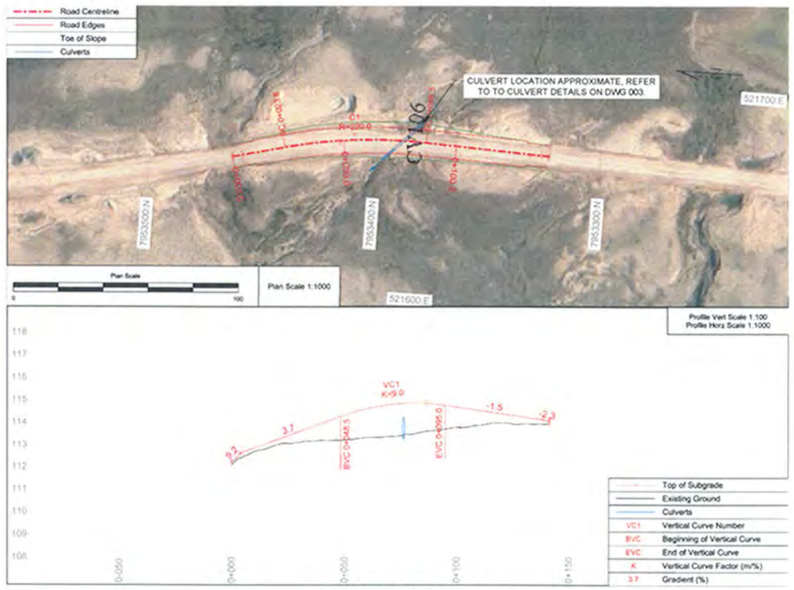
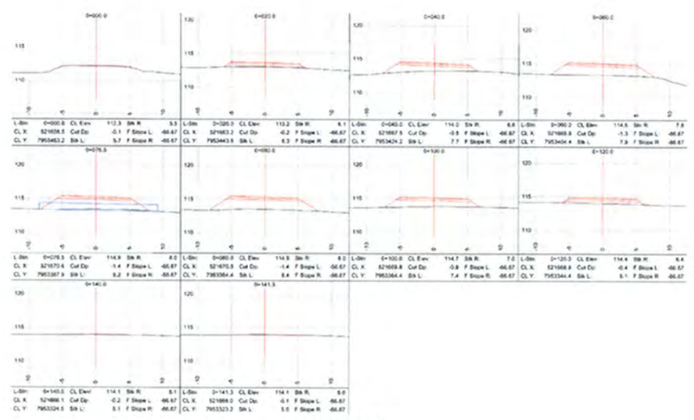


PLAN AND PROFILE



SECTIONS
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PROJECT
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TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV106

PROJECT NO	PHASE	REV		DRAWING
1667708	3000	2	4 of 4	004

Reduced Size
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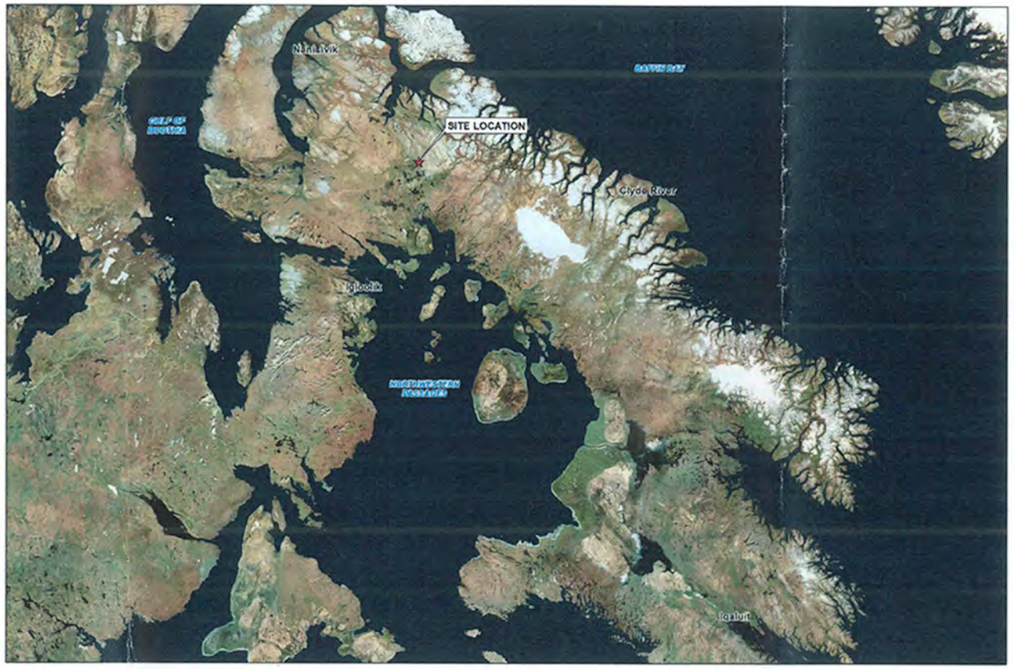
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV112

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV112	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV112	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV112	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV112	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



KEY PLAN
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REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

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Signature
Date 17-Mar-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

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CLIENT
Baffinland

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TITLE SHEET - CV112

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

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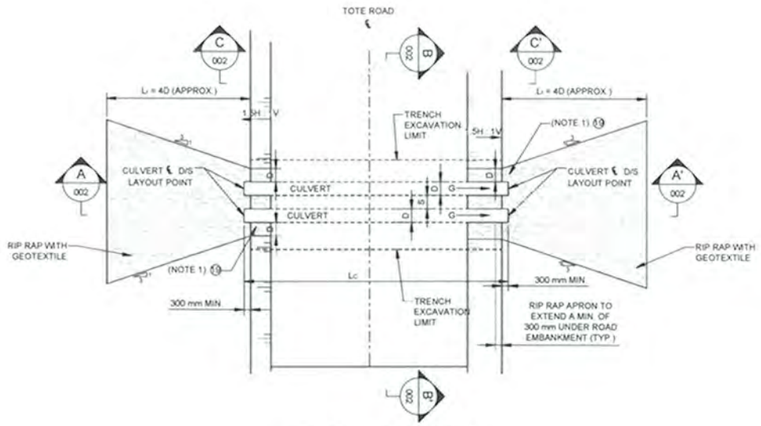
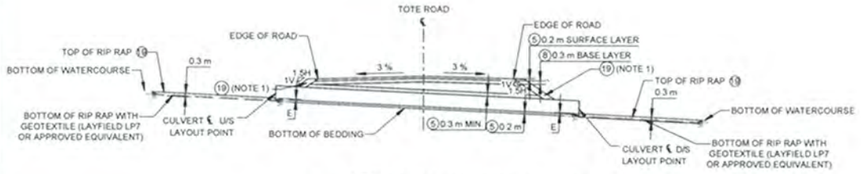
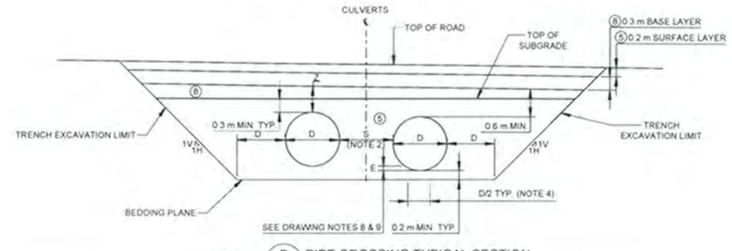
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m A 002 PIPE CROSSING TYPICAL PROFILE



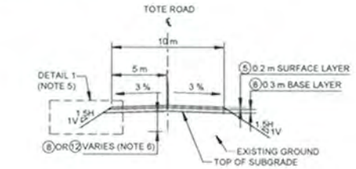
SCALE 1:50 m B 002 PIPE CROSSING TYPICAL SECTION

LEGEND

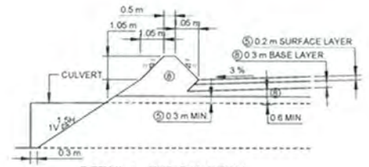
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m C 002 EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS. USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG 001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV112

PROJECT NO.	PHASE	REV.	2 of 4	DRAWING
1667708	3000	2		002

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CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+109.3	POTENTIAL	1200	15	2.47		24.4	1	521034.0	7954929.5	113	112.1	4	90	N	Y	4.8
0+112.0	POTENTIAL	500	15	2.99	50	24.7	1.7	521036.2	7954928.1	113	112	4	90	N	N	

† CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV112

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **WIDEN THE ROAD RUNNING SURFACE AT THE CULVERT LOCATION TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
4. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE CULVERT PIPE COVER, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL) AND THE ROAD RUNNING SURFACE A MINIMUM OF 10 m**
5. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002)
6. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
7. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
8. THE CULVERT MAY BE PERCHED. REINSTALL CULVERT. THE CULVERT END(S) MAY BE DAMAGED. REPLACE CULVERTS IF REQUIRED.
9. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	520980.9	7955021.4	116.6	-0.1	5.0	5.1	-0.6
0+004.1	520982	7955017.5	116.6	-0.2	5.1	5.1	-1.0
0+020.0	520986.3	7955002.2	116.4	-0.1	5.9	6.0	-1.8
0+034.2	520990.2	7954988.5	116.2	-0.4	6.0	6.2	-2.3
0+038.4	520991.4	7954984.5	116.1	-0.4	6.2	6.2	-2.4
0+040.0	520991.9	7954983	116.1	-0.4	6.2	6.2	-2.4
0+060.0	521000.2	7954964.8	115.6	-0.6	6.5	6.6	-2.4
0+061.3	521000.9	7954963.7	115.6	-0.5	6.5	6.6	-2.0
0+080.0	521011.9	7954948.6	115.2	-0.5	6.4	6.7	-1.2
0+100.0	521026.4	7954934.9	114.9	-0.5	7.2	13.3	-0.7
0+105.1	521030.5	7954931.8	114.9	-0.5	6.3	14.2	-0.6
0+109.3	521033.9	7954929.5	114.9	-0.5	6.4	14.5	-0.6
0+112.0	521036.2	7954928.1	114.9	-0.5	6.4	14.5	-0.6
0+120.0	521043.2	7954924.2	114.8	-0.7	6.7	14.3	
0+129.5	521051.9	7954920.3	114.8	-0.7	6.8	13.8	-0.4
0+140.0	521061.6	7954916.4	114.7	-0.8	6.7	8.4	-0.4
0+141.3	521062.8	7954915.9	114.7	-0.8	6.7	8.1	0.1
0+160.0	521080.2	7954909	114.7	-0.5	6.1	7.0	1.0
0+180.0	521098.8	7954901.6	114.9	-0.3	5.9	7.1	2.0
0+200.0	521117	7954893.3	115.3	-0.5	6.1	7.6	2.9
0+216.0	521131.3	7954886.2	115.8	-0.3	5.8	8.5	3.3
0+220.0	521134.9	7954884.4	115.9	-0.3	5.1	5.3	3.3
0+226.2	521140.5	7954881.6	116.2	-0.2	5.1	5.1	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	J.L.	CK/RAD	MJT	RAD
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A	2017-02-24	ISSUED FOR CLIENT REVIEW	J.L.	CK/RAD	MJT	RAD

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Date 19-04-25
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REGISTERED PROFESSIONAL ENGINEER
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV112

PROJECT NO.	PHASE	REV.	3 of 4	DRAWING
1667708	3000	2		003

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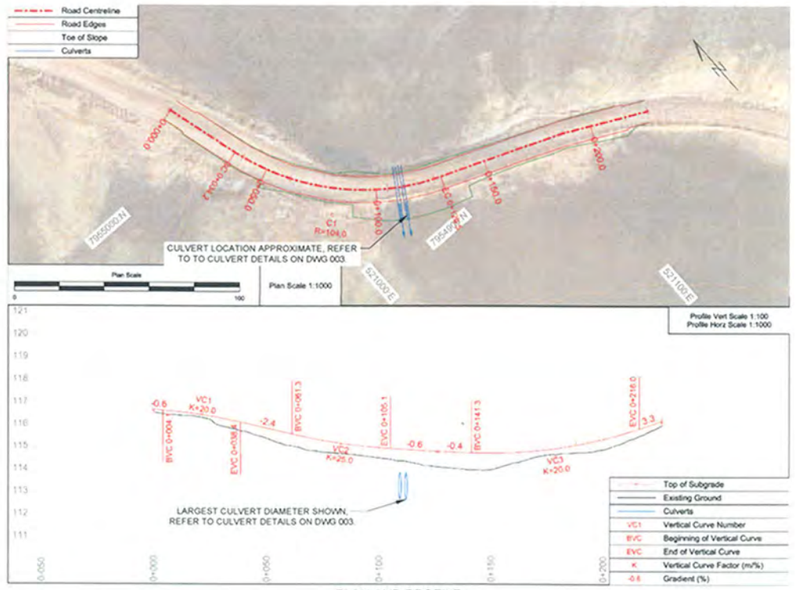
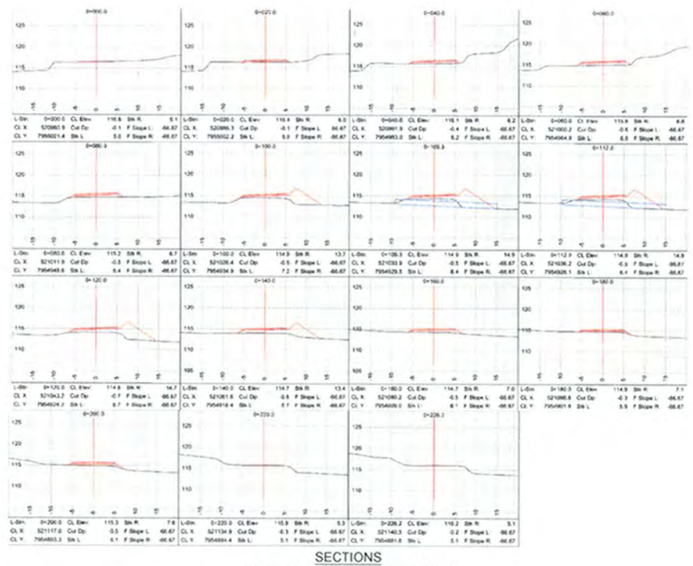


PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV112

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

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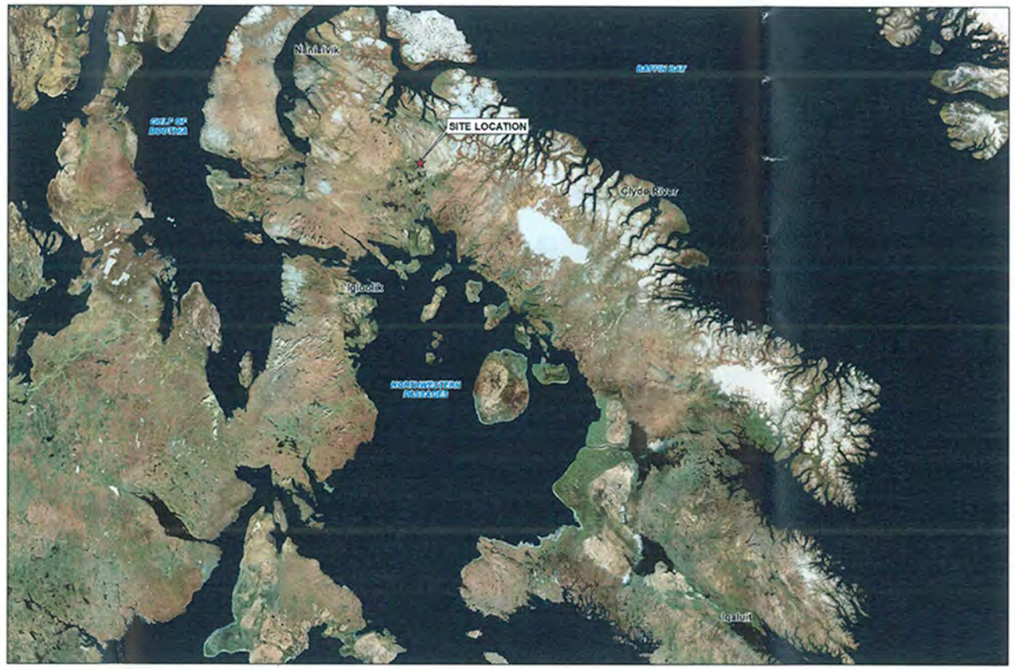
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV186

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV186	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV186	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV186	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV186	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



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NT/NU Association of Professional Engineers and Geoscientists

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TITLE
TITLE SHEET - CV186

PROJECT NO.	PHASE	REV		DRAWING
1667708	3000	2	1 of 4	001

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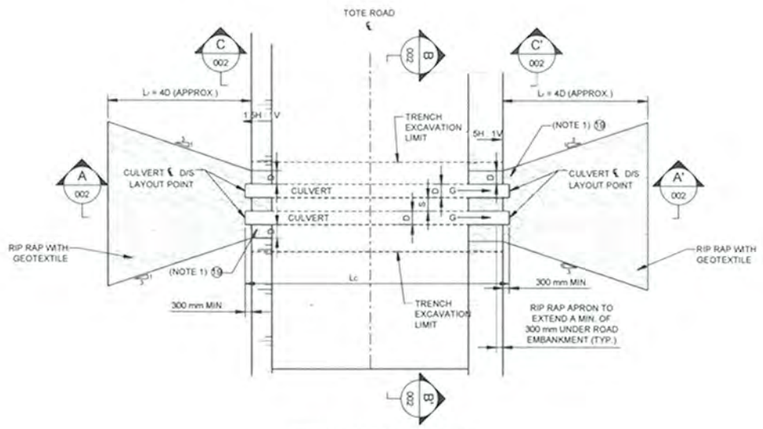
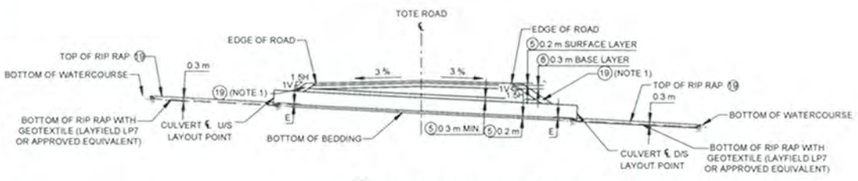


PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m A 002 PIPE CROSSING TYPICAL PROFILE

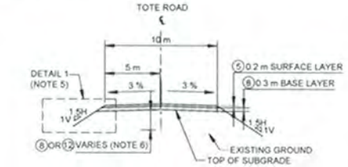
SCALE 1:50 m B 002 PIPE CROSSING TYPICAL SECTION

LEGEND

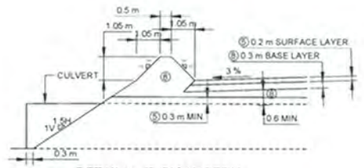
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m C 002 EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG 001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-09	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-05
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
17-04-05
NUNAVUT

CLIENT: Baffinland

CONSULTANT: Golder Associates

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CANADA
905-567-4444
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV186

PROJECT NO	PHASE	REV	2 OF 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+265.0	POTENTIAL	1000	21			37	0.9	560720.5	7913497.8	178.4	177.7	2	139	N	Y	4

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV186

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. CONSTRUCT THE ROAD ALONG THE REALIGNMENT (REFER TO DWG. 004).
2. **WIDEN THE ROAD RUNNING SURFACE AT THE CULVERT LOCATION TO A MINIMUM OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
4. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
5. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE CULVERT PIPE COVER, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL) AND THE ROAD RUNNING SURFACE A MINIMUM OF 10 m.**
6. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
7. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
8. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
9. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	560480.3	7913604.8	181.1	-0.2	5.1	5.0	1.6
0+017.9	560496	7913596.3	181.4	-0.2	5.9	13.2	1.5
0+020.0	560497.9	7913595.4	181.4	-0.2	5.9	13.2	0.3
0+040.0	560515.5	7913585.9	181.4	-0.1	5.8	9.8	-2.0
0+060.0	560533.1	7913576.4	181.1	-0.2	6.2	11.4	-3.5
0+067.9	560540	7913572.7	180.8	-0.3	6.3	13.1	-3.9
0+068.2	560540.4	7913572.5	180.8	-0.3	6.3	13.1	-3.5
0+080.0	560550.7	7913566.9	180.4	-0.2	6.5	13.4	-2.6
0+087.7	560557.5	7913563.3	180.1	-0.4	6.2	13.8	-1.8
0+100.0	560568.5	7913557.7	179.9	-0.4	6.1	13.6	-0.5
0+119.6	560586.5	7913550.2	179.8	-0.2	6.0	11.0	0.3
0+120.0	560587	7913550.1	179.8	-0.2	6.0	11.0	0.3
0+140.0	560606	7913544.2	179.9	-0.1	5.9	10.9	
0+157.4	560623	7913540.4	179.9	-0.2	6.1	10.2	0.0
0+160.0	560625.6	7913540	179.9	-0.2	6.2	10.2	0.0
0+165.0	560630.6	7913539.1	179.9	-0.2	6.3	6.0	0.0
0+180.0	560645.1	7913535.8	179.9	-0.2	6.8	5.8	0.0
0+196.4	560660.7	7913530.6	179.9	-0.3	6.5	6.0	0.0
0+200.0	560664	7913529.3	179.9	-0.2	6.4	6.0	0.0
0+212.1	560675.3	7913524.9	179.9	-0.2	6.2	6.0	0.0
0+220.0	560682.6	7913521.8	179.9	-0.3	6.4	6.0	0.0
0+225.4	560687.5	7913519.5	179.9	-0.3	6.5	10.4	0.2
0+240.0	560700.3	7913512.5	179.9	-0.4	6.8	13.4	0.6
0+260.0	560716.7	7913501	180	-1.2	8.3	6.4	0.9
0+264.0	560719.8	7913498.5	180.1	-1.4	8.3	6.5	0.9
0+264.4	560720.1	7913498.2	180.1	-1.4	8.3	6.5	1.0
0+265.0	560720.5	7913497.9	180.1	-1.4	8.3	6.5	1.1
0+280.0	560732.5	7913488.8	180.3	-0.5	7.8	6.5	1.4
0+284.1	560735.9	7913486.5	180.3	-0.4	7.7	6.4	1.4
0+300.0	560749.7	7913478.6	180.5	-0.2	6.1	6.3	1.4
0+320.0	560768	7913470.6	180.8	-0.2	6.0	6.1	1.4
0+325.7	560773.3	7913468.7	180.9	-0.1	6.1	5.9	1.3
0+328.1	560775.6	7913468	180.9	-0.1	6.1	5.9	0.9
0+337.3	560784.4	7913465.3	181	-0.1	6.1	5.8	0.5
0+340.0	560787	7913464.5	181	-0.1	5.2	5.1	0.5
0+350.9	560797.4	7913461.3	181.1	-0.2	5.1	5.0	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-09	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT-TO-PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NT/NU

Baffinland
CONSULTANT

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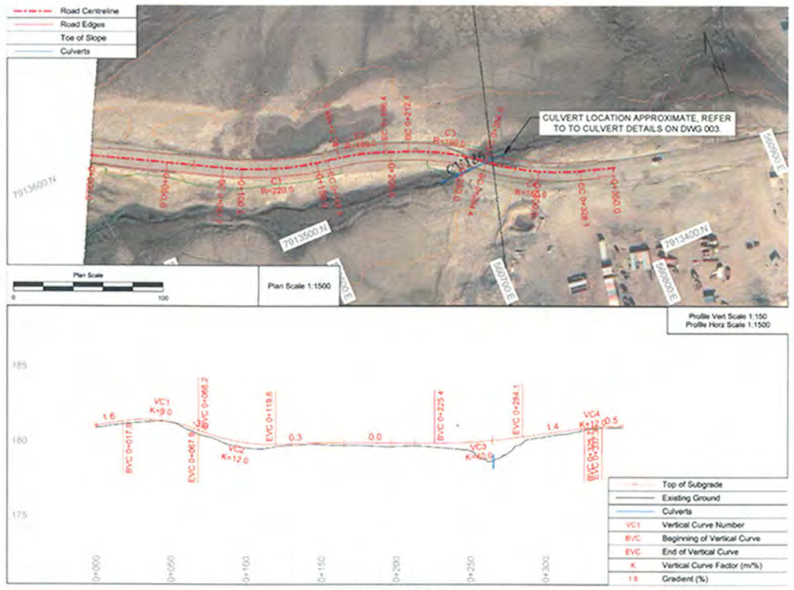
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

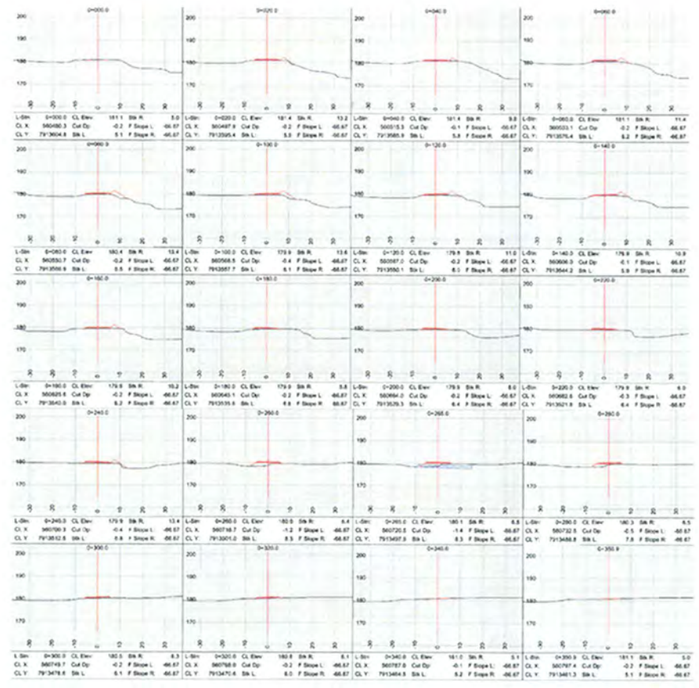
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV186

PROJECT NO	PHASE	REV	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
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PERMIT-TO-PRACTICE:
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NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV186

PROJECT NO	PHASE	REV.	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV187

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV187	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV187	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV187	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV187	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
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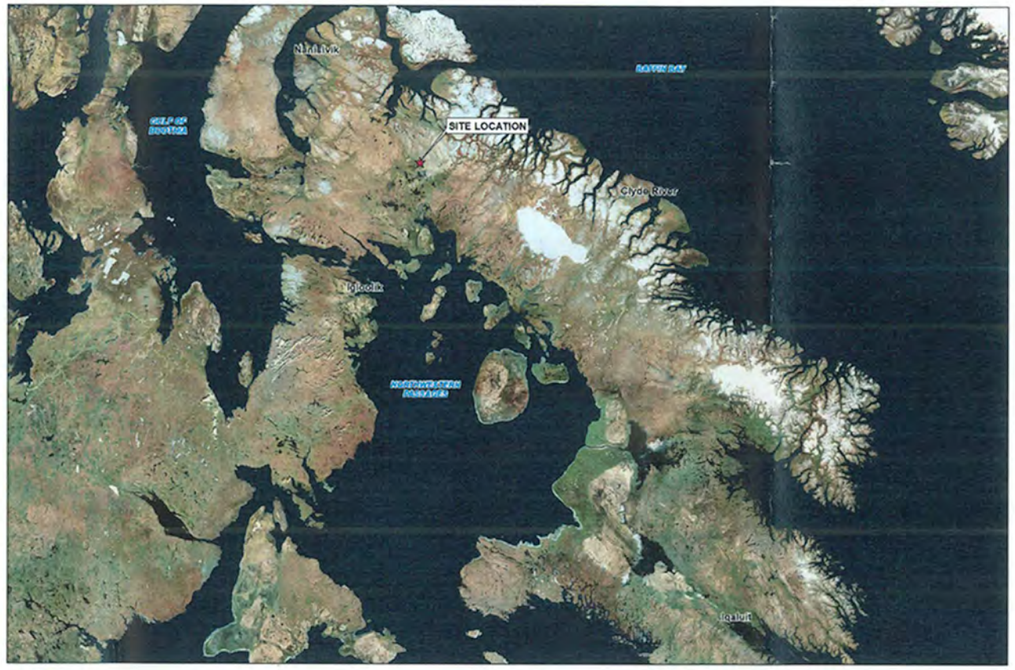

KEY PLAN
NOT TO SCALE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 12-Oct-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT: Baffinland

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PROJECT
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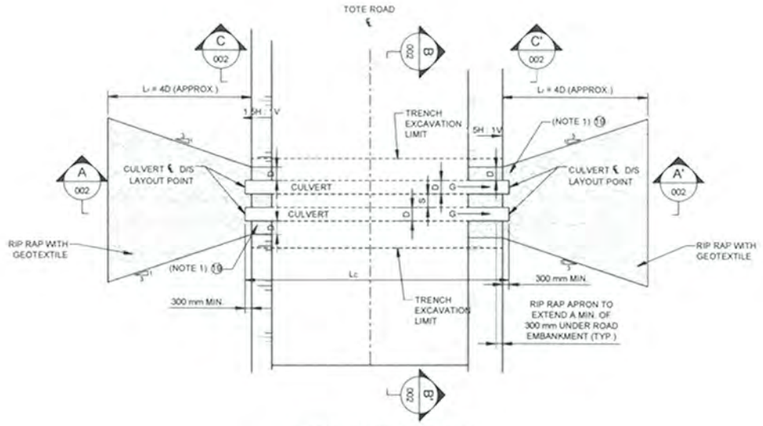
TOTE ROAD EARTHWORKS

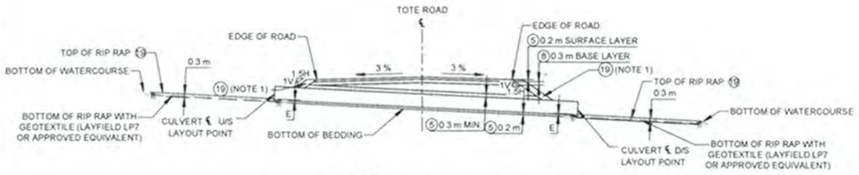
TITLE
TITLE SHEET - CV187

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

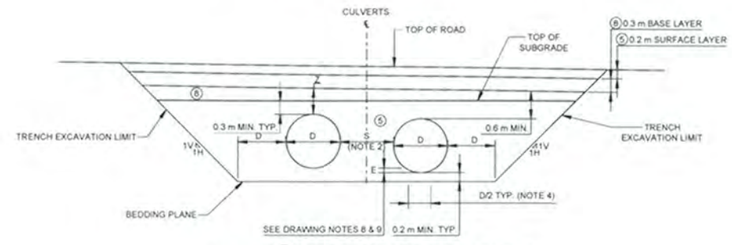
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A 002) PIPE CROSSING TYPICAL PROFILE



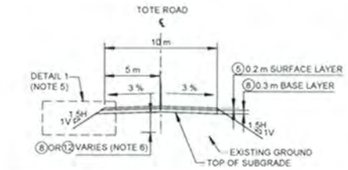
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

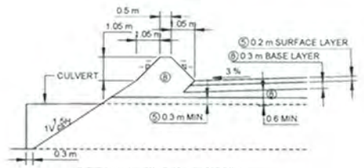
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED. FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS; USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG 001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NUNAVUT

Baffinland
CONSULTANT

Golder Associates

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MISSISSAUGA, ON
CANADA
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV187

PROJECT NO	PHASE	REV	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+054.6	POTENTIAL	500	10			39	1.8	560960.6	7913418.7	181.1	180.7	1	47	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DEM STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV187

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE. NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **WIDEN THE ROAD RUNNING SURFACE AT THE CULVERT LOCATION TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
4. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002)
5. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 M ABOVE EXISTING GROUND SURFACE
6. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
7. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	560907.4	7913430.9	182	-0.2	5.0	5.2	1.1
0+015.6	560922.6	7913427.4	182.2	-0.2	6.0	6.1	1.3
0+020.0	560926.9	7913426.4	182.2	-0.3	6.1	6.2	2.3
0+040.0	560946.4	7913422	182.7	-0.8	14.1	7.5	3.7
0+054.6	560960.6	7913418.7	183.2	-1	12.9	13.1	4.6
0+060.0	560965.9	7913417.5	183.5	-1	7.4	13.8	5.6
0+080.0	560985.4	7913413	184.6	-0.7	6.8	15.9	7.2
0+097.6	561002.5	7913409.1	185.9	-0.3	6.2	5.8	7.9
0+100.0	561004.9	7913408.5	186.1	-0.2	6.2	5.8	7.9
0+115.0	561019.5	7913405.2	187.2	-0.1	5.1	5.2	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 12-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NT/NU

CLIENT: Baffinland

CONSULTANT: Golder Associates

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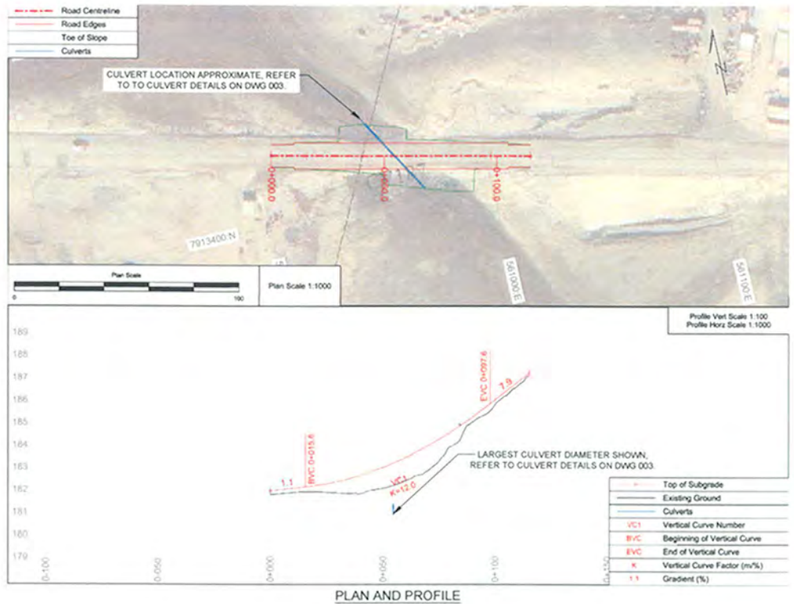
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

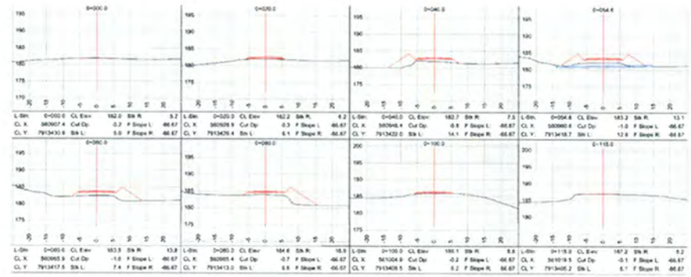
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV187

PROJECT NO.	PHASE	REV.	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

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2017-04-03
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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV187

PROJECT NO.	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV216

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV216	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV216	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV216	2
004	ROAD PLAN, PROFILE AND SECTIONS - CV216	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0

KEY PLAN
NOT TO SCALE

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
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0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-08	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT-TO PRACTICE
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Signature
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NT/NU Association of Professional Engineers and Geoscientists

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2017-04-03
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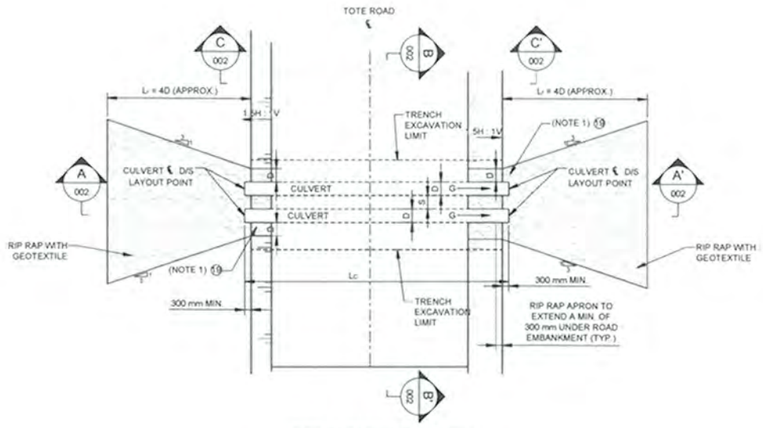
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

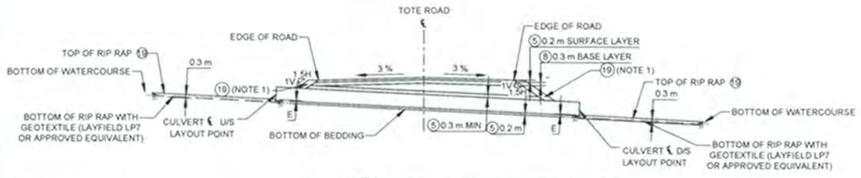
TITLE
TITLE SHEET - CV216

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

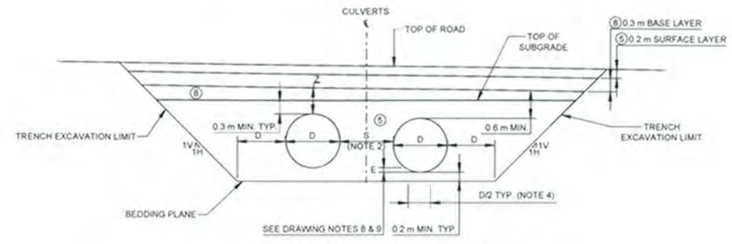
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A / 002) PIPE CROSSING TYPICAL PROFILE



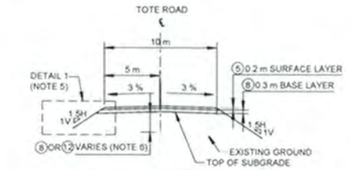
SCALE 1:50 m (B / 002) PIPE CROSSING TYPICAL SECTION

LEGEND

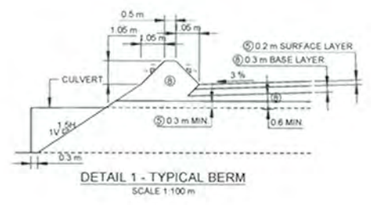
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(6)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED; FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C / 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

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0 2 4
1:50 METRES

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV216

PROJECT NO	PHASE	REV	2 of 4	DRAWING
1667708	3000	2		002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+117.3	YES	1200	15	0.67	120	20.5	1	542770.8	7921717.1	143.4	143.2	-1	76	N	N	
0+120.0	YES	1200	15	0.9	120	20.5	0.9	542772.9	7921715.5	143.4	143.2	-1	77	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV216

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **WIDEN THE ROAD RUNNING SURFACE AT THE CULVERT LOCATION TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
4. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
5. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
6. PROVIDE RIP RAP PROTECTION AT THE CULVERT OUTLETS.
7. THE EXISTING CULVERT MAY BE PERCHED. REINSTALL CULVERTS TO DESIGN.
8. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	542696.1	7921806.8	147.1	-0.1	5.1	5.4	0.7
0+020.0	542707.3	7921790.2	147.2	-0.2	5.9	6.1	0.7
0+034.2	542715.2	7921778.4	147.3	-0.1	5.9	6.1	0.4
0+039.7	542718.2	7921773.9	147.4	-0.1	5.9	6.0	0.1
0+040.0	542718.4	7921773.6	147.4	-0.1	5.9	6.0	-1.0
0+060.0	542730.2	7921757.5	147.2	-0.2	5.8	6.3	-3.2
0+078.7	542742.4	7921743.3	146.6	-0.2	6.3	5.9	-4.2
0+080.0	542743.3	7921742.4	146.5	-0.2	6.3	5.9	-4.2
0+082.7	542745.2	7921740.4	146.4	-0.3	6.3	6.0	-3.5
0+100.0	542757.6	7921728.3	145.8	-0.5	6.3	9.5	-2.0
0+117.3	542770.8	7921717.1	145.5	-0.2	5.9	9.2	-1.2
0+120.0	542772.9	7921715.5	145.4	-0.1	5.8	9.1	-1.1
0+120.0	542772.9	7921715.5	145.4	-0.1	5.8	9.1	-0.8
0+126.2	542777.8	7921711.8	145.4	-0.1	5.8	9.0	0.0

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-06	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

PERMIT-TO-PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 2017-04-05
PERMIT NUMBER: P 049
N.T./N.U. Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-05
NWT/NU

Baffinland
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Golder Associates

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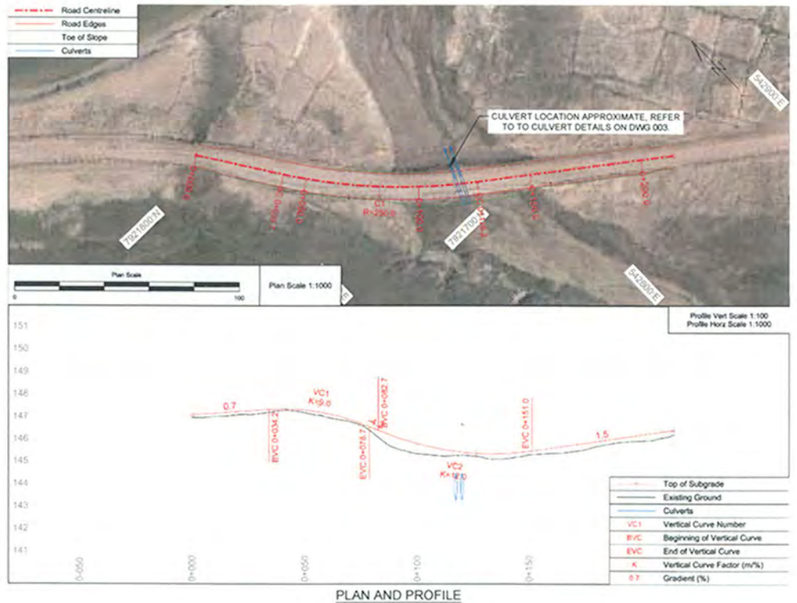
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

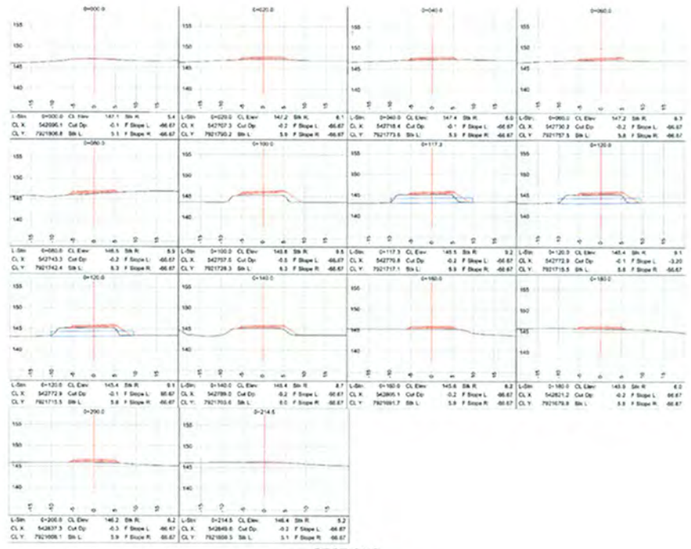
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV216

PROJECT NO	PHASE	REV	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	CK/RAD	JJL	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	CK/RAD	JJL	MJT	RAD
0	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-08	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

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Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT: Baffinland
CONSULTANT: Golder Associates

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV216

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

Reduced Size
NOT TO SCALE

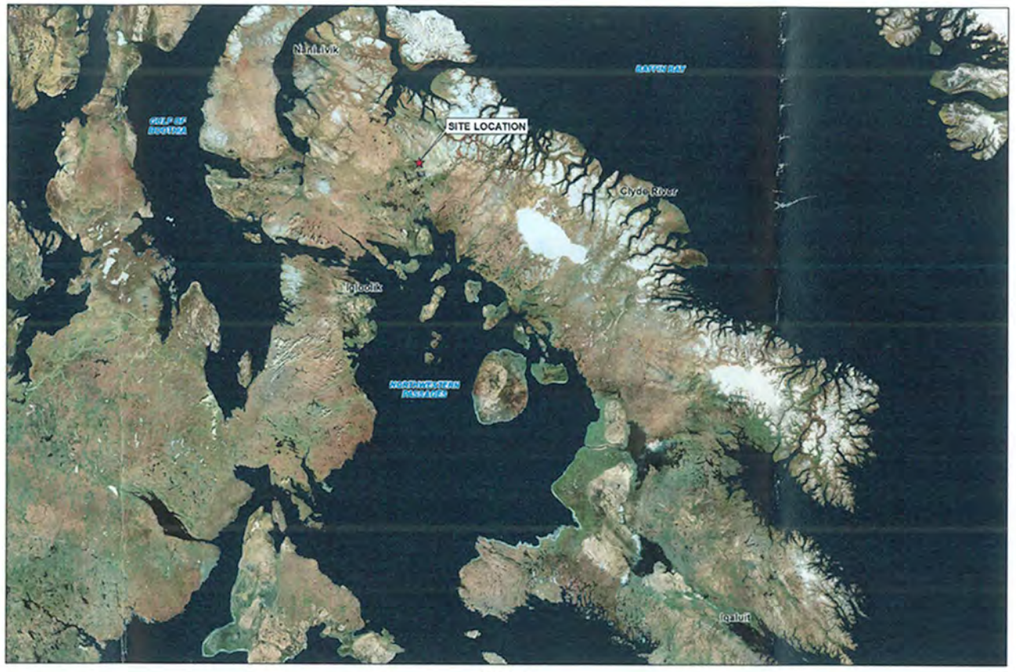
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
CV224

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - CV224	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - CV224	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV224	2
004	ROAD PLAN, PROFILE AND SECTIONS - 224	2

SPECIFICATIONS		
SPECIFICATION NO.	SPECIFICATION TITLE	REVISION NO.
1667708-S	TOTE ROAD EARTHWORKS	1

DESIGN REPORT		
REPORT NO.	REPORT TITLE	REVISION NO.
1667708	TOTE ROAD EARTHWORKS	0



KEY PLAN
NOT TO SCALE

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 949
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NORTHWEST TERRITORIES

CLIENT
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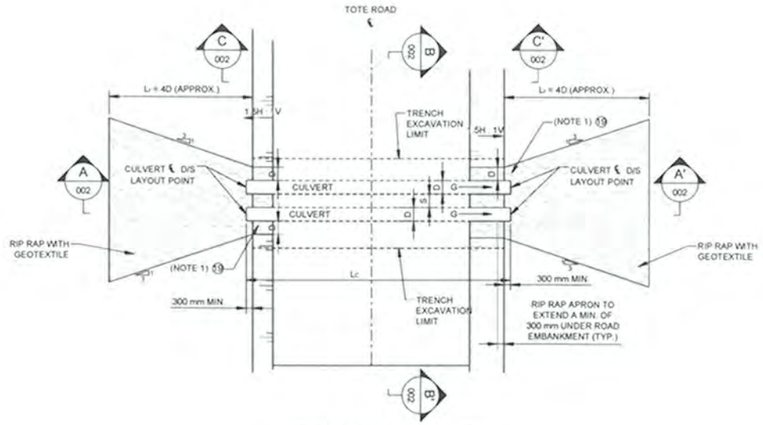
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

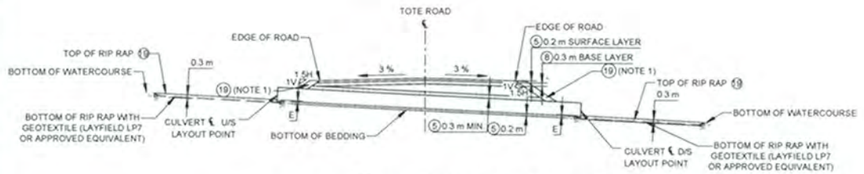
TITLE
TITLE SHEET - CV224

PROJECT NO	PHASE	REV	1 of 4	DRAWING
1667708	3000	2		001

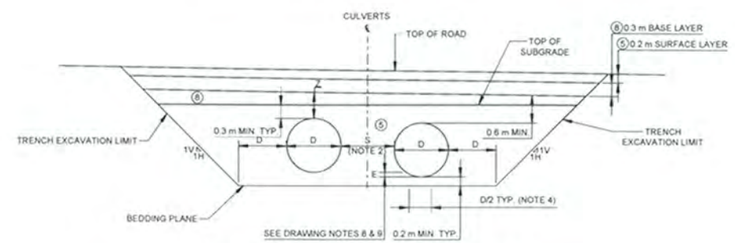
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



SCALE 1:200 m (A 002) PIPE CROSSING TYPICAL PROFILE



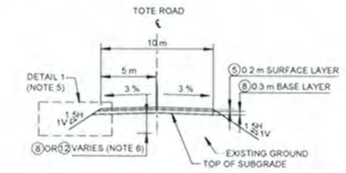
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

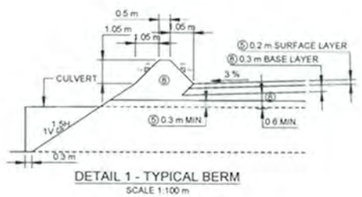
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

DRAWING NOTES

1. EROSION PROTECTION SHALL BE PLACED AROUND THE CULVERT INLET AND OUTLET AS PER THE DIRECTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
2. THE MINIMUM SPACING (S) BETWEEN CULVERTS SHALL BE D, WHERE D IS THE CULVERT DIAMETER, OR 1.5 m, WHICHEVER IS GREATER.
3. THE MINIMUM COVER DEFINED AS THE DISTANCE BETWEEN THE TOP OF CULVERT TO THE TOP OF SUBGRADE SHALL BE 0.6 m OR D/4, WHERE D IS THE CULVERT DIAMETER, WHICHEVER IS GREATER.
4. THE BEDDING TO BE SHAPED TO RECEIVE PIPE.
5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
6. FOR EMBANKMENT FILL DEPTHS LESS THAN 0.6 m, TYPE 8 MATERIAL SHALL BE USED; FOR FILL DEPTHS GREATER THAN 0.6 m, AND DEPENDING ON THE FILL EXTENTS, TYPE 12 MATERIAL MAY BE USED.
7. DEFINITIONS AND VALUES OF D,Lc,Lr, AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 003.
8. FOR FISH BEARING CULVERT WITH MULTIPLE PIPES, ONLY ONE SHALL BE EMBEDDED BY "E" AND ALL OTHER PIPES SHALL BE PLACED ON GROUND / BOTTOM OF WATER COURSE.
9. AS PER CULVERT DETAILS (DWG 003)FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



SCALE 1:200 m (C 002) EMBANKMENT SECTION



DETAIL 1 - TYPICAL BERM
SCALE 1:100 m

GENERAL CONSTRUCTION NOTES

1. IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THE USE OF ITS MOST RECENT REVISION.
2. THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE SPECIFICATIONS AND REPORT LISTED ON DWG. 001.
3. IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE SPECIFICATIONS, CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE SPECIFICATIONS.
4. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK.
5. THE INFORMATION PRESENTED ON THESE DRAWINGS IS INTENDED TO CONVEY THE PIPE CROSSING CONSTRUCTION DETAILS AND ROAD EMBANKMENT DETAILS.
6. ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED.
7. COORDINATE SYSTEM IS UTM (NAD 83) ZONE 17N.
8. CONTOUR INTERVAL IS 1 M WITH EXISTING TOPOGRAPHY.
9. THE DESIGN OF EACH INSTALLATION ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY.
10. THE GROUND SURFACE ELEVATIONS ARE CONSIDERED TO BE APPROXIMATE.
11. A DECISION ON WHETHER TO EXTEND OR REPLACE EACH CULVERT WILL BE MADE BY THE OWNER'S REPRESENTATIVE.
12. FIELD FITTING OF CULVERTS (INCLUDING LOCATIONS, LENGTHS, INVERT DEPTHS, GRADIENTS, AND SKEWS) TO ACTUAL CONDITIONS AT EACH SITE SHALL BE AS DIRECTED BY THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
13. FILL MATERIALS SHALL BE HANDLED, SORTED, PLACED AND COMPACTED AS SHOWN ON THE DRAWINGS, DESCRIBED IN THE SPECIFICATIONS AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE WITH INPUT FROM THE GEOTECHNICAL ENGINEER.
14. NO GEOTECHNICAL OR STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATIONS HAS **BEEN CARRIED OUT. A MINIMUM CULVERT COVER OF 0.6 m OR D/4 (WHERE D IS THE** DIAMETER OF THE CIRCULAR CULVERT PIPE) HAS BEEN ASSUMED TO BE APPROPRIATE FOR 10 TONNE AXLE LOADS. USE OF HEAVIER TRUCKS WILL REQUIRE STRUCTURAL ANALYSIS OF THE CULVERT INSTALLATION.
15. FISH BEARING STATUS IN CULVERT DETAILS TABLE ON DWG. 003 TAKEN FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
16. NO HYDROLOGIC OR HYDRAULIC ANALYSIS WAS CARRIED OUT. NUMBER OF CULVERTS, CULVERT DIAMETER(S), CULVERT LENGTH(S), EMBEDMENT DEPTH (E), AND REQUIREMENTS FOR RIP RAP FROM HATCH TOTE ROAD CULVERT DATA SHEETS H349000-3000-10-088-0030 THROUGH H349000-3000-10-088-0034.
17. IN SECTIONS, SKEWED CULVERTS ARE PROJECTED ONTO PLANE OF CROSS-SECTIONS.
18. AT LIMITS OF CONSTRUCTION NEW PAVEMENT THICKNESS NEEDS TO BE TAPERED TO MATCH EXISTING PAVEMENT SURFACE.
19. THE OWNER'S REPRESENTATIVE WILL CONFIRM THE REQUIREMENT FOR SAFETY BERMS ALONG THE ROAD EDGES BASED ON ENCOUNTERED FIELD CONDITIONS. TYPICAL BERM DETAILS ARE SHOWN ON DWG 002.
20. SITE SPECIFIC NOTES ON DWG. 003 MUST BE READ IN CONJUNCTION WITH THESE GENERAL NOTES, AND THE SPECIFICATIONS AND DRAWINGS LISTED ON DWG 001.
21. BAFFINLAND IS RESPONSIBLE FOR PERMITTING OF THE PROPOSED WORKS (IF REQUIRED).
22. PRIOR TO CONSTRUCTION, BAFFINLAND'S ENVIRONMENTAL REPRESENTATIVE WILL BE CONSULTED TO APPROVE THE REQUIRED EROSION CONTROL AND MITIGATION MEASURES ADJACENT TO WATER BODIES.

0 2 4
1:50 METRES

0 5 10
1:100 METRES

0 10 20
1:200 METRES

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT-TO-PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT: Baffinland
CONSULTANT: Golder Associates

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TYPICAL DETAILS AND GENERAL NOTES - CV224

PROJECT NO.	PHASE	REV.	SHEET	DRAWING
1667708	3000	2	2 of 4	002

Reduced Size
NOT TO SCALE

CULVERT DETAILS†

STATION (m)	FISH BEARING STATUS (REFER TO NOTE 15 ON DWG. 002)	EXISTING CULVERT DIAMETER (D) (mm) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT LENGTH (m) (REFER TO NOTE 16 ON DWG. 002)	EXISTING CULVERT GRADIENT (%) (REFER TO NOTE 16 ON DWG. 002)	EMBEDMENT DEPTH (E) (mm) (REFER TO NOTE 16 ON DWG. 002)	PROPOSED CULVERT LENGTH (m)	DEPTH FROM SUBGRADE TO TOP OF CULVERT AT CENTRELINE OF ROAD (Z) (m)	EASTING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	NORTHING OF CENTRELINE OF PIPE AT CENTRELINE OF ROAD (m)	INLET INVERT ELEVATION (m)	OUTLET INVERT ELEVATION (m)	CULVERT GRADIENT (G) (%)	CULVERT SKEW (deg)	INLET RIP RAP REQUIRED?	OUTLET RIP RAP REQUIRED?	RIP RAP APRON LENGTH (Lr) (m)
0+136.0	YES	1000	15	1.05		37.5	1.1	556232.2	7915055.6	154.8	154	2	122	N	N	

†CULVERT LOCATION DETAILS ARE BASED ON A DESK STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SUPPORTED BY FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 12 ON DWG. 002)

SITE SPECIFIC NOTES FOR CULVERT CV224

AS INDICATED IN THE GENERAL CONSTRUCTION NOTES ON DWG. 002, THE SITE SPECIFIC NOTES ARE BASED ONLY ON A DESKTOP STUDY OF THE SITE; NO FIELD WORK WAS CARRIED OUT TO SUPPORT THIS WORK. AN INSPECTION OF THE SITE SHALL BE CARRIED OUT BY THE OWNER'S REPRESENTATIVE AND/OR GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTION. THE SITE SPECIFIC NOTES ARE INTENDED TO BE COMPREHENSIVE BUT NOT ALL-INCLUSIVE.

1. **WIDEN THE ROAD RUNNING SURFACE AT THE CULVERT LOCATION TO A MINIMUM WIDTH OF 10 m, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
2. **WIDEN THE ROAD RUNNING SURFACE TO A MINIMUM OF 10 m ON THE APPROACHES TO THE CULVERT LOCATION, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL).**
3. **ADD/ SHAPE EMBANKMENT FILL TO FLATTEN THE ROAD EMBANKMENT SIDE SLOPES TO NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL), MAINTAINING THE ROAD RUNNING SURFACE WIDTH A MINIMUM OF 10 m.**
4. **RAISE THE ROAD EMBANKMENT TO PROVIDE ADEQUATE CULVERT PIPE COVER, MAINTAINING THE ROAD EMBANKMENT SIDE SLOPES NO STEEPER THAN 1.5 : 1 (HORIZONTAL : VERTICAL) AND THE ROAD RUNNING SURFACE A MINIMUM WIDTH OF 10 m.**
5. CAP THE ROAD SURFACE WITH SUITABLE RUNNING SURFACE MATERIAL (SEE TYPICAL SECTION ON DWG. 002).
6. PROVIDE SAFETY BERMS WHERE EMBANKMENT FILL IS GREATER THAN 3 m ABOVE EXISTING GROUND SURFACE.
7. PROVIDE RIP RAP PROTECTION AT THE CULVERT INLET AND OUTLET.
8. MARK THE CULVERT ENDS WITH DELINEATORS OF SUFFICIENT SIZE AND HEIGHT TO REDUCE THE RISK OF DAMAGE TO THE CULVERT PIPE ENDS BY SNOW PLOWING, SIDE SLOPING, OR OTHER MAINTENANCE OPERATIONS.

ROAD LAYOUT DETAILS

STATION (m)	TOP OF SUBGRADE			CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE		
	CENTRELINE EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)		OFFSET TO LEFT TOE** (m)	OFFSET TO RIGHT TOE** (m)	GRADIENT TO NEXT POINT (%)
0+000.0	556108.8	7914999	159.8	-0.3	5.2	5.5	-1.1
0+020.0	556126.8	7915007.8	159.5	-0.5	6.1	6.5	-1.1
0+036.4	556141.5	7915014.9	159.3	-0.5	6.3	6.4	-1.2
0+040.0	556144.7	7915016.5	159.3	-0.4	6.3	6.2	-1.7
0+060.0	556162.7	7915025.3	159	-0.4	6.8	6.1	-2.2
0+063.7	556166	7915026.9	158.9	-0.4	6.9	6.1	-2.2
0+080.0	556180.7	7915034.1	158.5	-0.4	6.5	6.2	-2.2
0+085.0	556184.1	7915040.7	158.2	-0.3	6.5	6.1	-2.2
0+100.0	556198.7	7915042.8	158.1	-0.2	6.1	6.0	-2.2
0+113.0	556210.6	7915048	157.8	-0.5	6.3	6.3	-1.9
0+120.0	556217.1	7915050.5	157.6	-1.1	11.7	6.5	-1
0+136.0	556232.3	7915055.6	157.5	-2.7	14.5	7.2	-0.2
0+140.0	556236.1	7915056.7	157.5	-2.7	14.5	7.3	0.8
0+160.0	556255.6	7915061.3	157.7	-2.4	13.4	7.6	1.9
0+164.8	556260.3	7915062.2	157.7	-1.5	13.7	7.4	2.7
0+180.0	556275.3	7915064.9	158.2	-0.7	7.2	6.5	4.2
0+200.0	556295	7915068.4	159	-0.2	6.5	5.9	5.8
0+220.0	556314.7	7915071.8	160.2	-0.4	6.4	5.9	7.2
0+233.2	556327.6	7915074.1	161.1	-0.4	6.4	6.4	7.8
0+240.0	556334.4	7915075.3	161.6	-0.5	6.5	6.4	7.8
0+260.0	556354	7915078.8	163.2	-0.8	7.1	7.0	7.8
0+280.0	556373.7	7915082.3	164.8	-0.3	5.7	6.4	7.8
0+289.4	556383	7915083.9	165.5	-0.2	5.3	5.2	

* NEGATIVE CUT DEPTH DENOTES FILL
** MEASURED ON GROUND SURFACE

REV	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
1	2017-03-24	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 0	JJL	CK/RAD	MJT	RAD
0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

CLIENT: Baffinland
CONSULTANT: Golder Associates

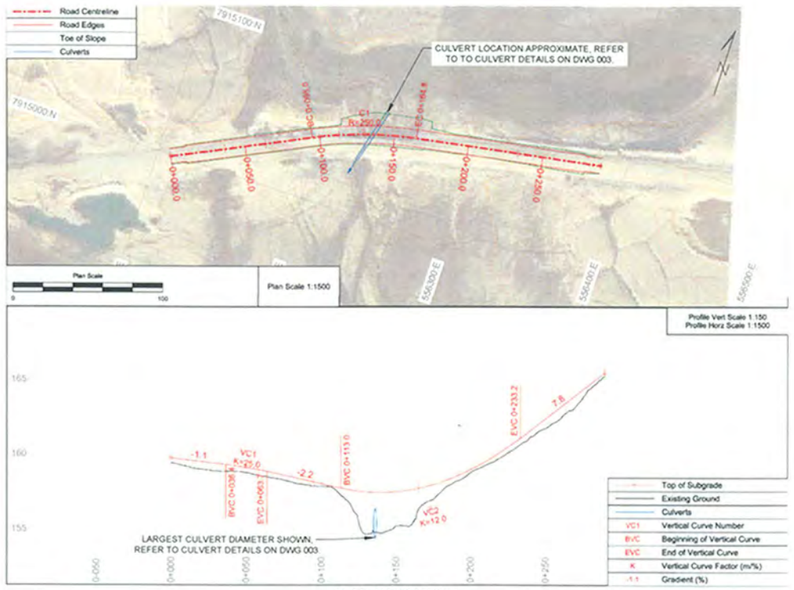
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

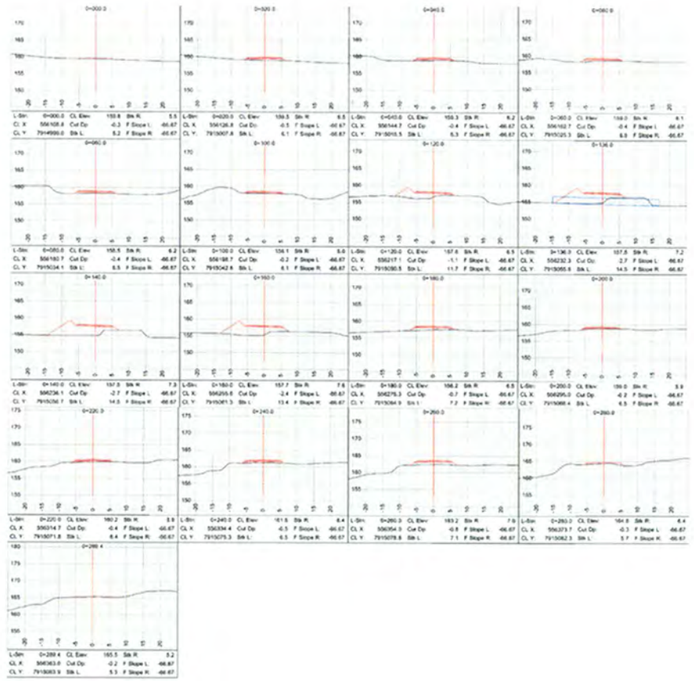
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV224

PROJECT NO	PHASE	REV	3 of 4	DRAWING
1667708	3000	2		003

Reduced Size
NOT TO SCALE



PLAN AND PROFILE



SECTIONS
(REFER TO GENERAL CONSTRUCTION NOTE 17)

REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
2	2017-04-03	ISSUED FOR CONSTRUCTION - SPECIFICATIONS REV. 1 / REPORT REV. 0	JJL	CK/RAD	MJT	RAD
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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
A	2017-02-24	ISSUED FOR CLIENT REVIEW	JJL	CK/RAD	MJT	RAD

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS CONSULTANT
LICENSEE
2017-04-03
NUNAVUT

Baffinland

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PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - CV224

PROJECT NO	PHASE	REV	4 of 4	DRAWING
1667708	3000	2		004

APPENDIX C

Specifications

SPECIFICATION

The document revision number is indicated below. Please replace all revised pages of this document and destroy the superseded copies.

PROJECT:	MARY RIVER PROJECT		SPECIFICATION NO.: 1667708-S				REV 1
PROJECT NO:	1667708		GOLDER REFERENCE NO.: 1667708-S				
TITLE:	TOTE ROAD EARTHWORKS PROJECT						
ISSUED FOR	REV No.	ORIGIN	DATE		ISSUED-PAGES/SECTIONS		INITIAL
			OUT	IN			
Client Review	A	RAD	3-Mar-17				
Issued for Construction	0	RAD	24-Mar-17				
Re-issued for Construction	1	RAD	3-Apr-17				

New Issue _____

Revised Sheet Only Attached _____

Entire Document Re-issued X

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature **Original Signed**
Date _____
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

FINAL DOCUMENT APPROVAL

BAFFINLAND APPROVAL		GOLDER APPROVAL	
Mine Manager:		Senior Review:	**Original Signed and Sealed**
Date:		Date:	April 3, 2017
Environmental Manager:		Project Manager:	**Original Signed**
Date:		Date:	April 3, 2017
Engineering Lead:		Originator:	**Original Signed**
Date:		Date:	April 3, 2017

Table of Contents

1.0 SCOPE OF WORK

1.1 General

.1 This Specification defines the requirements for furnishing of all labour, equipment and materials required for construction of Tote Road Earthworks as specified herein for Baffinland Iron Mine Corporation's Mary River Project in the Nunavut Territory of Canada.

.2 Modifications or deviations from this Specification and/or the Drawings listed herein shall only occur with the written approval of Golder Associates Ltd.

.3 The Scope of Work (hereafter referred to as the Work) defined herein includes the construction of culvert improvements including installation/extension of culverts, placement of erosion protection material, construction of road realignments, and pavement improvement/construction on the Tote Road, as indicated on the Drawings. Phased construction in support of the construction timeline is planned. Phase limits of works will be at the direction of the Owner's Representative based on the work schedule, weather, availability of construction materials, and the like.

.4 The Tote Road will remain active for the duration of the Work. The Contractor shall coordinate with the Owner's Representative such that interruptions to hauling activities are minimized.

.5 The Contractor shall perform the Scope of Work such that no damage to existing infrastructure occurs unless otherwise approved by the Owner's Representative.

.6 All Work shall conform to the lines, grades, cross-sections, and details indicated in the Drawings listed in Table 1. Included in the work is: care and control of water, processing of materials as necessary, material stockpiling, loading, hauling, fill placement, fill compaction, and finishing of all materials classified as acceptable for fill material. Excavation and backfilling of materials shall include sorting or screening that may be necessary to produce the required gradations.

1.2 Definitions

.1 The definition of primary terms used on the Construction Drawings and in the Specification for this contract is listed below:

.a	*Owner:*	*Baffinland Iron Mines Corporation*
.b	*Owner's Representative:*	*Baffinland Iron Mines Corporation or named representative.*
.c	*Geotechnical Engineer:*	*Golder Associates Ltd.*
.d	*Contractor:*	*Baffinland Iron Mines Corporation or Nunavut registered Company contracted to successfully carry out the Scope of Work described herein.*
.e	*Project Site:*	*Mary River Project.*
.f	*Work Site:*	*Limits of Work which is generally defined by the Tote Road and adjacent areas as shown on the Drawings.*
.g	*Quality Control*	*The planned system of inspections carried out to standard specifications that are used to directly monitor and control the quality of the construction project. Construction quality control is required to ensure that the work is carried out in compliance with the Drawings and this Specification.*
.h	*Quality Assurance*	*The planned system of activities that provide the Owner, lending institutions and permitting agencies assurance that the facilities were constructed as specified in the design. Quality Control forms a subset of the Quality Assurance program. Quality Assurance comprises inspections carried out during Quality Control and includes verification, evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. Quality Assurance refers to measures taken by the Quality Assurance organization to assess if the Contractor is in compliance with the design, Drawings, and this Specification.*
.i	*Passes*	*A pass, for compaction specification purposes, is defined as the complete passing over, and return, of the specified compaction equipment over a section of material. Material which has been compacted in one pass will have the equipment roll over it twice.*

1.3 Acronyms and Abbreviations

.1 The acronyms and abbreviations commonly used in the Drawings and in the Specification for this contract are listed below:

.a	*2H:1V*	*Slope of 2 horizontal units to 1 vertical unit.*
.b	*%*	*Percent.*
.c	*ASTM*	*ASTM International; formerly known as American Society for Testing and Materials.*
.d	*CSP*	*corrugated steel pipe.*
.e	*CSA*	*Canadian Standards Association.*
.f	*m*	*metre.*
.g	*mm*	*millimetre.*
.h	*N*	*Newton.*
.i	*t*	*tonne.*

1.4 Protection

.1 The Contractor is responsible for the care and protection of all existing utilities, instrumentation and site development that may be located within the Work Site areas.

.2 Confirmation of existing functioning culvert locations shall be completed by the Contractor prior to the start of work. The Contractor shall exercise care including but not limited to marking and protecting the culverts, such that these culverts are not damaged. Any damage caused, or suspected to have been caused by the Contractor, its Subcontractors and/or Sub-subcontractors shall be immediately reported to the Owner's Representative. Any damage to culverts caused by Contractor and its Subcontractors shall be repaired to the satisfaction of the Owner's Representative, with input from the Geotechnical Engineer.

.3 In areas where construction activities are carried out in or adjacent to existing site development, the location, isolation, and/or relocation of buried utilities shall be completed before any excavation commences. Care shall be exercised during excavation to avoid damage to existing buried pipes, structures, ducts, power and grounding cables. If damage to any of these occurs, the Owner's Representative shall be notified immediately, and corrective action shall be taken by the Contractor according to the instructions of the Owner's Representative.

1.5 Drawings

.1 This Specification defines the requirements for performing the work as outlined on the most recent revision of the Drawings presented in Table 1 for the culvert sites listed in Table 2. In the event of a discrepancy between the Specification and the Drawings, the discrepancy shall be reported to Geotechnical Engineer in writing; the Geotechnical Engineer shall provide clarification to the Owner. The Contractor shall proceed only upon receipt of written clarification from the Owner.

Table 1: Tote Road Earthworks Project Drawings Set Per Culvert Site Listed in Table 2

Drawing Number	Drawing Title
001	Title Sheet
002	Pipe Crossing Typical Details and General Notes
003	Culvert Installation Design Recommendations & Design Tables
004	Road Plan, Profile and Sections

Table 2: Tote Road Earthworks Culvert Sites

Culvert Site	Drawing Set Revision No.
BG01	2
BG04	2
BG29	2
BG32	2
CV001	2
CV046 A&B	2
CV059	2
CV099	2
CV106	2
CV112	2
CV186	2
CV187	2
CV216	2
CV224	2

1.6 Submissions

.1 The Contractor shall prepare and submit a Work Plan to the Owner for review and approval within five days of receipt of a Notice to Proceed. The Contractor shall revise the Work Plan to the satisfaction of the Owner, following review. The Contractor shall commence with the Scope of Work only upon written authorization from the Owner.

.2 In general, the Work Plan shall contain the following:

.a A detailed Health, Safety and Environmental Plan for all the tasks within the Scope of Work. The Health, Safety and Environmental Plan shall satisfy all Project Site requirements and be to the satisfaction of the Owner.

.b The Contractor's understanding of the Scope of Work.

.c The Methods for performing the Scope of Work.

.d The list of equipment to be used to perform the Scope of Work, with the service records for all equipment for a two-year period prior to the start of the work.

.e A description of the Temporary Protection System to protect the stability and function of the Tote Road during construction.

.f A description of the dust control measures to be used.

.g A Quality Control Plan. The Contractor is responsible for controlling the quality of the Work including that performed by its Subcontractors, Sub-subcontractors, and Suppliers and for assuring that the specified quality is achieved. The Contractor, and its Subcontractors, Sub-subcontractors, and Suppliers shall be responsible for developing and maintaining a quality control program which is responsive to the requirements of the Specification.

.h A Schedule for performing the Scope of Work, including work activities and milestones. The schedule shall be revised and updated throughout the performance of the Work. Weekly updates of the Schedule shall be submitted by the Contractor in hardcopy and electronic formats for review and comment by the Owner.

.i *A list of Personnel for performing the Scope of Work.*

.j *A list of proposed Subcontractors, Sub-subcontractors, and Suppliers. Use of Subcontractors, sub-Subcontractors and/or Suppliers shall be made only upon approval by the Owner.*

.k *Inclusion of additional requirements presented in the Specification.*

.3 The Contractor shall submit weekly as-built survey information in hardcopy and electronic formats to the Owner for review and comment. All as-built survey information may be checked by the Owner with input provided by the Geotechnical Engineer. The Contractor will revise as-built survey information as directed by the Owner. All as-built information mutually agreed upon between the Contractor and Owner shall not thereafter be subject to dispute.

.a *For earthworks: At the direction of the Owner's Representative, with input provided by the Geotechnical Engineer, the Contractor shall survey the limits of prepared surfaces. Cross sections and longitudinal profiles shall be obtained to define the form and elevations of the prepared surfaces. In areas of fill placement, accurate surveying shall be performed to determine the limits of fill placement and presentation of cross sections at no less than 5 m spacing along the culvert axis and 20 m spacing along the road centreline. All survey information may be checked at any time during the Work by the Owner's Representative and/or the Geotechnical Engineer.*

.b *For geosynthetic materials: At the direction of the Owner's Representative with input provided by the Geotechnical Engineer, the Contractor shall survey the limits of the prepared surfaces prior to the placement of geosynthetic materials. During placement, the Contractor shall record the limits of placement for each panel of geosynthetic material and include the type and roll number. All survey information may be checked at any time during the Work by the Owner's Representative and/or the Geotechnical Engineer.*

.c *The Contractor may be directed by the Owner's Representative, with input from the Geotechnical Engineer, to collect and present survey information outside of the requirements presented in the Specification. The details of this survey information shall be mutually agreed between the Contractor and Owner's Representative prior to the start of activity.*

.4 The Contractor shall submit daily and weekly Construction Activity Reports including, but not limited to the following:

.a *A description of work activities performed.*

.b Lists of the equipment and personnel utilized.

.c Results and comments on quality of work performed.

.d A list of submissions.

.e A summary of progress relative to the schedule, and necessary updates and/or changes.

.f The quantities of materials placed, hauled and the like.

.g A summary of health and safety performance.

1.7 Dust Control

.1 The dust resulting from construction activities shall be controlled by the Contractor to prevent the spreading of dust and to avoid creation of a nuisance in the surrounding area. The requirement and judgment of acceptability of dust control measures shall be at the direction of the Owner's Representative.

.2 During fill placement, dust control, such as watering the upper surface of the fill to maintain a damp condition, may be utilized. Any use of dust suppression chemicals shall only be used with the approval of the Owner's Representative.

1.8 Inspection and Testing

.1 The Owner will provide Quality Assurance measures to monitor for compliance with the Drawings and Specification requirements with input from the Geotechnical Engineer. Quality Assurance monitoring will be performed throughout the Work activities.

.2 The Contractor shall perform activities to meet the requirements of the Quality Control Plan. The results of these activities shall be provided to the Owner's Representative and Geotechnical Engineer in hardcopy and electronic format.

.3 The minimum requirements for Quality Control testing are presented in Table 3. It is important to note that additional requirements are presented throughout this Specification. It is the responsibility of the Contractor to ensure that all Quality Control requirements are satisfied. The Owner's Representative and/or Geotechnical Engineer shall monitor all Quality Control testing and results; the Contractor shall cooperate accordingly.

.4 When Checklist items (Section 8.0) are completed, the Contractor shall submit written requests for Quality Assurance approvals to the Owner's Representative.

Table 3: Minimum Requirements for Quality Control Testing

Material	Test	Frequency
Screened Material – Type 5	Lift thickness	Measured continually
	Elevation of compacted lift	Measured continually
	Compaction effort including number of passes and equipment traffic pattern	Monitored continually
	Particle-size analysis (ASTM D422 and ASTM D1140)	One test for every 750 m^3 placed
Jaw Run Material – Type 8	Lift thickness	Measured continually
	Elevation of compacted lift	Measured continually
	Compaction effort including number of passes and equipment traffic pattern	Monitored continually
	Maximum particle size (visual inspection)	Measured continually
Run of Quarry – Type 12	Lift thickness	Measured continually
	Elevation of compacted lift	Measured continually
	Compaction effort including number of passes and equipment traffic pattern	Monitored continually
	Maximum particle size (visual inspection)	Measured continually
Erosion Protection Material – Type 19	Lift thickness	Measured continually
	Elevation of compacted lift	Measured continually
	Maximum particle size (visual inspection)	Measured continually

.5 The Contractor shall cooperate and assist with the Quality Assurance monitoring activities including, but not limited to the following:

.a *Obtaining samples of materials.*

.b *Providing and reviewing of documentation.*

.c *Surveying the sampling locations.*

.6 The Contractor and the Owner's Representative will be made aware of the Quality Assurance monitoring results. The Geotechnical Engineer shall provide recommendations, if appropriate, to the Owner's Representative regarding corrective measures required to be carried out by the Contractor. At the direction of the Owner's Representative, the Contractor shall make reasonable efforts to address the identified deficiencies.

.7 Construction checklist forms included at the end of this Specification are required for documenting the quality control and other aspects of the construction activities as detailed in the quality control plan(s). The checklists included in Section 8.0 shall be finalized and signed off by the Contractor, the Owner's Representative, and the Geotechnical Engineer for acceptance of the construction activities. If the Geotechnical Engineer is not on site, the Owner's Representative is required to provide the information to the Geotechnical Engineer.

1.9 Codes and Standards

.1 Work shall conform to, but not be limited to, the requirements of the most recent editions of the following standards and codes which are part of this Specification. It is important to note that additional standards may be referenced by those listed below; it is the responsibility of the user of this document to be familiar with all the applicable standards.

.a	ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.b	ASTM D422	Standard Test Method for Particle-Size Analysis of Soils.
.c	ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
.d	ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
.e	ASTM D4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
.f	ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
.g	ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
.h	ASTM D6241	Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.

.i	ASTM D5199	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
.j	ASTM D5261	Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
.k	CSA-G401	Corrugated Steel Pipe Products

.l Safety Act of Nunavut (Consolidation of Safety Act R.S.N.W.T. 1988,c.S-1)

.a Mine Health and Safety Act and Regulations for Nunavut.

1.10 Description of Items

.1 The Tote Road Culvert Improvement Project consists of the following:

.a Pipe Crossing Construction – The work shall include the construction of trenches, the supply and placement of bedding, the supply and laying of pipes, joining of pipes, backfilling of trenches, construction of culvert inlet end rip rap protection, construction of culvert outlet end rip rap protection, construction of the granular pavement, and site reinstatement as specified, and the supply of all materials, labour, plant, transport and tools required for proper completion of the work

.b Tote Road Pavement Reinstatement/Construction – The work shall include the supply and placement of fills for the reconstruction of granular road pavements over pipe crossings and approaches, and the construction of new granular pavements on Tote Road realignments, and reinstatement as specified, and the supply of all materials, labour, plant, transport and tools required for proper completion of the work.

.2 The Contractor is required to load and haul materials from the crusher, pits, quarries and other locations for placement at the Tote Road. These materials will be stockpiled by Others in locations as directed by the Owner's Representative. The Contractor shall load and haul from the stockpiles as directed by the Owner's Representative.

1.11 Dimensional Tolerances

.1 All excavations and fill shall be completed to be within 0.1 m horizontally and plus 0.1 m vertically of specified lines and grades unless otherwise approved by the Owner's Representative. Fill placement and/or removal to meet these tolerances to the lines and limits shown in the Drawings shall be performed by the Contractor at no additional cost to the Owner.

.2 Culvert pipe gradients shall be established within ±0.5% of those shown on the Drawings.

.3 Slopes shall not be steeper than those shown on the Drawings unless otherwise approved by the Owner's Representative with recommendations provided by the Geotechnical Engineer.

.4 Temporary excavation and fill slopes shall not be steeper than two horizontal to one vertical (2H:1V) unless otherwise approved by the Owner's Representative with recommendations provided by the Geotechnical Engineer.

.5 Temporary bedrock excavation slopes shall not be steeper than one tenth horizontal to one vertical (0.1H:1V) unless otherwise approved by the Owner's Representative with recommendations provided by the Geotechnical Engineer.

2.0 CARE OF WATER

.1 Excavation, fill and backfill work areas shall be continuously and effectively drained. Excessive water shall not be permitted to accumulate in excavations or areas for fill. The Contractor shall construct suitable dykes or drains, or provide pumping equipment, as required to divert water flows away from Work areas. The proposed points of discharge shall be approved by the Owner's Representative. The Contractor must also ensure that sediments contained in diverted water will not enter natural watercourses.

.2 The Contractor shall be responsible for the design and construction of all temporary diversion measures, dewatering systems, pumping facilities, siphons, snow/ice removal and the like, required for satisfactory management of water and ice on the Site. These shall be submitted for review and approval by the Owner's Representative prior to commencing construction.

.3 Backfill operations may not commence until all water and snow/ice has been drained or otherwise removed from the excavation and the Owner's Representative, with input from the Geotechnical Engineer, has approved the commencement of backfilling operations.

3.0 TRENCH EXCAVATION

3.1 Work Sequence

.1 The limits of works and elevations will be at the direction of Owner's Representative based on field conditions.

.2 The Contractor may start work after the following:

- Receipt of an Approval to Proceed from the Owner's Representative.
- Receipt of approval from the Owner's Representative of the as-built survey information submission for pre-work conditions.
- The implementation of the Temporary Protection System.
- Completion of the perimeter water control structures around the work area, thereby containing/diverting runoff.

3.2 Products

.1 Unsuitable Material includes topsoil, organic soils, vegetation, and boulders to a depth or in a location that will impede the placement and compaction of Competent Material. Unsuitable Material may be frozen in situ. Within the excavation limits of the pipe crossing, Unsuitable Material may include Mineral Soil that has high clay, silt, water, and/or ice content.

.2 Mineral Soil is the near-surface layer of earth materials generally composed of till-like soil, including but not limited to varying proportions of clay, silt, sand, gravel, cobbles, and boulders. Thawed Mineral Soil materials are normally suitable for mechanical excavation. Frozen Mineral Soil materials may require the use of drilling, blasting, ripping, and/or other techniques approved by the Owner's Representative with input from the Geotechnical Engineer to prepare the materials for excavation.

.3 Existing Fill is the soil and rock fill placed previously for the construction of the Tote Road. Thawed Existing Fill materials are normally suitable for mechanical excavation. Frozen Existing Fill materials may require the use of drilling, blasting, ripping and/or other techniques approved by the Owner's Representative (with input from the Geotechnical Engineer) to prepare the materials for excavation.

.4 Bedrock is the underlying rock formation composed of frost-shattered weathered bedrock and/or intact unweathered bedrock that will require the use of drilling, blasting, ripping, and/or other approved techniques to prepare the materials for excavation.

.5 Competent Material includes Mineral Soil, Existing Fill and the underlying Bedrock as determined by the Geotechnical Engineer.

.6 The determination of Unsuitable Material and Competent Material will be made by the Geotechnical Engineer. The Contractor may be required to assist during the determination by performing such work as proof rolling, test pit excavation, and sampling as directed by the Geotechnical Engineer.

3.3 Execution

.1 The Contractor shall ensure that the Temporary Protection System for the Tote Road is in place.

.2 The Contractor shall excavate Unsuitable Material, Mineral Soil, Existing Fill, and/or Bedrock for the pipe crossing construction in areas indicated in the Drawings and as directed by the Owner's Representative (with input from the Geotechnical Engineer).

.3 Excavation shall be to the lines, grades and dimensions specified in the Drawings and the Specifications.

.4 Excavations shall be kept stable and dry.

.5 Excavated Unsuitable Materials shall be disposed of at locations indicated by the Owner's Representative. Surfaces of disposed material shall be sloped such that no water ponds on the surface. Suitable erosion protection shall be installed to capture sediments (i.e. silt fencing) at the direction of the Owner's Representative.

.6 Excavated Mineral Soil, Existing Fill, and/or Bedrock which is considered by the Geotechnical Engineer suitable for reuse shall be stockpiled at locations indicated by the Owner's Representative. A determination of the acceptability of materials for reuse shall be made with input from the Geotechnical Engineer.

.7 The Contractor shall allow the Owner's Representative and the Geotechnical Engineer to review the excavation to evaluate conformance to the Drawings and Specifications. Acceptance of excavations shall be performed and recorded by the Owner's Representative.

.8 The disposal area for Unsuitable Material shall be shaped to smooth, uniform surfaces with side slopes not steeper than three horizontal to one vertical (3H:1V).

.9 The Contractor shall prepare and submit as-built information of excavation limits, disposal areas and stockpiles to Owner's Representative for review.

.10 The Contractor shall submit appropriate checklists according to Section 8.0.

4.0 CULVERT PIPE SUPPLY AND INSTALLATION

4.1 General

.1 The Owner shall provide CSPs for use in Pipe Crossing Construction as per the Drawings or as directed by the Owner's Representative.

.2 The Contractor shall be responsible for the installation of the CSP.

4.2 Handling and Storage

.1 Handling on site is the responsibility of the Contractor and/or Owner as directed by the Owner's Representative.

.2 The Contractor shall ensure the handling equipment used on the site is adequate and does not pose any risk of damage to the CSP. Any damage to a CSP shall be repaired by the Contractor as per Manufacturer's recommendations or shall be replaced, as directed by the Owner's Representative.

.3 Upon start-up of the Work, the Contractor and the Owner's Representative shall conduct a surface observation of all CSPs for defects and for damage.

.4 The Owner's Representative may identify the following:

.a CSPs or portions thereof, which should be rejected and removed from the site because they have severe flaws;

.b CSPs which include minor repairable flaws, which can be used follow repair.

.5 The Owner shall provide storage space in a location (or several locations) such that on-site transportation and handling are minimized.

4.3 Installation

.1 CSP shall be laid within the location, alignment, and grade tolerances specified in Section 1.11 and as per the Drawings.

.2 CSP shall be kept clean and dry as work progresses.

.3 CSPs shall be joined by means of steel couplers. Couplers shall be installed to lap approximately equal portions of the pipe being connected and such that the corrugations of the couplers properly engage the pipe corrugations. As the couplers are being tightened they shall be tapped with a mallet to take up the slack.

.4 The diameter or the span and rise of flexible culvert pipes shall not vary from the manufactured dimensions by more than 5% during cover and backfill placing operations.

.5 The Contractor shall submit checklists according to Section 8.0.

5.0 PIPE CROSSING CONSTRUCTION

5.1 Work Sequence

.1 The limits of works and elevations will be at the direction of Owner's Representative based on field conditions.

.2 The Contractor may start work after the following:

- Receipt of an Approval to Proceed from the Owner's Representative.
- Receipt of approval from Owner's Representative of the as-built survey information submission for pre-work conditions.
- Completion of Excavation, if applicable.

5.2 Products

.1 Pipe includes CSP as defined in Section 4.0.

.2 Fill Materials include excavated Mineral Soil or Existing Fill (as defined in Section 3.0), Screened Material – Type 5, Jaw Run Materials – Type 8, and/or other materials free from frozen lumps, ice, snow, cinders, ash, refuse, and cobbles and boulders over 150 mm approved by the Owner's Representative, with recommendations provided by the Geotechnical Engineer, for culvert construction.

.3 Screened Material – Type 5 consists of 32 mm minus material produced by a screening plant. This material will be stockpiled separately at the Crusher Site by Others. Placement of Screened Material – Type 5 will be within the areas as shown on the Drawings and/or as directed by the Owner's Representative. In general, the Screened Material will meet the gradation specifications shown in Table 4.

Table 4: Screened Material – Type 5 Gradation Specification

Sieve Designation	Percent Passing, by Weight
32 mm	100%
25 mm	70 – 100%
9.5 mm	40 – 70%
4.75 mm	30 – 55%
2.0 mm	22 – 42%
0.6 mm	15 – 30%
0.075 mm	4 – 8%

.4 Jaw Run Material – Type 8 consists of 150 mm minus material produced by the crusher. This material will be stockpiled separately at the Crusher Site by Others. Placement of Jaw Run Material will be within the areas as shown on the Drawings and/or as directed by the Owner's Representative. In general, the Jaw Run Material will meet the following gradation specifications (Table 5):

Table 5: Jaw Run Material – Type 8 Fill Gradation Specification

Sieve Designation	Percent Passing, by Weight
200 mm	100%
150 mm	95 - 100%
100 mm	50 - 100%
50 mm	30 - 60%
19 mm	15 - 35%
4.75 mm	10 - 25%
0.075 mm	0 - 5%

.1 Geotextile as defined in Section 7.0.

.2 Erosion Protection Material – Type 19 consists of selected Run of Quarry material. Erosion Protection Material will be stockpiled separately. The Contractor will be responsible for sorting the Run of Quarry material to meet the specifications for Erosion Protection Material. Placement of Erosion Protection Material will be within the areas shown on the Drawings and/or as directed by the Owner's Representative. In general, the Erosion Protection Material will meet the following gradation specification:

Table 6: Erosion Protection Material – Type 19 (D_{50} of 150 mm) Gradation Specification

Particle Diameter (mm)	Percent Passing, by Weight
300	100%
285	85 – 100%
240	65 – 85%
210	50 – 75%
150	25 – 50%
135	15 – 45%
75	0 – 15%

5.3 Execution

.1 Trench Excavation (Section 3.0) to be completed, if applicable.

.2 Culvert pipe trench is to be plane and uniform and to the lines and grades shown in the Drawings. No fill materials are to be placed on the prepared surface without approval from the Owner's Representative with input from the Geotechnical Engineer. The checklist (Section 8.0) shall be signed off by the Contractor, Owner's Representative and Geotechnical Engineer for acceptance of the surface before bedding or fill may be placed. The Owner's Representative is required to document and report observations to the Geotechnical Engineer.

.3 The Contractor shall develop and document a compaction equipment pattern to achieve required compaction of Fill Materials to the satisfaction of the Owner's Representative, with input from the Geotechnical Engineer.

.4 The Contractor shall haul materials to designated fill placement area(s) in the Pipe Crossing area and spread material in horizontal lifts starting from the lowest grade. The maximum loose lift thicknesses are as follows:

.a *0.2 m for Screened Material – Type 5.*

.b *0.3 m for all other Fill Materials.*

.c *0.3 m for Erosion Protection Material – Type 19.*

.d *Modifications to maximum loose lift thicknesses shall be at the direction of the Owner's Representative with recommendations provided by the Geotechnical Engineer. The Owner's Representative, with input from the Geotechnical Engineer, shall, with the cooperation of the Contractor, conduct field trials to assess material placement techniques and achieved placement densities to assess possible variations to the loose lift thicknesses.*

.5 Any Fill Materials which have become saturated, softened, loosened, or have undergone a reduction in density by precipitation, ponded water, construction traffic, or frost action are to be excavated and replaced with suitable material. The Owner's Representative with input from the Geotechnical Engineer shall identify areas in which material should be removed. This work shall be performed to the satisfaction of the Owner's Representative. The excavated material may be dried and/or thawed and used for fill upon approval from the Owner's Representative using recommendations provided by the Geotechnical Engineer.

.6 Before suspension of operations each day or before inclement weather, the in-place material shall be compacted and the surface smoothed and crowned to promote runoff of precipitation.

.7 Erosion Protection Material shall be placed around the culvert inlet and outlet at the direction of the Owner's Representative, with input from the Geotechnical Engineer.

.8 Geotextile is to be placed at areas shown on the Drawings or at the direction of the Owner's Representative (with input from the Geotechnical Engineer). Geotextile to be installed as per Section 7.4.

.9 Culvert pipe Bedding shall consist of Screened Material – Type 5 which shall be shaped to the dimensions specified in the Drawings, compacted and shaped to receive the shape of the pipe.

.10 Culvert Pipe to be installed as per Section 4.3.

.11 Screened Material – Type 5 placed in the pipe haunches must be compacted prior to continued placement of backfill material around the pipe.

.12 Screened Material – Type 5 shall be placed and compacted on both sides of the pipe simultaneously. At no time shall the levels of material on each side differ by more than 0.2 m.

.13 Cover material shall be placed so that damage to or movement of the pipe is avoided. Before allowing the movement of any construction equipment or vehicular traffic over the completed pipe culvert, the depth of cover over the pipe shall be at least 0.6 m or D/4 (where D is the pipe diameter) whichever is greater, and must be a sufficient depth required for protection.

.14 Oversize particles shall be removed from the fill. Where reduced lift thicknesses are required, particles larger than two-thirds (2/3) of the reduced lift thickness shall be removed prior to compaction. Requirements for reduced lift thicknesses shall be determined by the Owner's Representative with recommendations provided by the Geotechnical Engineer.

.15 Fill Materials shall be compacted using a vibratory plate tamper or other compaction equipment approved by the Geotechnical Engineer:

a. *Mineral Soil, Fill Materials, Erosion Protection Materials and other Materials shall be compacted using a performance-based requirement. It is expected that a minimum of 5 passes (see Section 1.2 for the definition of a "pass") of compaction equipment will be required for the Mineral Soil and Fill Materials. The compaction method and degree of compaction achieved in the field will be monitored by the Owner's Representative with input from the Geotechnical Engineer. The Contractor shall cooperate with the Owner's Representative and Geotechnical Engineer to develop methods to achieve a satisfactory degree of compaction for the Bedding and Fill Materials.*

.16 Pipe Crossings shall be constructed to the lines, grades and cross sections shown in the Drawings or as directed by the Owner's Representative with input from the Geotechnical Engineer.

.17 Stream bed approach to be re-trained to the satisfaction of the Owner's Representative, with input from the Geotechnical Engineer, if applicable.

.18 Fill Materials placed in the Trench shall be free from lenses, pockets, or layers of materials which are significantly different in gradation from the surrounding material. The Contractor shall employ methods to limit the amount and zones of segregated materials. The Contractor shall work with the Owner's Representative with input from the Geotechnical Engineer to develop such methods which may include, but not be limited to, the placement of parallel strips of Fill Materials within a given lift and/or material blending. The Geotechnical Engineer shall provide recommendations to the Owner's Representative as to the acceptability of the results of the placed materials. Fill Materials shall be placed and compacted to the satisfaction of the Owner's Representative.

.19 Sufficient survey control and records shall be maintained to provide the following:

.a *Layout of the work.*

.b *Measurement of in-place quantities of each product placed, including but not limited to, providing elevation of the prepared surface prior to fill placement.*

.c *Preparation of as-built information for hard copy and electronic submission to the Owner's Representative; the Contractor shall maintain as-built records suitable to update the Drawings upon completion.*

.d *Verification of the accuracy of the work.*

.e *Survey records which may be reviewed at any time by the Owner's Representative and/or Geotechnical Engineer.*

.f *Timely provision and quality of survey information to the satisfaction of the Owner's Representative with recommendations provided by the Geotechnical Engineer.*

.20 The Contractor shall submit appropriate checklists according to Section 8.0.

6.0 TOTE ROAD PAVEMENT CONSTRUCTION

6.1 Work Sequence

.1 The limits of works and elevations will be at the direction of Owner's Representative based on field conditions.

.2 The Contractor may start work after the following:

- Receipt of an Approval to Proceed from the Owner's Representative.
- Receipt of approval from Owner's Representative of as-built survey information submission for pre-work conditions.
- Completion of embankment filling operations and culvert installation as appropriate.

6.2 Products

.1 Fill Materials as defined in Section 5.2.

.2 Screened Material – Type 5 as defined in Section 5.2.

.3 Jaw Run Material – Type 8 as defined in Section 5.2.

.4 Run of Quarry – Type 12 consists of unsorted run of quarry material. This material will be stockpiled separately at the Quarry locations by Others. Placement of Run of Quarry Material will be within the areas as shown on the Drawings and/or as directed by the Owner's Representative. The Contractor will be responsible for removing oversized material. In general, the Run of Quarry Material will meet the gradation specification in Table 7:

Table 7: Run of Quarry Material – Type 12 Gradation Specification

Particle Diameter (mm)	Percent Passing, by Weight
1000	100%
600	95 – 100%
300	50 - 100%
150	0 – 80%
19	0 – 30%
4.75	0 – 10%

6.3 Execution

.1 Limits of Tote Road Pavements are shown on the Drawings.

.2 The pavement shall consist of a Surface layer 0.2 m thick, placed and compacted on a Base layer 0.3 m thick, placed and compacted on the new embankment fill or existing embankment.

.3 The Surface layer shall consist of Screened Material Type 5 material.

.4 The Base layer shall consist of Jaw Run Material Type 8 material.

.5 The Contractor shall haul materials to designated fill placement area(s) within the haul road area and spread material in horizontal lifts starting from the lowest grade. The maximum loose lift thicknesses will be:

.a 0.2 m for Screened Material – Type 5.

.b 0.3 m for Jaw Run Material – Type 8.

.c 1.0 m for Run of Quarry – Type 12.

.d Modifications to maximum loose lift thicknesses shall be at the direction of the Owner's Representative with recommendations provided by the Geotechnical Engineer. The Owner's Representative, with input from the Geotechnical Engineer, shall, with the cooperation of the Contractor, conduct field trials to assess material placement techniques and achieved placement densities to assess possible variations to the loose lift thicknesses.

.6 Surface layer and Base layer materials shall be compacted using equipment traffic approved by the Geotechnical Engineer.

.7 Surface layer and Base layer materials shall be compacted using a performance-based requirement. The Contractor shall cooperate with the Owner's Representative and the Geotechnical Engineer to develop methods to achieve a satisfactory degree of compaction for the Fill Materials: the Contractor shall develop and document a compaction equipment pattern to achieve required compaction of Fill Materials to the satisfaction of the Owner's Representative, with input from the Geotechnical Engineer. The compaction methods and degree of compaction achieved in the field will be monitored by the Owner's Representative with input from the Geotechnical Engineer.

.8 Sufficient survey control and records shall be maintained to provide the following:

.a Layout of the Work.

.b Measurement of in-place quantities.

.c Preparation of as-built information for hardcopy and electronic submission to the Owner's Representative.

.g Verification of the accuracy of the work.

.h Survey records which may be reviewed at any time by the Owner's Representative and/or Geotechnical Engineer.

.i Timely provision and quality of survey information to the satisfaction of the Owner's Representative with recommendations provided by the Geotechnical Engineer.

.9 The Contractor shall submit appropriate checklists according to Section 8.0.

7.0 GEOTEXTILE SUPPLY AND INSTALLATION

7.1 General

.1 The Work includes the handling and installation of non-woven needle-punched Geotextile for possible use in Ditch Repair/Construction, and/or Erosion Protection as directed by the Owner's Representative. The Contractor shall be responsible for the handling and installation of the Geotextile.

.2 The Owner will provide the Geotextile that meets the Specification.

7.2 Non-Woven Geotextile Material Properties

.1 The Owner shall furnish a Geotextile whose material properties meet or exceed the requirements of this Specification.

.2 The specific properties for non-woven Geotextile Layfield LP12 or its equivalent as listed in Table 8 shall be met.

Table 8: Property Specifications for Non-Woven Geotextile

Material Property	Qualifier	Unit	Specified Value	Test Method
Mass	minimum	g/m^2	407	ASTM D5261
Grab Tensile Strength	minimum	N	1330	ASTM D4632
Grab Elongation	minimum	%	50	ASTM D4632
Tear Resistance	minimum	N	511	ASTM D4533
Thickness	nominal	mm	3.0	ASTM D5199
CBR Puncture Strength	minimum	N	3510	ASTM D6241
Apparent Opening Size	maximum	mm	0.150	ASTM D4751
Permittivity	minimum	sec^{-1}	0.8	ASTM D4491
Water Flow Rate	minimum	$L/min/m^2$	2,650	ASTM D4491
UV Resistance	minimum	% @ 500 hr	70	ASTM D4355

7.3 Handling and Storage

.1 Handling on site is the responsibility of the Contractor and/or Owner as directed by the Owner's Representative.

.2 The Contractor shall ensure the handling equipment used on the site is adequate and does not pose any risk of damage to the Geotextile.

.3 Upon start-up of the Work, the Contractor and the Owner's Representative shall conduct a surface observation of all rolls or factory panels for defects and for damage. This inspection shall be conducted without unrolling rolls or unfolding factory panels unless defects or damages are found or suspected.

.4 The Owner's Representative may:

.a Identify rolls, factory panels, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and

.b Identify rolls or factory panels which include minor repairable flaws.

.5 The Owner shall provide storage space in a location (or several locations) such that on-site transportation and handling are minimized.

.6 The Contractor shall ensure that storage of the Geotextile provides adequate protection against UV exposure, dirt, shock, and other sources of damage in accordance with the Manufacturer's recommendations.

7.4 Installation

.1 Geotextile sheet shall be installed with sufficient tension to preclude fold and wrinkles and the entire geotextile sheet shall be weighted with sandbags or equivalent to avoid wind damage until the Erosion Protection Material is placed.

.2 If weather damage should occur the Owner's Representative will determine if the geotextile shall be repaired or replaced. Weather damage to the geotextile will include tears and dirty fabric.

.3 All seams shall consist of minimum 0.6 m overlaps. Greater overlaps shall be provided if there is potential for the overlap to move.

.4 Overlaps shall be shingled in the direction of flow such that the upgradient sheet is installed on top of the downgradient sheet.

.5 Overlaps shall be arranged in the direction of slopes. Horizontal overlaps running across slopes are not acceptable.

.6 The Contractor shall ensure the handling equipment used on the site is adequate and does not pose any risk of damage to the Geotextile.

8.0 CONSTRUCTION CHECKLISTS

The following construction checklist forms documenting QA and QC and other aspects of the construction activities, by work activity, are attached:

- Tote Road Site Checklist – Pipe Crossing
  - Trench Excavation
  - Bedding and Pipe Installation
  - Trench Backfill
- Tote Road Site Checklist – Road Embankment Construction
- Tote Road Site Checklist – Granular Pavement Construction

The Contractor may propose alternative forms for approval by the Owner's Representative and the Geotechnical Engineer.

The checklists are to be signed by all parties prior to acceptance of each activity within the defined work area.

Tote Road Site Checklist – Pipe Crossing – Trench Excavation

CONTRACTOR:	DATE:	SHIFT: DAY - NIGHT
CULVERT ID:	STATION:	ROAD SIDE: LEFT - RIGHT

No.	ITEMS TO BE INSPECTED	INSPECTED BY CONTRACTOR	INSPECTED BY QA REPRESENTATIVE
1	Survey lines checked to ensure the locations conform with the Drawings.		
2	Storage areas planned for disposal/ stockpiling of removed materials.		
3	Occurrence of snow and removal method in place, if required.		
4	Occurrence of surface water and its impact mitigation, if required.		
5	Dewatering measures provided, if required.		
6	Pre-construction condition photographed (along alignment of planned excavation, both directions).		
7	Unsuitable materials, snow, ice, and saturated materials and Mineral Soils removed from area as indicated in the Drawings.		
8	Visual inspection during excavation performed and photographed (along alignment of excavation and sidewalls).		
9	Surface competent and free of major protrusions and photographed (along alignment of trench, both ways).		
10	Final surface conditions meets the Specification and photographed (along alignment of trench, both ways).		
11	As-built survey conducted pre- and post- excavation and disposal of Organic Material and Stockpiled Material.		

REMARKS:

DEVIATIONS: (Attach list if necessary)

DATE OF RECTIFICATION:

ACCEPTED BY QA REPRESENTATIVE	ACCEPTED BY CONTRACTOR	ACCEPTED BY OWNER'S REPRESENTATIVE
NAME: _____	NAME: _____	NAME: _____
SIGNATURE: _____	SIGNATURE: _____	SIGNATURE: _____
DATE: _____	DATE: _____	DATE: _____

Tote Road Site Checklist – Pipe Crossing – Bedding and Pipe Installation

CONTRACTOR:	DATE:	SHIFT: DAY - NIGHT
CULVERT ID:	STATION:	

No.	ITEMS TO BE INSPECTED	INSPECTED BY CONTRACTOR	INSPECTED BY QA REPRESENTATIVE
1	Survey lines and layout conform to the Drawings.		
2	Required visual inspection of existing condition before Fill Material placement (photographed after excavation).		
3	Required assessment of Fill Material before placement (Particle-size analysis for Type 5 – Screened Material).		
4	Unsuitable Materials, snow, ice and loose or saturated materials removed prior to placement.		
5	Dewatering measures provided, if required.		
6	Fill lift thickness according to Specifications.		
7	Fill materials contain no frozen lumps or Unsuitable Material.		
8	Bedding shaped to receive pipe and photographed.		
9	Pipe condition inspected prior to installation and photographed along pipe axis, both directions.		
10	Segregation of fill materials controlled during placement.		
11	Required visual inspection of placed materials performed.		
12	Weather conditions meet requirements during fill placement and compaction.		
13	As-built survey conducted pre- and post- construction. Final work photographed.		

REMARKS:

DEVIATIONS: (Attach list if necessary)

DATE OF RECTIFICATION:

ACCEPTED BY QA REPRESENTATIVE	ACCEPTED BY CONTRACTOR	ACCEPTED BY OWNER'S REPRESENTATIVE
NAME: _____	NAME: _____	NAME: _____
SIGNATURE: _____	SIGNATURE: _____	SIGNATURE: _____
DATE: _____	DATE: _____	DATE: _____

Tote Road Site Checklist – Pipe Crossing – Trench Backfill

CONTRACTOR:	DATE:	SHIFT: DAY - NIGHT
CULVERT ID:	STATION:	ROAD SIDE: LEFT - RIGHT

No.	ITEMS TO BE INSPECTED	INSPECTED BY CONTRACTOR	INSPECTED BY QA REPRESENTATIVE
1	Survey lines and layout conform to the Drawings.		
2	Required visual inspection of trench condition before Fill Material placement		
3	Required assessment of Fill Material before placement (particle- size analysis for Type 5 and visual inspection of Type 8 maximum particle size).		
4	Unsuitable Materials, snow, ice and loose or saturated materials removed prior to placement.		
5	Dewatering measures provided, if required.		
6	Fill lift thickness according to Specifications.		
7	Fill materials contain no frozen lumps or Unsuitable Material.		
8	Screened Material – Type 5 completed on each side of the pipe simultaneously. Material in the haunches placed and well compacted prior to continued fill placement.		
9	Segregation of fill materials controlled during placement.		
10	Required visual inspection of placed materials performed and photographed.		
11	Required compaction of fill materials performed.		
12	Weather conditions meet requirements during fill placement and compaction.		
13	As-built survey conducted pre- and post- construction. Final work photographed.		

REMARKS:

DEVIATIONS: (Attach list if necessary)

DATE OF RECTIFICATION:

ACCEPTED BY QA REPRESENTATIVE	ACCEPTED BY CONTRACTOR	ACCEPTED BY OWNER'S REPRESENTATIVE
NAME: _____	NAME: _____	NAME: _____
SIGNATURE: _____	SIGNATURE: _____	SIGNATURE: _____
DATE: _____	DATE: _____	DATE: _____

SPECIFICATION

Tote Road Site Checklist – Road Embankment Construction

CONTRACTOR:	DATE:	SHIFT: DAY - NIGHT
CULVERT ID:	STATION:	ROAD SIDE: LEFT - RIGHT

No.	ITEMS TO BE INSPECTED	INSPECTED BY CONTRACTOR	INSPECTED BY QA REPRESENTATIVE
1	Survey lines and layout conform to the Drawings.		
2	Required visual inspection of condition of footprint of new embankment on existing road embankment or existing ground before Fill Material placement		
3	Required assessment of Fill Material before placement (visual inspection of particle size Type 8 and/or Type 12 maximum particle size).		
4	Unsuitable Materials, snow, ice and loose or saturated materials removed prior to placement.		
5	Dewatering measures provided, if required.		
6	Fill lift thickness according to Specifications.		
7	Fill materials contain no frozen lumps or Unsuitable Material.		
9	Segregation of fill materials controlled during placement.		
10	Required visual inspection of placed materials performed and photographed.		
11	Required compaction of fill materials performed.		
12	Weather conditions meet requirements during fill placement and compaction.		
13	Surface of fill left compacted, smooth, and graded to promote drainage at end of every fill operation or the end of each shift, whichever occurs sooner.		
14	As-built survey conducted pre- and post- construction. Final work photographed.		

REMARKS:

DEVIATIONS: (Attach list if necessary)

DATE OF RECTIFICATION:

ACCEPTED BY QA REPRESENTATIVE	ACCEPTED BY CONTRACTOR	ACCEPTED BY OWNER'S REPRESENTATIVE
NAME: _____	NAME: _____	NAME: _____
SIGNATURE: _____	SIGNATURE: _____	SIGNATURE: _____
DATE: _____	DATE: _____	DATE: _____

SPECIFICATION

Tote Road Site Checklist – Granular Pavement Construction

CONTRACTOR:	DATE:	SHIFT: DAY - NIGHT
CULVERT ID:	STATION:	ROAD SIDE: LEFT - RIGHT

No.	ITEMS TO BE INSPECTED	INSPECTED BY CONTRACTOR	INSPECTED BY QA REPRESENTATIVE
1	Survey lines and layout conform to the Drawings.		
2	Required visual inspection of condition of completed compacted subgrade before Fill Material placement		
3	Required assessment of Fill Material before placement (particle- size analysis for Type 5 and visual inspection of Type 8 maximum particle size).		
4	Unsuitable Materials, snow, ice and loose or saturated materials removed prior to placement.		
5	Dewatering measures provided, if required.		
6	Fill lift thicknesses according to Specifications.		
7	Fill materials contain no frozen lumps or Unsuitable Material.		
8	Segregation of fill materials controlled during placement.		
9	Required visual inspection of placed materials performed and photographed.		
10	Required compaction of fill materials performed.		
11	Weather conditions meet requirements during fill placement and compaction.		
12	Surface of fill left compacted, smooth, and graded to promote drainage at end of every fill operation or the end of each shift, whichever occurs sooner.		
13	As-built survey conducted pre- and post- construction. Final work photographed.		

REMARKS:

DEVIATIONS: (Attach list if necessary)

DATE OF RECTIFICATION:

ACCEPTED BY QA REPRESENTATIVE	ACCEPTED BY CONTRACTOR	ACCEPTED BY OWNER'S REPRESENTATIVE
NAME: _____	NAME: _____	NAME: _____
SIGNATURE: _____	SIGNATURE: _____	SIGNATURE: _____
DATE: _____	DATE: _____	DATE: _____

END OF SECTION: 1667708-S

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APPENDIX D

Inspection Form

APPENDIX D
Inspection Form

INSPECTOR:	DATE:
LOCATION (CULVERT ID, STATION):	

No.	INSPECTION QUESTIONNAIRE	INSPECTOR ANSWERS	ADDITIONAL COMMENTS
Culvert Sites			
1	Is the culvert inlet free of debris/ sediment?	Y N N/A	
2	Is the culvert inlet in good condition (i.e. no signs of erosion, erosion protection in good condition)?	Y N N/A	
3	Are the culverts sitting on the stream bed or embedded in the streambed (i.e. not perched)?	Y N N/A	
4	Is the culvert outlet free of debris/ sediment?	Y N N/A	
5	Is the culvert outlet in good condition (i.e. no signs of erosion, erosion protection in good condition)?	Y N N/A	
6	Is the streambed downstream of the outlet in good condition?	Y N N/A	
7	Are the culverts free draining? Are they free from blockage?	Y N N/A	
8	Is the culvert in good structural condition? (i.e. ends are not damaged, no buckling, etc.)	Y N N/A	
9	Is the water discharging from the culvert clear? [if no, comment on the colouring of the water] Did you take a sample of the water?	Y N N/A Y N N/A	
10	Is the road above the culvert in good condition (i.e. no signs of settlement)?	Y N N/A	
11	If there are constructed ditches that drain to the culvert, are the ditches free draining? Are they free from blockage? Do the ditches have sufficient freeboard (0.3 m min.) from the top of the tote road? [If no, note the locations in the comments]. Is the erosion protection in the ditch in good condition (i.e. no signs of erosion/ movement)? [If no, note the locations in the comments and photograph.] Is the water in the ditch clear? [If no, provide comment on the colouring of the water and note the location of change.] Did you take a sample of the water?	Y N N/A Y N N/A Y N N/A Y N N/A Y N N/A	
12	If there are any cut slopes in the area, are they adequately protected with erosion protection? [If no, note the locations in the comments and photograph.]	Y N N/A	
13	Did you take a photos of the site, culvert inlet and outlet, cut slopes, ditches and any other relevant observations? Record the photograph ID and description of the photograph on next page.	Y N N/A	

INSPECTOR RATING OF OVERALL CONDITION OF CULVERT CROSSING:

VERY POOR POOR MODERATE GOOD VERY GOOD

INSPECTOR OVERALL COMMENTS:

REVIEWER'S COMMENTS ON INSPECTION:

ACCEPTED BY REVIEWER

NAME: _____ SIGNATURE: _____ DATE: _____

MAINTENANCE/ REPAIR RECOMMENDATIONS:

MAINTENANCE COMPLETED SIGNOFF:

NAME: _____ SIGNATURE: _____ DATE: _____

INSPECTOR:		DATE:
LOCATION (CULVERT ID, STATION):		
PHOTO ID.	**DATE OF PHOTO CAPTURE**	**BRIEF PHOTO DESCRIPTION**

ADDITIONAL/ MISCELLANEOUS COMMENTS:
(i.e. weather, recent precipitation, nearby earthworks, recent grading, recent site upgrades?):

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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