Baffinland

2017 WORK PLAN ADDENDUM

May 26, 2017

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2017-05-11	0	Issued for Use	A. Grzegorczyk	T. Burlingame	B. Penney
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SECTION 1.0 - INTRODUCTION

On November 4, 2016, Baffinland Iron Mines Corporation (Baffinland) submitted the 2017 Work Plan for the Mary River Project. The following document presents a 2017 Work Plan Addendum ('Addendum') which is an update to the 2017 Work Plan submitted on November 4, 2016. The purpose of this Addendum is to include additional detail and work scope proposed for 2017 that was not captured in the November 4, 2016 submission.

The additional work scope items presented in this document are required to facilitate the ongoing Project as approved under amended NIRB Project Certificate No. 005 and current Type A Water Licence 2AM-MRY1325 and shall be conducted in accordance to Commercial Lease No. Q13C301 (the Lease) agreed between Baffinland and the Qikiqtani Inuit Association (QIA).

In the event the Project does not advance, the work items as described and constructed in the Addendum will be subject to reclamation, as per the Mary River Project Interim Closure and Reclamation Plan (BAF-PH1-830-P16-0012) and relevant regulatory and permit obligations.

The Addendum has been prepared in accordance with the Draft Commercial Lease Operations Guide developed during 2015. The draft Operations Guide is a set of procedures developed jointly by QIA and Baffinland to guide the on-going administration of the Lease. This document was developed using the draft Commercial Lease Operations Guide procedure entitled "Annual Work Plan Submission".

An overview of the work activities included in the Addendum is provided below and further details are presented in subsequent sections of the document.

1. Execution of the Tote Road Earthworks Execution Plan and Design Report – previously identified as required in November 4, 2016 submission but details were not available at that time
2. Replacement of accommodations camps
3. Development of required support infrastructure for increased work force (e.g. fuel storage and water treatment).

SECTION 2.0 - LIST OF CURRENT PERMITS

The Addendum is presented within the context of the applicable regulatory authorizations. Subject to corresponding modifications and/or amendments, the main regulatory instruments that allow for the Addendum have not changed from Baffinland's original 2017 Work Plan submission in November 2016.

SECTION 3.0 - SCOPE OF WORK FOR 2017 WORK PLAN ADDENDUM

The Mary River Project requires several capital improvements to address sedimentation issues, meet production targets for the 2018 and 2019 shipping season, and help address employee attraction and retention concerns. These capital improvements are predominantly based around the upgrade of accommodations camps, corresponding additional site support infrastructure, and the purchase and mobilization of additional equipment. The work proposed is summarized in Table 3-1 and further detailed in the subsections 3.1 and 3.2 below.

3.1 PRE-2017 SEALIFT

Commencing prior to the 2017 sealift(s), capital improvements are focused along the Tote Road in an effort to address dust and sedimentation issues which have been identified as a growing concern. In order to prioritize the sites along the Tote Road requiring remediation or modification to address dust and sedimentation issues, Baffinland underwent an iterative engineering process through engagement of subject matter experts to prioritize the sites and required activities. The result of this process and the actions proposed to be conducted by Baffinland is described in a 'Tote Road Earthworks Execution Plan and Design Report' (Golder, 2017).

The Tote Road Earthworks Execution Plan and Design Report is presented in Appendix C of the 2017 Work Plan Addendum and includes replacement of 14 culverts and road re-surfacing. Due the nature of the activities (replacement, resurfacing), the actions described within the Tote Road Earthworks Execution Plan and Design Report are not expected to have a financial security impact. See Appendix C for the Tote Road Earthworks Execution Plan and Design Report.

3.2 POST-2017 SEALIFT

In addition to the activities described in the Tote Road Earthworks Execution Plan and Design Report (Appendix C), additional work activities are planned in 2017, post-sealift, in order to meet production targets for the 2018 and 2019 shipping season and to help address employee attraction and retention issues. In order to achieve these activities, equipment and materials to execute the work are proposed to be delivered during the 2017 open water season.

Baffinland is in the position to execute these capital improvements in 2017 based on improved iron ore prices and access to new capital. Addressing the issues these capital improvements are hoping to solve (performance of the Tote Road, camp capacity limitations during peak periods, employee attraction and retention) are deemed necessary and is expected to be beneficial to the Mary River Project's performance as whole.

The activities proposed to occur post-2017 sealifts includes the replacement of existing camps on-site to allow for a standard of living which is consistent with industry standards in the Canadian Arctic and the indirect increases of maintenance/laydown areas, housing for 3rd Party contractors and additional fuel requirements to allow for the activity to occur. The specific activities planned to occur post-2017 sealift are described further in the subsections below. Current planning expects all work to be complete by the 2018 open water season in order for construction equipment, materials and facilities no longer required to be backhauled during this period.

3.2.1 Accommodations and Support Utilities

3.2.1.1 Mine Site

The Mine Site presently has a 210-person hard walled camp along with a 140-person soft-walled camp. The soft-walled camp has been in service since 2007 and has shared occupancy rooms and bathrooms.

Existing operations presently fill both camps with no surplus room for contractors and any surges during the summer season. The style and age of the soft walled camp has caused significant employee attraction and retention issues to the extent financial supplements per rotation need to be offered to Baffinland operational employees housed in soft walled accommodations in order to maintain required staffing levels.

In order to address employee attraction and retention issues while increasing camp capacity to allow for workforce surges, a new camp is proposed to be mobilized and installed to replace both the existing soft walled camp and the existing hard-walled camp. The camp will be capable of housing all operations, contractors and surge personnel to consolidate housing and therefore lower costs and risks while not limiting the operation in manpower.

This 800-person camp will include the following:

- 3 story with precast concrete foundations
- Hard walled with individual washrooms
- Kitchen, dining, rec, kitchen and office facilities
- Potable water treatment plant
- Sewage water treatment plant
- Incinerator
- Power generation (Two (2) at 2MW)

The camp proposed was selected based on used camps available on the open market that can provide accommodations in a standard of living which is consistent with industry standards in the Canadian Arctic. Additional camp design details are shown in Attachment D.

Once the 800-person camp is commissioned and operational, the existing soft walled camp and the existing hard-walled camp will be disassembled and demobilized. This is expected to occur in 2018.

In addition to the replacement of the existing camps at the Mine Site (post-sealift), an existing 35-person camp that was previously located at the Mid-Rail camp site will be assembled to handle surge labor during the summer of 2017. The 35-person camp includes the following:

- Four-Person ‘Norseman’-style’ Tents installed on an existing laydown
- Kitchen, dining, rec, kitchen and office facilities

Although there will be an increase in bed-space relative to current operations, water usage and discharge will remain within currently permitted values and discharge locations in 2017. Existing infrastructure and utilities at the Mine Site (sewage treatment, potable water, incinerators, and landfill) will be used to service the proposed camps in addition to the marginal increase of infrastructure and equipment described above.

3.2.1.2 Port Site

Milne Port presently has a 120-person hard walled camp along with as 153-person soft walled camp. The soft-walled camp was built to a lower standard to the hard-walled camp, with shared washrooms and showers, minimal recreation areas, minimal phones and generally a lesser quality solution for housing. Existing operations presently fill both camp with no surplus room for contractors and any surges during the summer season. To house contractors initially for the 2017 capital improvements, a new 50-person

soft-wall rapid deploy will be mobilized and assembled in 2017. The new 50-person rapid deploy includes the following:

- Soft wall tents installed on an existing laydown
- Kitchen, dining, rec, kitchen and office facilities

The laborers held at the 50-person rapid deploy camp will be utilized to assemble a 380-person temporary camp. This 380-person temporary camp includes:

- Soft-walled dorm facilities with hard walled core facilities
- Rig matt foundations on existing laydown
- Single rooms with common washrooms and shower facilities
- kitchen, dining, rec, kitchen and office facilities
- Potable water treatment plant
- Sewage water treatment plant
- Incinerator

Additional camp design details for the 380-person temporary camp are shown in Attachment D.

Although not planned to occur in 2017, in 2018, upon the replacement of the 210-person hard-walled camp at the Mine Site, three (3) wings or 90 rooms from the Mine Site hard-walled camp shall be relocated to Milne Port to provide additional accommodations at an equal standard to the existing 120-person hard-wall camp at Milne Port. Upon completion, the expanded hard-walled camp at Milne Port will then be able to accommodate 210-persons and 380-person temporary camp may no longer be required.

Although there will be an increase in bed-space relative to current operations, water usage and discharge will remain within currently permitted values and discharge locations. Existing infrastructure and utilities at the Milne Port (sewage treatment, potable water, incinerators, and landfill) will be used to service the proposed camps in addition to the marginal increase of infrastructure and equipment described above.

3.2.2 Laydowns

With the addition of ore haul trucks and associated labour, further storage will be required for parts, consumables and food. Existing laydowns are only sufficient for the current operations therefore expansion of these pads or additional pads will be required to accept the 2017 sealift and provide temporary areas for contractors to stage equipment, facilities and materials. See Table 3-1 for details on proposed additional laydowns.

3.2.3 Fuel Storage

With the addition of camp space, ore haul trucks and support equipment, site fuel burn rates have increased. More frequent deliveries are not an option due to the limited shipping window, therefore additional fuel storage is proposed. The additional fuel tanks proposed to be constructed in 2017 include:

- 1 x 15 million litre diesel fuel tank
- 1 x 3 million litre diesel fuel tank
- 1 x 750,000 litre Jet-A fuel tank
- Relocation of the existing marine manifold

All tanks will be installed in the existing fuel containment berm at Milne Port adjacent to existing tanks (see Appendix A). All associated piping will be designed and installed inside the fuel containment berm to allow for filling and dispensing with minimal piping and no additional dispensing modules.

Design engineering has confirmed the proposed additional fuel tanks and their storage volumes do not exceed the established design criteria and capacity requirements of the existing fuel containment berm.

Tanks are intended to be built, commissioned and filled during the 2017 open water season for use throughout the following year.

See Appendix D for the arrangement of the proposed additional bulk fuel tanks and new location of the marine fuel delivery manifold, with associated piping.

3.2.4 Foundations

Additional foundation materials is expected to be delivered to site in 2017. This material will be used for installation of concrete foundations at project facilities. The anticipated volume of pre-case concrete delivered to site in 2017 is expected to be approximately 2,400 m^3 or 8,000 m^2 at 30 cm thickness.

3.3 INFRASTRUCTURE LAYOUT AT END OF 2017

Site layouts for Milne Port and Mary River Mine Site upon completion of the Addendum can be found in Appendix A of this document.

Table 3-1 Changes from Previous Year Operations and Work for 2017

Property Section	Land Use Area	Approximate Location	Description	Description of Effect on Feature(s)	Anticipated Completion Year	Required Permit Applications	Other Information
e.g. Milne Inlet/Tote Road/Mine Site	*e.g. Impact Area/Exploration Area*	*Approximate UTM (if known)*	*Provide a detailed description of the activity.**	*A description of how the feature(s) (topographical and/or manmade) will be affected***	*N/A*	*List any associated permit applications if applicable.*	*e.g. Issued for construction documentation, OENs.*
Additional Details for Work Included in 2017 Work Plan							
Tote Road	Impact Area	Various	Execution of Tote Road Earthworks Execution Plan and Design Report, including replacement of culverts: BG01, BG03, BG04, BG10, BG11, BG 11-B&C, BG14-B, BG14-C, BG17, BG19, BG19-B-DS, BG19-C-DS, BG25 (A&B), and BG27.	Minor leveling and grading within existing Tote Road alignment.	2017	N/A	N/A
New Work Proposed for 2017 Work Plan Addendum							
Mine Site	Impact Area	N 7914181 E 560035	Installation of 800-person temporary camp inclusive of, potable water treatment, sewage treatment, incinerator, kitchen, dining, locker, recreational and washroom facilities.	Leveling and grading within Potential Development Area	2017	TBD	IFCs, revised EMPs required
Mine Site	Impact Area	TBD	Installation of 35-person soft-walled camp inclusive of locker and recreational facilities.	Leveling and grading within Potential Development Area	2017	TBD	IFCs, revised EMPs required
Mine Site	Impact Area	N 7914181 E 560035	Laydown pad development approximately 45,000 m^2 comprised of 6" and 1 1/4" aggregate, varying thickness with a minimum of 200 mm cover on all tundra. Free draining to appropriate ditches and water courses.	Minor leveling and grading within Potential Development Area	2017	N/A	N/A
Mine Site	Impact Area	N 7914614 E 558518	Laydown pad approximately 15,000 m^2 comprised of 6" and 1 1/4" aggregate, varying thickness with a minimum of 300 mm cover on all tundra. Free draining to appropriate ditches and water courses.	Minor leveling and grading within Potential Development Area	2017	N/A	N/A
Milne Port	Impact Area	N 7975642 E502744	Installation of 380-person temporary camp inclusive of potable water treatment, sewage treatment, incinerator, kitchen, dining, locker, recreational and washroom facilities.	Leveling and grading within Potential Development Area	2017	TBD	IFCs, revised EMPs required
Milne Port	Impact Area	N 7975642 E502744	Installation of 50-person soft wall rapid deploy camp inclusive of locker, recreational and washroom facilities.	Leveling and grading within Potential Development Area	2017	TBD	IFCs, revised EMPs required
Milne Port	Impact Area	N 7975642 E502744	Laydown pad approximately 45,000 m^2 comprised of 6" and 1 1/4" aggregate, varying thickness with a minimum of 300 mm cover on all tundra. Free draining to appropriate ditches and water courses.	Minor leveling and grading within Potential Development Area	2017	N/A	N/A
Milne Port	Impact Area	N 7975549 E 502 986	Laydown pad and access roads approximately 150,000 m^2 comprised of 6" and 1 1/4" aggregate, varying thickness with a minimum of 300 mm cover on all tundra. Free draining to appropriate ditches and water courses.	Minor leveling and grading within Potential Development Area	2017	N/A	N/A

Property Section	Land Use Area	Approximate Location	Description	Description of Effect on Feature(s)	Anticipated Completion Year	Required Permit Applications	Other Information
e.g. Milne Inlet/Tote Road/Mine Site	*e.g. Impact Area/Exploration Area*	*Approximate UTM (if known)*	*Provide a detailed description of the activity.**	*A description of how the feature(s) (topographical and/or manmade) will be affected***	*N/A*	*List any associated permit applications if applicable.*	*e.g. Issued for construction documentation, OENs.*
Mine Port	Impact Area	N 7976199 E 503620	Install 15 ML and 3 ML arctic diesel fuel tanks and 750,000 liter jet-A fuel tank to same design criteria as existing tanks, in existing containment and interconnecting pipelines to existing filling and distribution system.	N/A	2017	TBD	IFCs, revised EMPs required

SECTION 4.0 - MINING AND EXPLORATION ACTIVITES

4.1 EXPLORATION ACTIVITIES AND DRILLING PLANS

The Addendum does not propose a change to the exploration and drilling plans presented in the original 2017 Work Plan submission.

4.2 AMOUNT AND TYPE OF ORE AND WASTE TO BE MINED

The Addendum does not propose a change to the amount and type of ore and waste to be mined relative to the original 2017 Work Plan submission.

4.3 AMOUNT AND TYPE OF ORE TO BE SHIPPED EACH MONTH

The Addendum does not propose a change to the expected total ore shipping quantities for 2017 a relative to the original 2017 Work Plan submission.

4.4 SPECIFIED SUBSTANCES TO BE QUARRIED AND EXPECTED USES

In order to expand laydowns and supply aggregate for proposed works, QMR2 and Q1 will be expanded. Expansions will include overburden removal, additional access points, push-backs and all associated drainage works. In addition, Q13 Quarry is proposed to be developed. Table 4-1 summarizes the marginal increase in quarry quantities expected as a result of the activities described in the Addendum.

Table 4-1: Forecasted Marginal Increase of Quarry Quantities

Quarry	Km Location	Permitted	Total Volume m^3	Est. Surface Area m^2	Material Type
Q1	1	Permitted	500,000	50,000	Rock
Q13	30.8	Proposed	250,000	25,000	Rock
QMR2	102	Permitted	500,000	50,000	Rock
Total	-	-	1,250,000	125,000	-

SECTION 5.0 - ANNUAL QUANTITIES OF SOLID WASTE

5.1 SOLID WASTE DISPOSAL

Estimated quantities of solid waste to be deposited in approved waste storage areas to reflect Addendum activities is shown Table 5-1.

Table 5-1: Annual Volume of Solid Waste to be deposited in Waste Storage Areas in 2017

Property Section	Waste Storage Area	Volume of Solid Waste to be disposed of (m^3)
e.g. Milne Port/Tote Road/Mine Site	-	
Mine Site	Landfill	984
	TOTAL	984

SECTION 6.0 - EXPECTED USES OF WATER

6.1 WATER USE

The Addendum does not propose a change to the expected water use quantities for 2017 a relative to the original 2017 Work Plan submission.

SECTION 7.0 - MATERIALS TO BE SHIPPED OFF THE PROPERTY

7.1 MATERIALS SHIPPED OUT

The Addendum does not propose a change to the expected materials to be backhauled in 2017 relative to the original 2017 Work Plan submission.

SECTION 8.0 - MATERIALS TO BE SHIPPED TO THE PROPERTY

Based on Addendum activity requirements, it is expected there will be one additional bulk fuel deliveries during the 2017 sealift. Additional arctic diesel and Jet A fuel will be delivered to fill the tanks at the Milne Port tank farm.

The anticipated additional fuel delivery is as follows:

Table 8-1: 2017 Anticipated Fuel Delivery

	Diesel	Jet A
Total Bulk Fuel Delivery	18 ML	750,000L

Materials, equipment, supplies, buildings and machinery to support construction and operations through the remainder of 2017 and 2018 will arrive on the 2017 sea lift are included in Table 8-2.

Table 8-2: Mobile and Mechanical Equipment to be received during 2017

Property Section	Equipment/Material Item	Owner	Quantity
Mine / Port	Haul Truck	Third Party	50 units
Mine / Port	Excavator	Third Party	15 units
Mine / Port	Bulldozer	Third Party	12 units
Mine / Port	Loader	Third Party	12 units
Mine / Port	Piling Rig	Third Party	3 units
Mine / Port	Quarry Drills	Third Party	10 units
Mine / Port	Mobile Crusher	Third Party	4 units
Mine / Port	Misc Support Equip.	Third Party	40 units
Mine / Port	Light Vehicles	Third Party	30 units
Milne Port	380-Person Camp – 10,720 m^2	BIM	1 units
Mine Site	800-Person camp – 13,000 m^2	BIM	1 units
Milne Port	Soft-Walled maint. shop	Third Party	3 units
Mine Site	Soft-Walled maint. shop	Third Party	3 units
Milne Port	Const Offices, lunchrooms, washrooms	Third Party	6 units

Property Section	Equipment/Material Item	Owner	Quantity
Mine Site	Const Offices, lunchrooms, washrooms	Third Party	6 units
Mine / Port	Pre-Cast Concrete	BIM	2,400 m^3
Mine / Port	20-man rapid deployment camp	Third Party	1 units
Mine / Port	Bulk & prefab steel for fuel tanks	BIM	1 units
Mine / Port	Electrical switchgear	BIM	2 units
Mine Site	Sewage Treatment Plant	BIM	1 units
Mine Site	Water treatment plant	BIM	1 units
Mine Site	2 MW Generator Sets	BIM	2 units
Milne Port	Sewage Treatment Plant	BIM	1 units
Milne Port	Water treatment plant	BIM	1 units

All contractor equipment and facilities are planned to be backhauled on the 2018 sealift upon completion of all works.

SECTION 9.0 - UPDATES TO ITEMS CONTAINED IN THE SCHEDULES OF THE LEASE

9.1 UPDATES TO THE EMERGENCY RESPONSE PLAN

The emergency response plan is expected to be updated to reflect consideration of the new accommodation camps and other site changes.

9.2 UPDATES TO ENVIRONMENTAL MANAGEMENT AND MONITORING PLANS

All updated Environmental Management and Monitoring Plans were submitted in March 2017 with the Annual Reports. An extensive list of these plans that were submitted can be seen in the table below:

Table 9-1: Environmental Monitoring and Management Plans

Document Number	Plan Name	Version
BAF-PH1-830-P16-0002	Air Quality and Noise Abatement Management Plan	March 2016
BAF-PH1-830-P16-0006	Cultural Heritage Resource Protection Plan	March 2016
SD-STD-002	Hazard Identification and Risk Assessment Procedure	December 2010
N/A	EHS Framework Standard	December 2010
H337697-0000-01-126-0002	Health and Safety Management Plan	January 2012
SD-SEMP-003	Human Resources Management Plan	December 2010
BAF-PH1-830-P16-0027	Terrestrial Environmental Management and Monitoring Plan	March 2016
BAF-PH1-830-P16-0025	Stakeholder Engagement Plan	March 2016
BAF-PH1-830-P16-0023	Roads Management Plan	March 2016
BAF-PH1-830-P16-0024	Shipping and Marine Wildlife Management Plan	March 2016
N/A	Blasting Management Plan (see Note 1)	April 2013

Document Number	Plan Name	Version
BAF-PH1-830-P16-0004	Borrow Pits and Quarry Management Plan	March 2014
N/A	Borrow Source Management Plan (See Note 2)	October 2013
BAF-PH1-830-P16-0030	Borrow Source Management Plan - Kilometer 2	October 2014
BAF-PH1-830-P16-0032	Borrow Source Management Plan - Kilometer 97	October 2014
BAF-PH1-830-P16-0035	Borrow Source Management Plan - Kilometer 104	March 2014
H349000-4200-07-245-0001	Quarry Management Plan D1Q1	October 2013
H349000-4200-07-245-0002	Quarry Management Plan D1Q2	October 2013
H349000-1000-07-126-0013	Quarry Management Plan Q1	March 2013
H349000-3000-07-245-0002	Quarry Management Plan Q11	October 2013
H349000-3000-07-245-0003	Quarry Management Plan Q19	October 2013
H349000-3000-07-245-0001	Quarry Management Plan Q7	October 2013
BAF-PH1-830-P16-0040	Quarry Management Plan QMR2	September 2014
BAF-PH1-840-P16-0002	Emergency Response Plan	March y 2017
BAF-PH1-830-P16-0036	Spill Contingency Plan	March 2017
BAF-PH1-830-P16-0008	Environmental Protection Plan	August 2016
BAF-PH1-830-P16-0010	Fresh Water, Sewage and Wastewater Management Plan	March 2016
BAF-PH1-830-P16-0011	Hazardous Materials and Hazardous Waste Management Plan	March 2017
BAF-PH1-830-P16-0012	Interim Abandonment and Reclamation Plan	March 2016
BAF-PH1-830-P16-0026	Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan	March 2016
BAF-PHI-830-P16-0001	Surface Water Sampling Program - Quality Assurance and Quality Control Plan	March 2017
BAF-PH1-830-P16-0039	Aquatic Effects Monitoring Plan	March 2016
BAF-PH1-830-P16-0028	Waste Management Plan	March 2017
BAF-PH1-830-P16-0029	Phase 1 Waste Rock Management Plan	April 2014
BAF-PH1-830-P16-0031	Life of Mine Waste Rock Management Plan	April 2014
N/A	Explosives Management Plan (see Note 3)	August 2013
BAF-PH1-830-P16-0013	Milne Port Oil Pollution Emergency Plan (OPEP)	June 2015
BAF-PH1-830-P16-0041	Polar Bear Safety Plan	March 2016
BAF-PH1-830-P16-0037	Exploration Spill Contingency Plan	June 2014
BAF-PH1-830-P16-0038	Exploration Closure and Reclamation Plan	July 2014
BAF-PH1-830-P16-0042	Spill at Sea Response Plan	August 2015

NOTES:

[1] The Blasting Management Plan appears in each quarry-specific management plan.
[2] Discontinued and incorporated into the March 2014 Borrow Pits and Quarry Management Plan.
[3] The Explosives Management Plan is a contractor document.

9.3 PROPOSED UPDATES TO THE INTERIM CLOSURE AND RECLAMATION PLAN

The Interim Closure and Reclamation Plan (ICRP) for the project has been provided as an appendix to the original 2017 Work Plan.

The activities described in this Addendum are planned to occur exclusively on Inuit Owned Land (IOL) administered by the QIA. As indicated during the 2017/18 Annual Security Review process in December 2017, Baffinland and the QIA are currently in discussion regarding unit rates applied for the purpose of financial security estimates. Based on the outcome of this process, it is expected updated closure and reclamation security estimates will be developed by the QIA and Baffinland, inclusive of the Addendum activities. It is Baffinland's intention that based on these revised estimates a negotiated agreement on security to reflect the 2017 Work Plan Addendum activities will be reached and required security will be posted prior work being conducted. The Nunavut Water Board, Indigenous and Aboriginal Affairs Canada, and other interested parties will be informed and consulted as this process occurs and prior to the conduction of any Addendum activities.

SECTION 10.0 - REQUESTED AMENDMENTS TO THE PROVISIONS OF THE LEASE

Baffinland intends to discuss the Addendum with the QIA to determine Lease amendment requirements (if any).

SECTION 11.0 - ADDITIONAL REPORTS, INFORMATION OR DATA

Additional reports, information or data required to support the Addendum is summarized in Table 11-1 below.

Table 11-1: Additional Reports, Information or Data

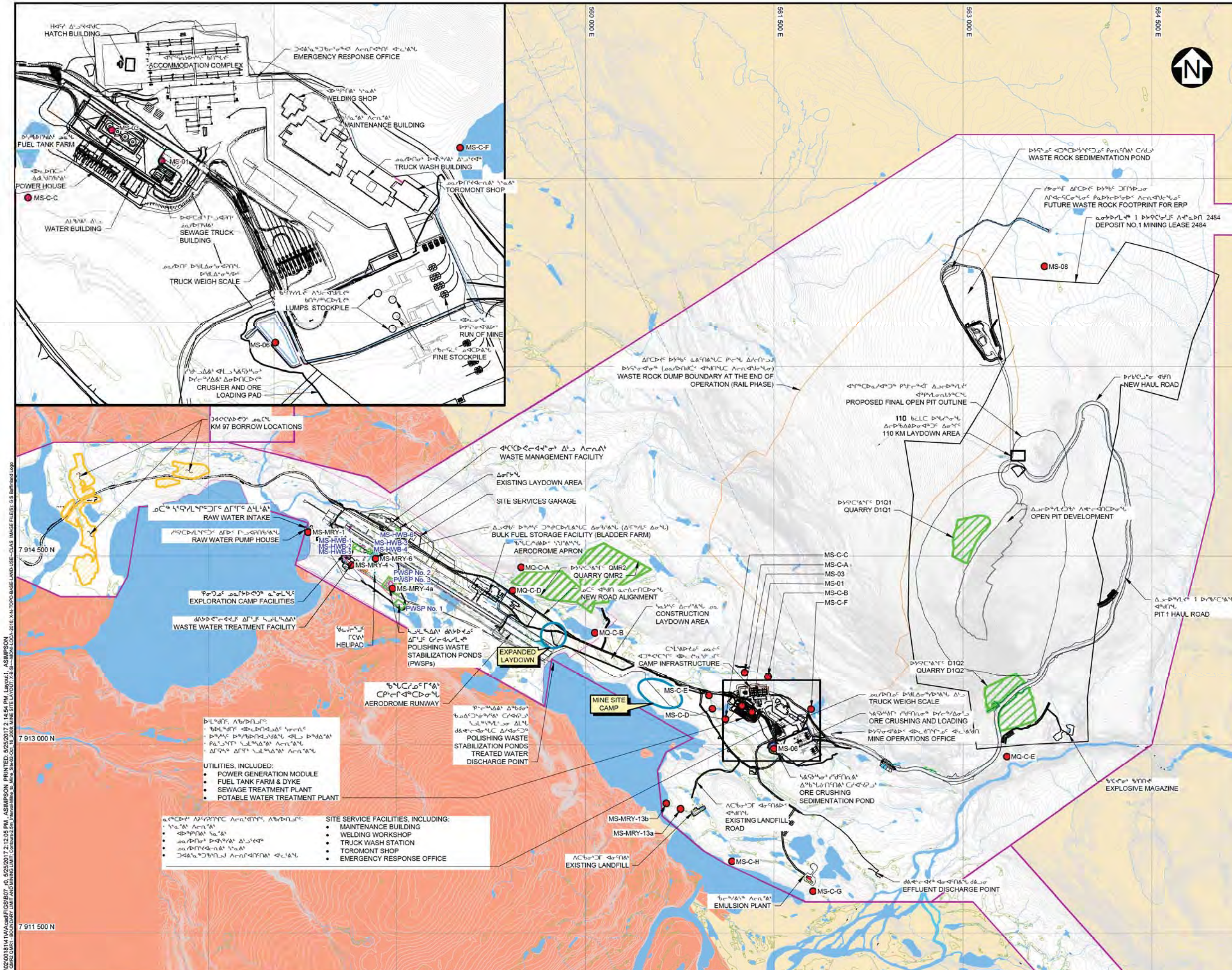
Title	Organization	Date	Annex
Identify the title of the additional report, information or data to be included with the Annual Work Plan.	*Disclose the name of the organization that produced the addition report, information or data.*	*Include the publish date or reference year to the additional report, information or data.*	*Identify the Annex letter/number corresponding to the additional report, information or data.*
Milne Port – Infrastructure Footprint – Work Plan 2017	Knight Piésold on behalf of Baffinland	May 2017	Appendix A
Mine Site – Infrastructure Footprint – Work Plan 2017	Knight Piésold on behalf of Baffinland	May 2017	Appendix A
2017 Addendum Marginal Closure and Reclamation Financial Security Estimate	Baffinland	May 2017	Appendix B
Tote Road Earthworks Execution Plan and Design Report	Golder Associates	April 2017	Appendix C
Supporting Documents and Camp Details	Misc	May 2017	Appendix D

Appendix A:

2017 Work Plan Addendum Site Layouts

2017 Work Plan – Milne Port Site Layout

2017 Work Plan – Mine Site Layout



HATCH BUILDING
ACCOMMODATION COMPLEX
EMERGENCY RESPONSE OFFICE
WELDING SHOP
MAINTENANCE BUILDING
FUEL TANK FARM
POWER HOUSE
MS-03
MS-01
MS-C-C
MS-C-F
TRUCK WASH BUILDING
TOROMONT SHOP
WATER BUILDING
SEWAGE TRUCK BUILDING
TRUCK WEIGH SCALE
LUMPS STOCKPILE
RUN OF MINE
FINE STOCKPILE
MS-06
CRUSHER AND ORE LOADING PAD
KM 97 BORROW LOCATIONS
WASTE MANAGEMENT FACILITY
EXISTING LAYDOWN AREA
SITE SERVICES GARAGE
BULK FUEL STORAGE FACILITY (BLADDER FARM)
AERODROME APRON
RAW WATER INTAKE
RAW WATER PUMP HOUSE
MS-MRY-1
MS-HWB-1
MS-HWB-2
MS-HWB-3
MS-HWB-4
MS-HWB-6
MS-MRY-6
MS-MRY-4
MS-MRY-4a
PWSP No. 1
PWSP No. 2
PWSP No. 3
EXPLORATION CAMP FACILITIES
WASTE WATER TREATMENT FACILITY
HELIPAD
POLISHING WASTE STABILIZATION PONDS (PWSPs)
MQ-C-A
QUARRY QMR2
MQ-C-D
NEW ROAD ALIGNMENT
CONSTRUCTION LAYDOWN AREA
MQ-C-B
EXPANDED LAYDOWN
CAMP INFRASTRUCTURE
AERODROME RUNWAY
MINE SITE CAMP
MS-C-E
MS-C-D
POLISHING WASTE STABILIZATION PONDS TREATED WATER DISCHARGE POINT
UTILITIES, INCLUDED:
POWER GENERATION MODULE
FUEL TANK FARM & DYKE
SEWAGE TREATMENT PLANT
POTABLE WATER TREATMENT PLANT
SITE SERVICE FACILITIES, INCLUDING:
MAINTENANCE BUILDING
WELDING WORKSHOP
TRUCK WASH STATION
TOROMONT SHOP
EMERGENCY RESPONSE OFFICE
WASTE ROCK DUMP BOUNDARY AT THE END OF OPERATION (RAIL PHASE)
WASTE ROCK SEDIMENTATION POND
FUTURE WASTE ROCK FOOTPRINT FOR ERP
DEPOSIT NO.1 MINING LEASE 2484
MS-08
NEW HAUL ROAD
PROPOSED FINAL OPEN PIT OUTLINE
110 KM LAYDOWN AREA
QUARRY D1Q1
OPEN PIT DEVELOPMENT
PIT 1 HAUL ROAD
MS-C-C
MS-C-A
MS-03
MS-01
MS-C-B
MS-C-F
QUARRY D1Q2
TRUCK WEIGH SCALE
ORE CRUSHING AND LOADING
MINE OPERATIONS OFFICE
MS-06
MQ-C-E
ORE CRUSHING SEDIMENTATION POND
EXPLOSIVE MAGAZINE
EXISTING LANDFILL ROAD
MS-MRY-13b
MS-MRY-13a
EXISTING LANDFILL
MS-C-H
MS-C-G
EMULSION PLANT
EFFLUENT DISCHARGE POINT
560 000 E
561 500 E
563 000 E
564 500 E
7 914 500 N
7 913 000 N
7 911 500 N
N

LEGEND:

- INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS
- INUIT OWNED LAND - SURFACE AND SUBSURFACE INCLUDING MINERALS
- WATER
- BORROW AREAS (2013 UNDER Q10C3001)
- QUARRY AREA (EXISTING UNDER Q13C301)
- WASTE STORAGE AREA
- RIVER/STREAM/DRAINAGE
- ROAD
- QIA SURFACE COMMERCIAL LEASE BOUNDARY
- WATER LICENCE WATER QUALITY MONITORING LOCATION

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 13, 2015).
4. CONTOUR INTERVAL IS 2.5 METRES.
5. ALL SAMPLE ID'S SHOWN IN BRACKETS REPRESENT THE TYPE B WATER LICENCE(S) MONITORING POINTS. ALL OTHERS ARE MONITORING POINTS AS PER THE TYPE A WATER LICENCE (2AM-MRY1325).

SCALE A 300 150 0 500 1000 1500 m

Baffinland

MARY RIVER PROJECT

MINE SITE LAYOUT AND WATER LICENCE MONITORING LOCATIONS

Knight Piésold CONSULTING

P/A NO.	REF NO.	
NB102-181/41	NB17-00356	
FIGURE 1.0		REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	25MAY'17	ISSUED WITH 2017 WORK PLAN AMENDMENT	AG	AS	AK

SAVED: I:\1\02\00181\41\A\Acad\FIGS\B06_r0, 5/25/2017 2:02:37 PM , ASIMPSON PRINTED: 5/25/2017 2:18:28 PM, Layout1, ASIMPSON
XREF FILE(S): Contours-2.5m_Interval-Milne_to_Mine_Site-02-Oct_16_2008; MILNE SITE LAYOUT, X-B-SI---MONI-LOCA-2015; X-N TOPO-BASE-LAND-ISE---CLAS IMAGE FILE(S): GIS-Baffinland Logo milne_inlet_wo3745_wv2_wv3_aug2015_tile01

502 500 E | 503 000 E | 503 500 E | 504 000 E | 504 500 E

7 977 000 N | 7 976 500 N | 7 976 000 N | 7 975 500 N | 7 975 000 N

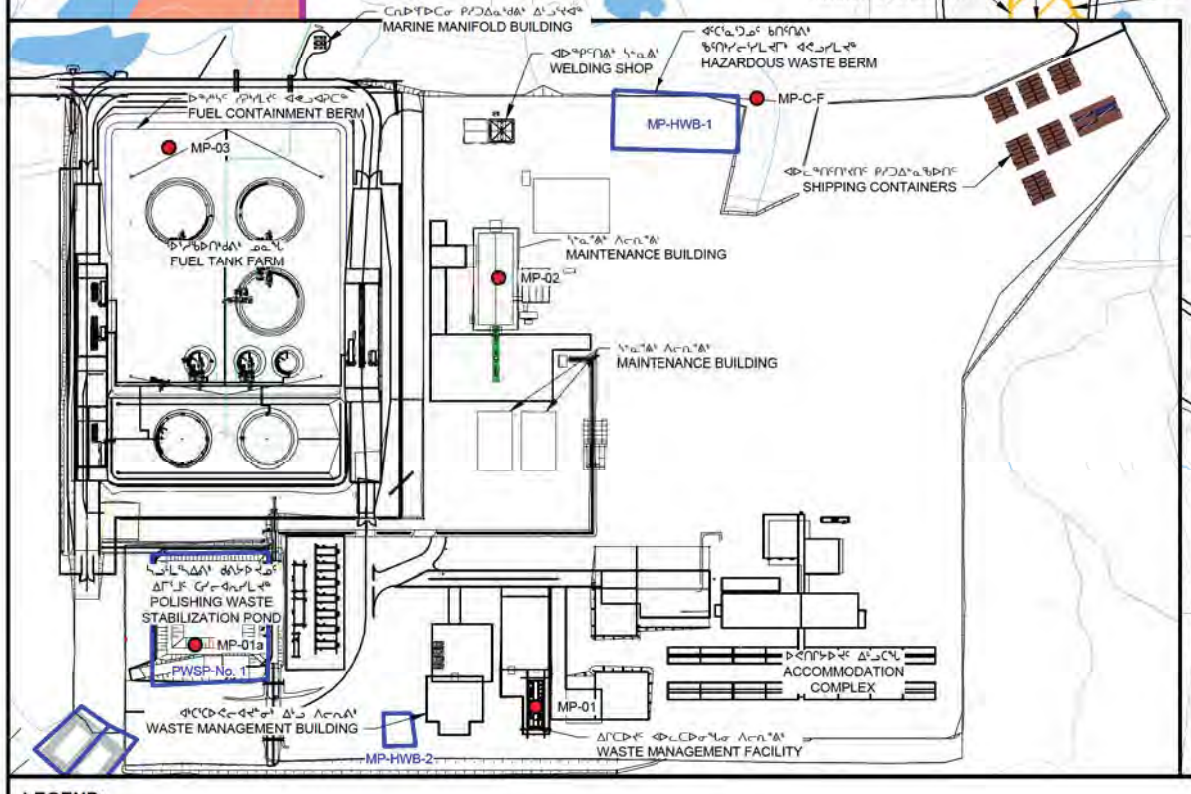
MOORING BUOY
ORE DOCK
SETTLING POND
EFFLUENT DISCHARGE LOCATION
FUEL TANK FARM
SEALIFT BARGE LANDING AREA
EXISTING HTO CABIN
RAMP TO BEACH
LAYDOWN AREA
ORE STOCKPILE
FUEL CONTAINMENT BERM
POWER GENERATORS
POLISHING WASTE STABILIZATION POND
HAZARDOUS WASTE BERM
PORT SITE WEATHERHAVEN
LAND FARM MP-04
POTABLE WATER INTAKE LOCATION
MAINTENANCE BUILDING
PORT CONSTRUCTION CAMP
MOBILE REFUELING MODULE TEMPORARY CONTAINMENT BERM
TOTE ROAD(NEW ALIGNMENT)
APPROXIMATE EXTENT OF QUARRY Q1 DEVELOPMENT
PERMITTED OPEN BURN PIT AREA
BORROW SOURCE NO.1
BORROW PITS
TOTE ROAD (OLD ALIGNMENT)

MP-06 MP-05 MP-C-E MP-C-F MP-C-H MP-03 MP-02 MP-01a MP-01 MP-HWB-1 MP-HWB-2 MP-HWB-3 MP-HWB-4 PWSP-No. 1 MP-C-B01 MP-C-B MP-MRY-2 MP-04 MP-04a MP-Q1-01 MP-Q1-02

LAND FARM | SNOW DUMP

SERVICE AREA PAD SITE FACILITIES, INCLUDING:
- MAINTENANCE/WAREHOUSE BUILDING
- WELDING SHOP BUILDING
- WORKSHOP OFFICE BUILDING

CAMP SITE INFRASTRUCTURE PAD SITE FACILITIES, INCLUDING:
- ACCOMMODATION COMPLEX
- EMERGENCY RESPONSE OFFICE / GARAGE
- SEWAGE TREATMENT PLANT
- POTABLE WATER TREATMENT PLANT
- WASTE MANAGEMENT FACILITY



NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN/SECTION BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 31,2014).
4. CONTOUR INTERVAL IS 2.5 METRES.
5. ALL SAMPLE ID'S SHOWN IN BRACKETS REPRESENT THE TYPE B WATER LICENCE(S) MONITORING POINTS. ALL OTHERS ARE MONITORING POINTS AS PER THE TYPE A WATER LICENCE (2AM-MRY1325).

LEGEND:

- WATER
- BORROW AREAS (2013 UNDER Q10C3001)
- QUARRY AREA (EXISTING UNDER Q13C301)
- INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS
- WASTE STORAGE AREA
- RIVER/STREAM/DRAINAGE
- ROAD
- QIA SURFACE COMMERCIAL LEASE IMPACT BOUNDARY
- WATER LICENCE WATER QUALITY MONITORING LOCATION

SCALE A: 100 50 0 100 200 300 400 500 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	25MAY'17	ISSUED WITH 2017 WORK PLAN AMENDMENT	AV	AS	AK

Baffinland

MARY RIVER PROJECT

MILNE PORT SITE LAYOUT AND WATER LICENCE MONITORING LOCATIONS

Knight Piésold CONSULTING

P/A NO. NB102-181/41 | REF NO. NB17-00356

FIGURE 2.0 | REV 0

Appendix B:

2017 Work Plan Amendment Marginal Closure and Reclamation Financial Security Estimate

PENDING

Appendix C:

Tote Road Earthworks Execution Plan and Design Report

April 2017

MARY RIVER PROJECT

Tote Road Earthworks Execution Plan and Design Report

Submitted to:

Baffinland Iron Mines Corporation
2275 Upper Middle Road East, Suite 300
Oakville ON Canada
L6H 0C3

REPORT

Report Number: 1667708 (Rev. 0)

Distribution:

1 e-copy – Baffinland Iron Mines Corporation
1 e-copy – Golder Associates Ltd.

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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APPENDICES

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

GOLDER ASSOCIATES LTD.

Original Signed

Cara Kennedy, M.Sc., EIT (ON)
Geotechnical Engineer in Training

Original Signed

Michelle Tyldesley, P.Eng (ON)
Project Manager

Original Signed and Sealed

Robert Douglas, P.Eng
Senior Engineer

CK/MJT/RAD/sk

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

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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, Dwg. No. H349000-3000-10-088-0030 through H349000-3000-10-088-034. Prepared for Baffinland Iron Mines Corporation. January 23, 2014. 5 p.

Hatch (Hatch Limited). 2014b. Construction Summary Report: Tote Road Upgrade Package – Bridge Crossings. Prepared for Baffinland Iron Mines Corporation. File No. H349000-3130-10-124-0005. December 4, 2014. 53 p.

Knight Piésold (Knight Piésold Consulting). 2009. (As-built) Road Upgrades, Plan and Profile (AutoCAD File). Prepared for Baffinland Iron Mines. October 9, 2009.

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

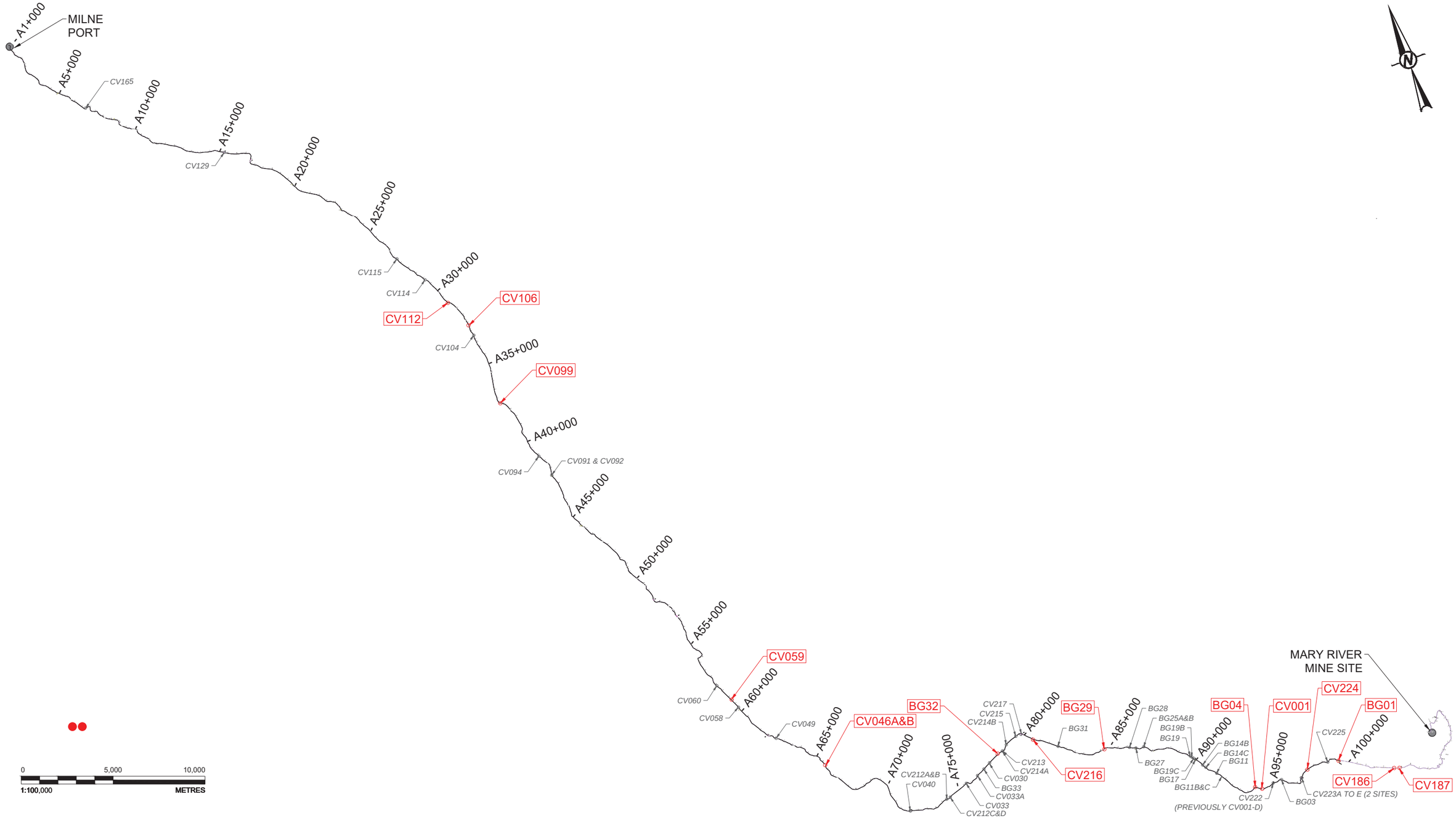
Table 3: Assumptions used for Parameters in Table 2

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
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\gal\m\Clients\Baffinland_Iron_Mines_Corp\Baffin_Island\99_PROJ\1667708_Tote_Road_Earthworks\40_PROD\0016_Tote_Road_Culvert_Sites\ | File Name: 1667708-0016-GM-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.

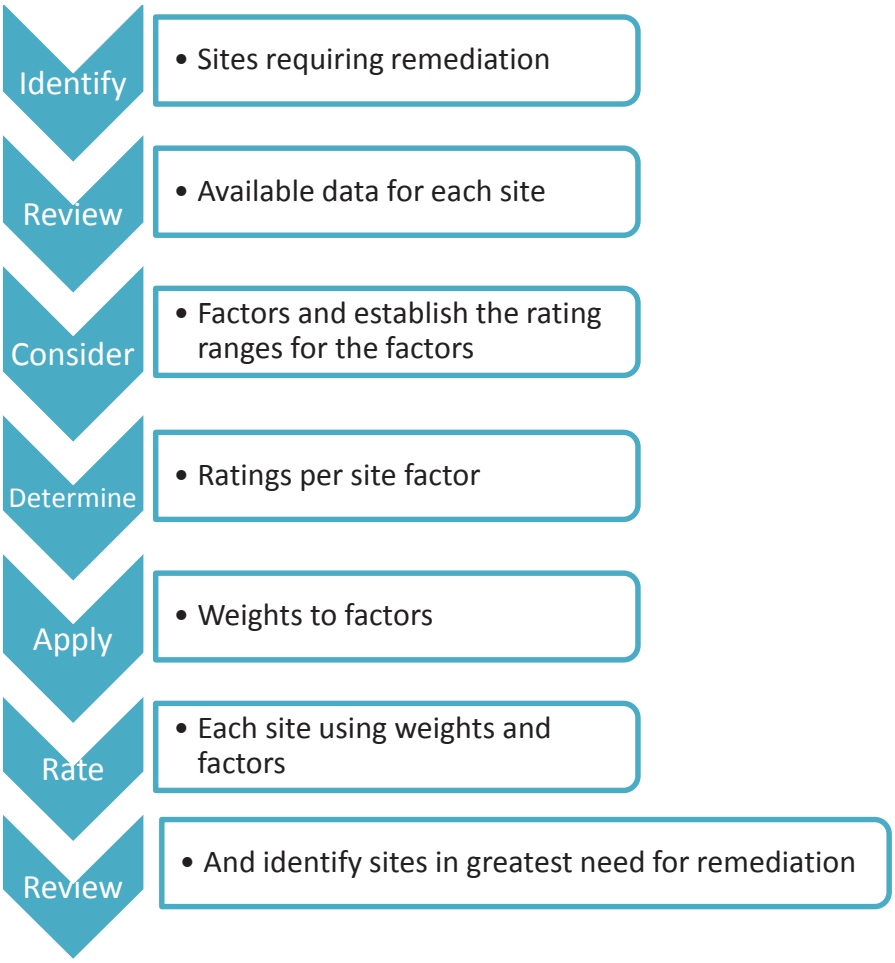


Figure A1: Overview of prioritization process.

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
NORTHWEST TERRITORIES AND NUNAVUT

Baffinland
CONSULTANT

Golder Associates

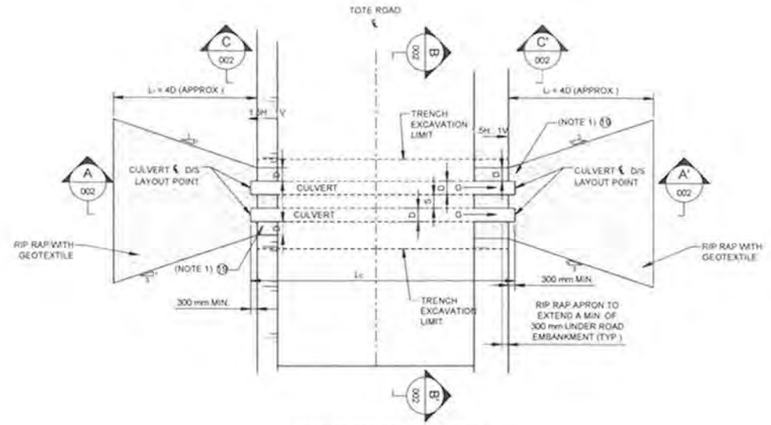
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

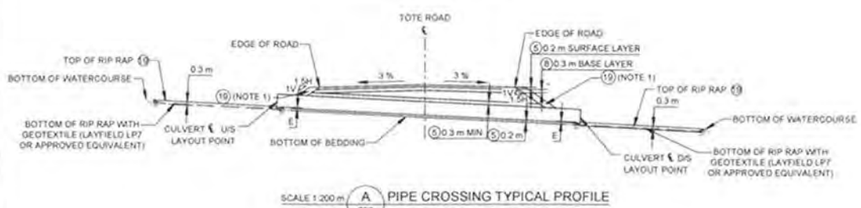
TITLE
TITLE SHEET - BG01

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

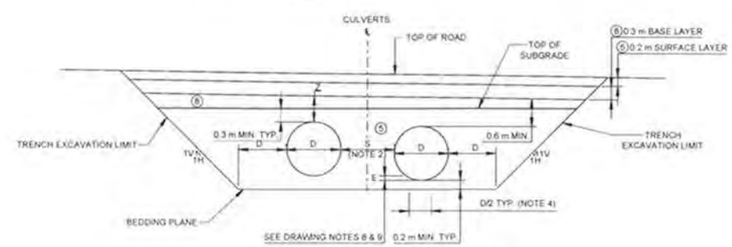
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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



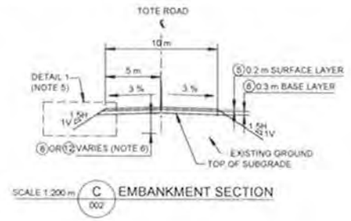
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

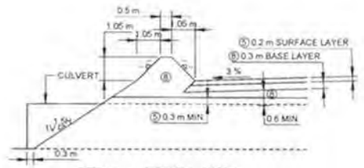
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(6)	JAW RUN	(19)	EROSION PROTECTION

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, L, 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
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
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 - BG01

PROJECT NO.	PHASE	REV.	SHT.	DRAWING
1667708	3000	2	2 of 4	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 15 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	558004.6	7914936.4	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 DEM STUDY USING A DIGITAL ELEVATION MODEL AND SATELLITE IMAGERY PROVIDED BY BAFFINLAND, AND ARE NOT SURVEYED 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	8.3	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+068.5	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	558004.6	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+168.6	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
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. DOUGLAS
CONSULTANT
LICENSEE
2017-04-03
NWT/NU

Baffinland

Golder Associates

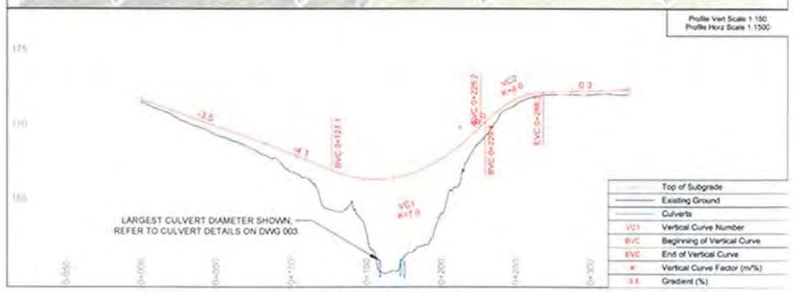
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

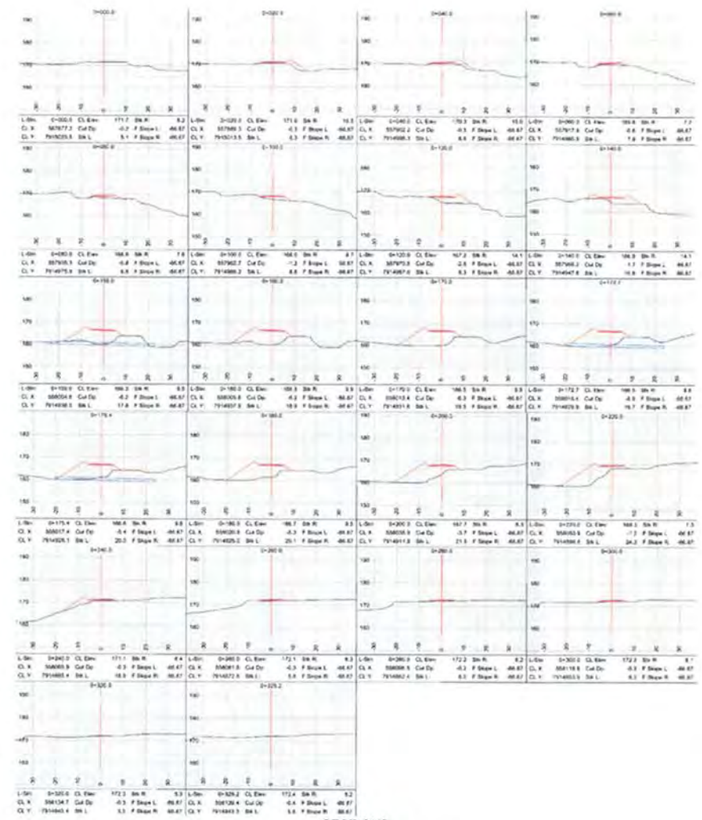
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG01

PROJECT NO.	PHASE	REV.	SHEET	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

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

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R.A. DOUGLAS
LICENSEE
2019-04-23
NWT/NU

Baffinland
CONSULTANT

Golder Associates

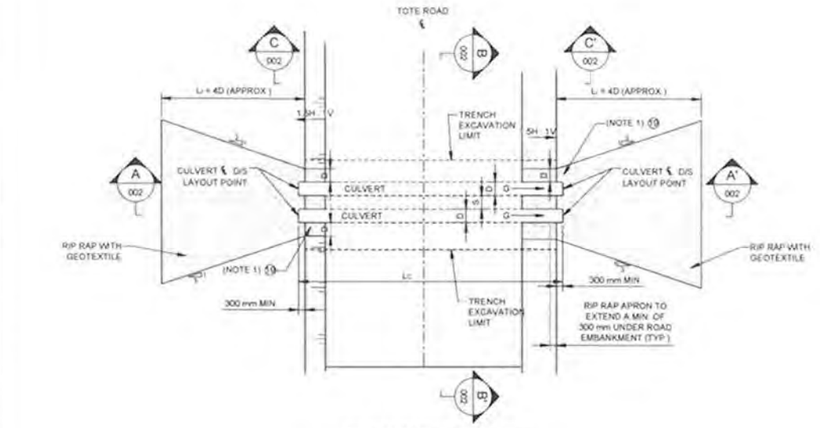
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

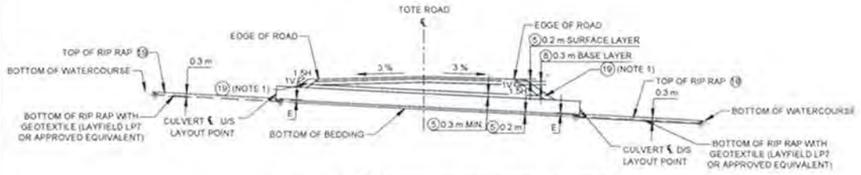
TITLE
TITLE SHEET - BG04

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

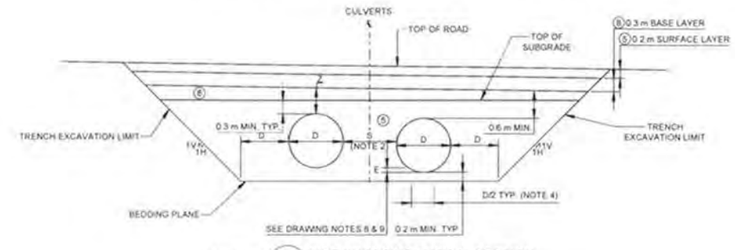
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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



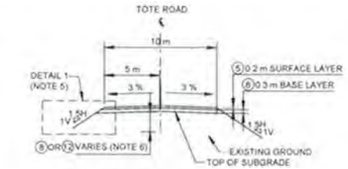
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

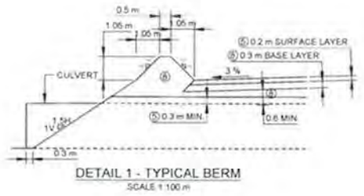
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(6)	JAW RUN	(19)	EROSION PROTECTION

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,L,Lc, 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 = 0.2 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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PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 17-03-22
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-05
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
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 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. 001)

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	0.8
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

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	2017-03-06	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 17-04-06
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2019-04-05
NWT/NU

CLIENT: Baffinland

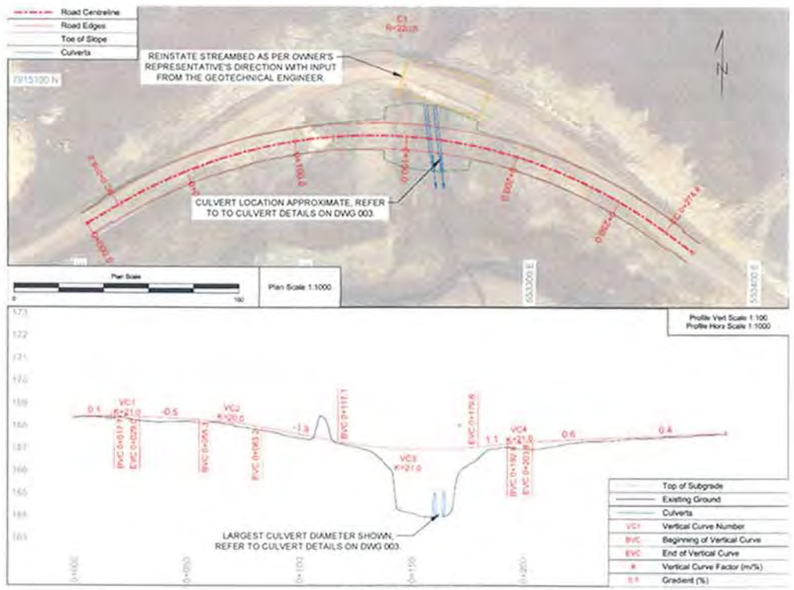
CONSULTANT: Golder Associates
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

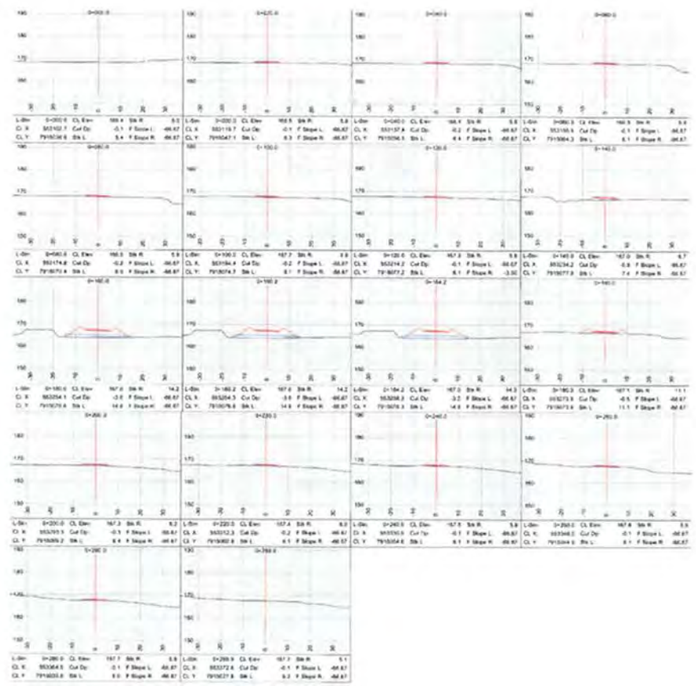
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG04

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

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

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

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
ROAD PLAN, PROFILE AND SECTIONS - BG04

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
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
004	ROAD PLAN, PROFILE AND SECTIONS - BG29	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	2017-03-10	ISSUED FOR CONSTRUCTION	CK/RAD	JJL	MJT	RAD
A	2017-03-09	ISSUED FOR CLIENT REVIEW	CK/RAD	JJL	MJT	RAD

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NT/NU Association of Professional Engineers and Geoscientists

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2019-04-03
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CONSULTANT
Golder Associates
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
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www.golder.com

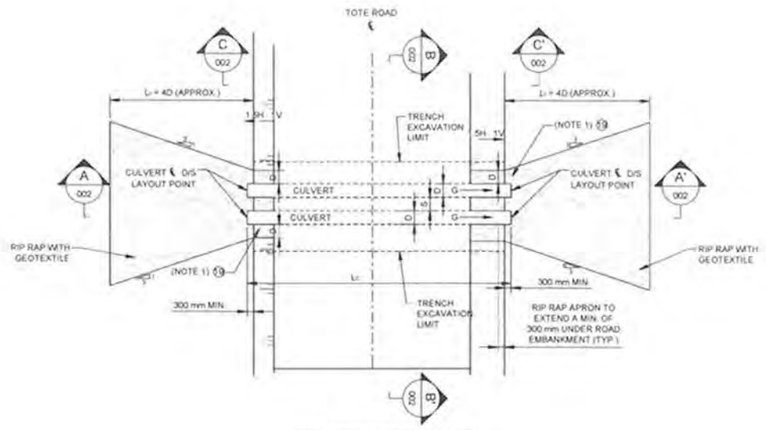
CLIENT
Baffinland

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

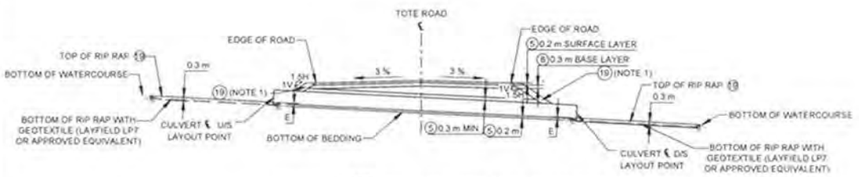
TITLE
TITLE SHEET - BG29

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

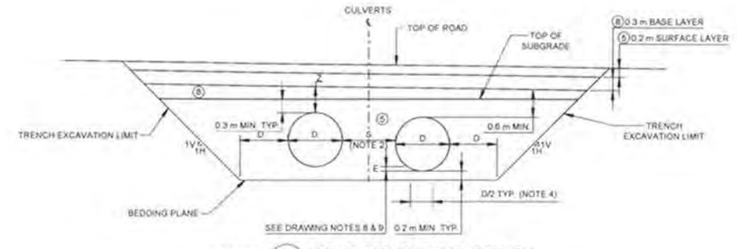
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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



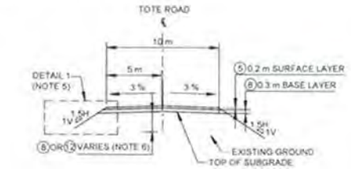
SCALE 1:50 m (B / 002) PIPE CROSSING TYPICAL SECTION

LEGEND

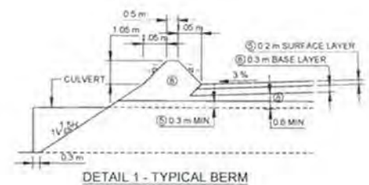
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

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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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 Granted
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

Baffinland

Golder Associates

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

TITLE
TYPICAL DETAILS AND GENERAL NOTES - BG29

PROJECT NO.	PHASE	SHEET	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 (%) (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	-4.6	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	-0.8	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.

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

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

Baffinland
CONSULTANT

Golder Associates

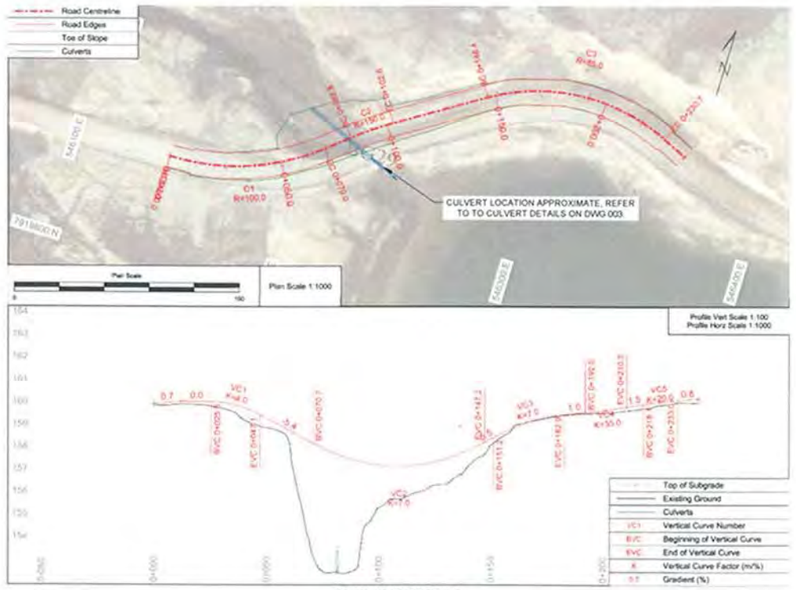
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

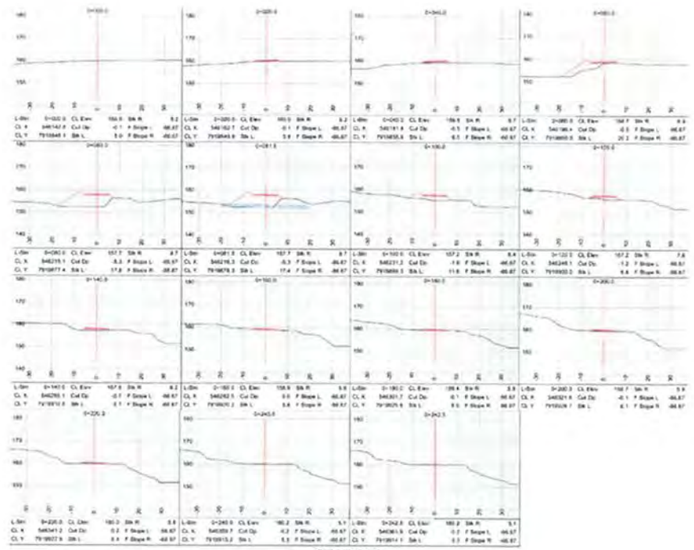
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG29

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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R.A. DOUGLAS
LICENSEE
2017-04-13
NWT/NU

Baffinland

Golder Associates

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

PROJECT
MARY RIVER PROJECT
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TITLE
ROAD PLAN, PROFILE AND SECTIONS - BG29

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

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MARY RIVER PROJECT
TOTE ROAD EARTHWORKS
BG32

INDEX OF DRAWINGS		
DRAWING NO.	DRAWING SHEET TITLE	REVISION NO.
001	TITLE SHEET - BG32	2
002	PIPE CROSSING TYPICAL DETAILS & GENERAL NOTES - BG32	2
003	CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - BG32	2
004	ROAD PLAN, PROFILE AND SECTIONS - BG32	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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6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
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PROJECT
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TITLE
TITLE SHEET - BG32

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

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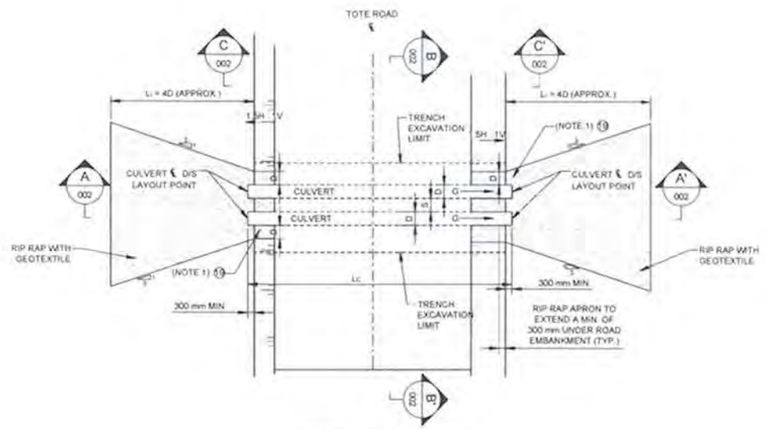
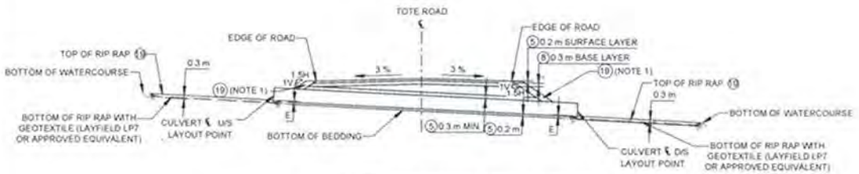
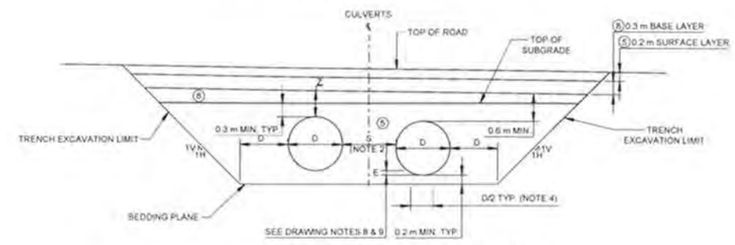


PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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



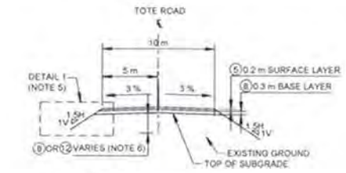
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

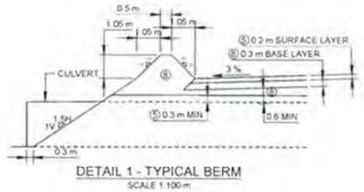
(5)	SCREENED MATERIAL	(6)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

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 2 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,L1, 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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R.A. DOUGLAS
LICENSEE
2017-04-23
NWT/NU

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Golder Associates

MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
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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
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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+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 A FIELD STUDY (REFER TO GENERAL CONSTRUCTION NOTE 13 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	7921616	145.8	-0.6	9.4	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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PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-03
NWT/NU

Baffinland

Golder Associates

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

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TOTE ROAD EARTHWORKS

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

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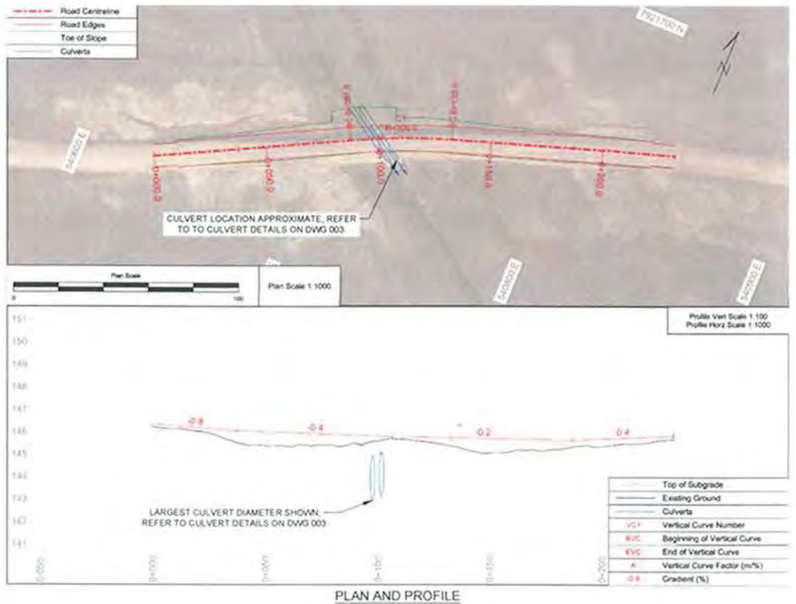
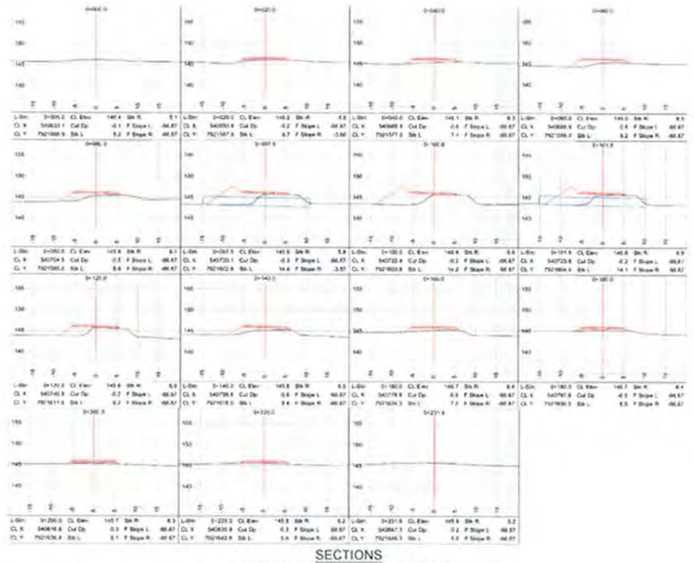


PLAN AND PROFILE



SECTIONS
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REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-04-05
NORTHWEST TERRITORIES
PROVINCE OF NUNAVUT

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Baffinland

CONSULTANT
Golder Associates

MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
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905-567-4444
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PROJECT
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TITLE
ROAD PLAN, PROFILE AND SECTIONS - BG32

PROJECT NO	PHASE	REV	# OF #	DRAWING
1667708	3000	2		004

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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
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 17-24-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
R.A. DOUGLAS
LICENSEE
2017-24-03
NUNAVUT

Baffinland

Golder Associates

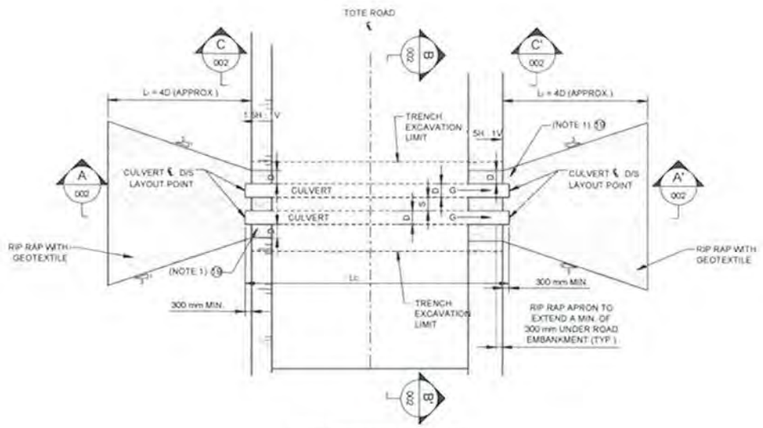
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

TITLE
TITLE SHEET - CV001

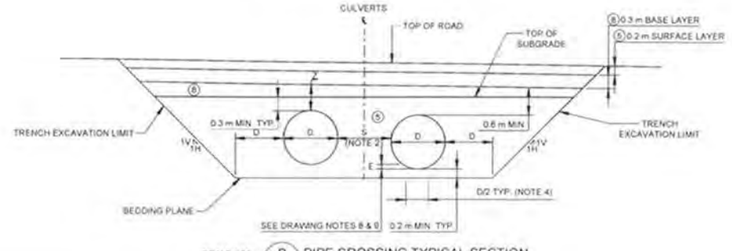
PROJECT NO.	PHASE	REV.	1 of 4	DRAWING
1667708	3000	2		001

Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m

SCALE 1:200 m PIPE CROSSING TYPICAL PROFILE



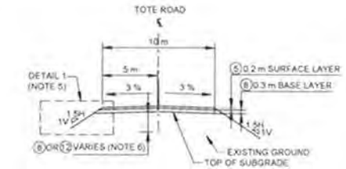
SCALE 1:50 m PIPE CROSSING TYPICAL SECTION

LEGEND

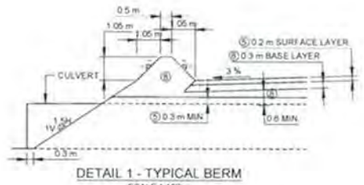
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

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,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 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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MISSISSAUGA, ON
CANADA
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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	553468.8	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	553501.6	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	7914889.6	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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PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
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NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER
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MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
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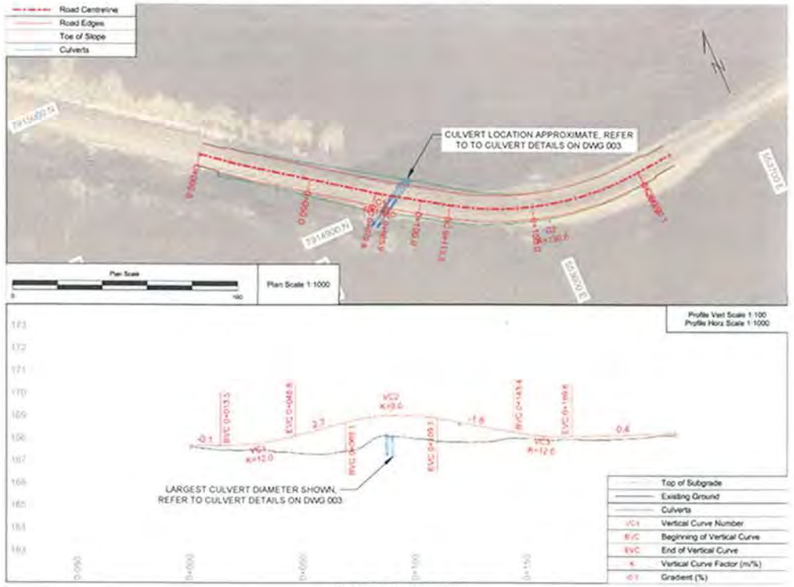
CLIENT
Baffinland

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

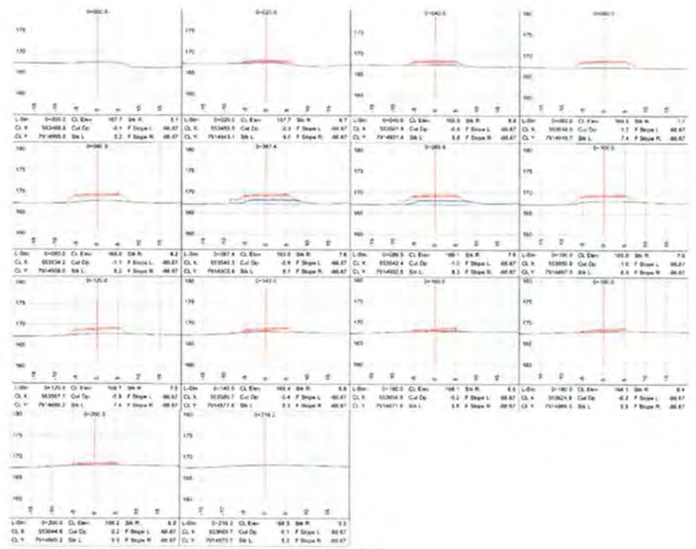
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV001

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
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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
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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.
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CONSULTANT: Golder Associates

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MISSISSAUGA, ON
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PROJECT
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TITLE
TITLE SHEET - CV046 A&B

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

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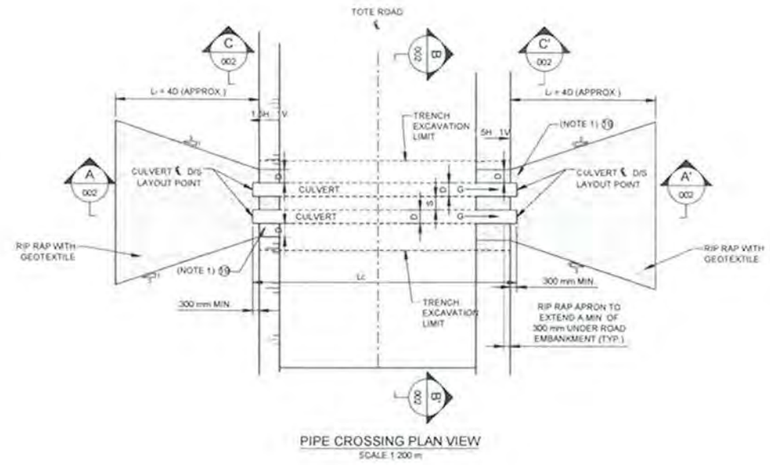
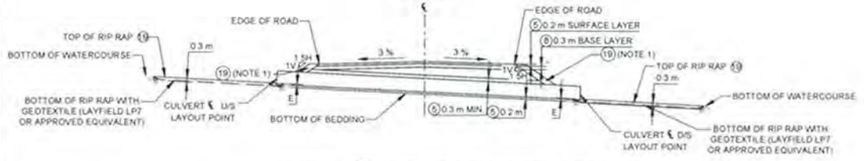
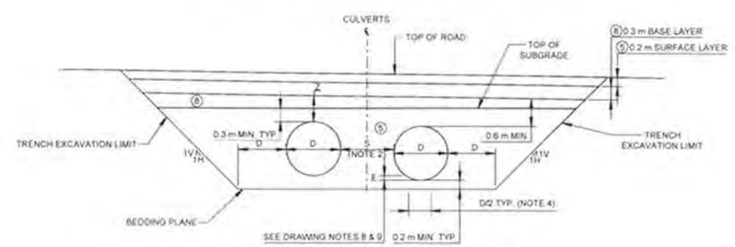


PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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

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5. SAFETY BERMS ARE REQUIRED FOR EMBANKMENTS GREATER THAN 3 m IN HEIGHT.
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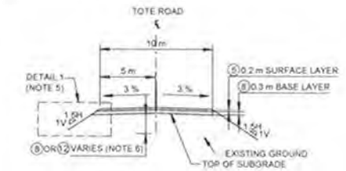
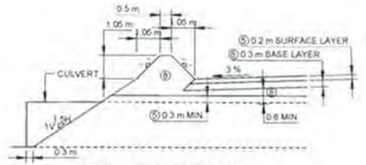
9. AS PER CULVERT DETAILS (DWG 003) FOR FISH BEARING CULVERT, E = 0.1 D. FOR NON-FISH BEARING CULVERT E=0.



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

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
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 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 (%) (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	238.0	235.1	2	142	N	N	
0+107.3	POTENTIAL	500	15	5.32	50	49	1.4	531695.0	7924260.4	238.0	235.1	2	141	N	Y	2
0+111.3	POTENTIAL	1000	15	8.63	100	49	1	531694.9	7924256.4	238.0	235.1	2	140	N	Y	4
0+115.3	POTENTIAL	500	15	5.26	50	49	1.7	531694.6	7924252.4	238.1	235.1	2	139	N	Y	2
0+119.3	POTENTIAL	500	15	4.97	50	49	1.9	531694.3	7924248.4	238.1	235.1	2	139	N	Y	2

*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 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+006.8	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	8	
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

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

Baffinland
Golder Associates

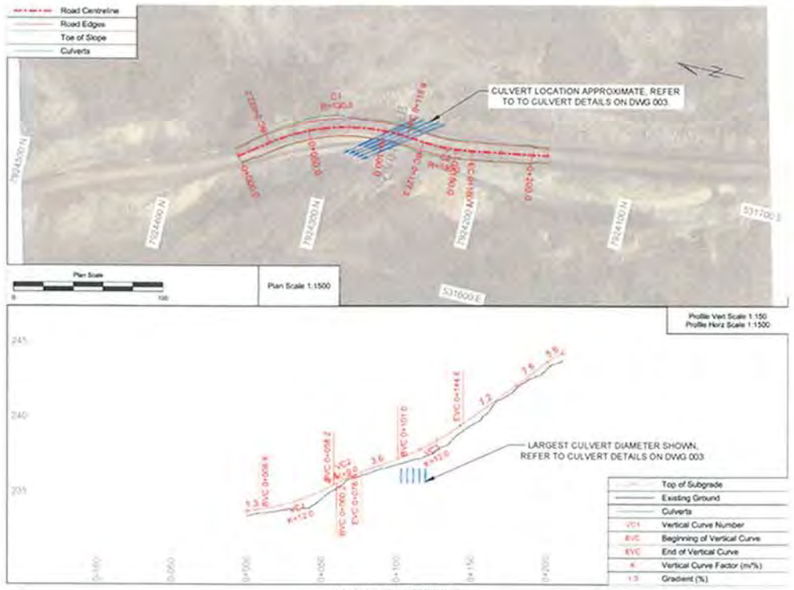
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

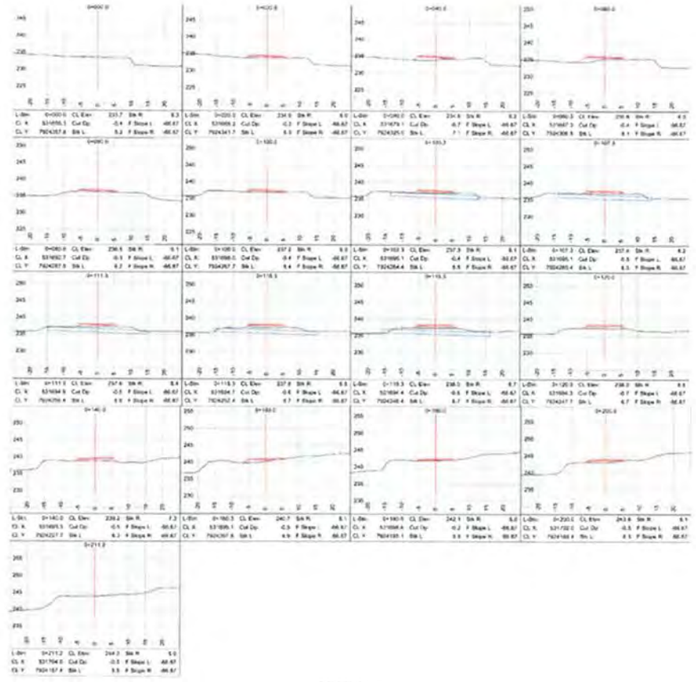
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV046 A&B

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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0	2017-03-09	ISSUED FOR CONSTRUCTION	JJL	CK/RAD	MJT	RAD
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MISSISSAUGA, ON
CANADA
905-567-4444
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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.
1667706-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
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 2017-04-03
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

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NUNAVUT

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MISSISSAUGA OFFICE
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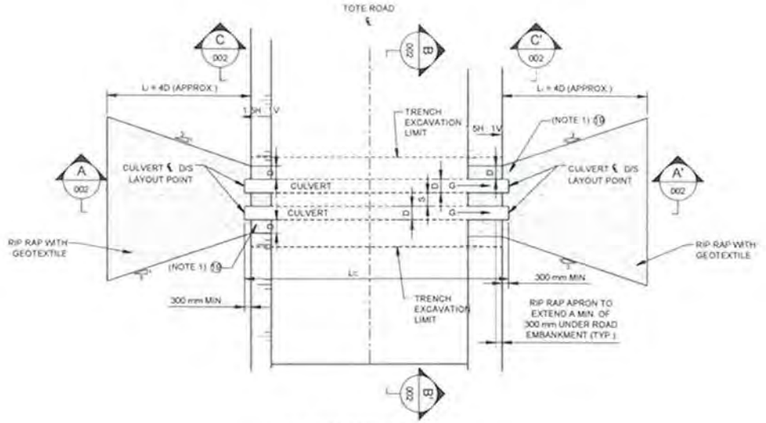
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

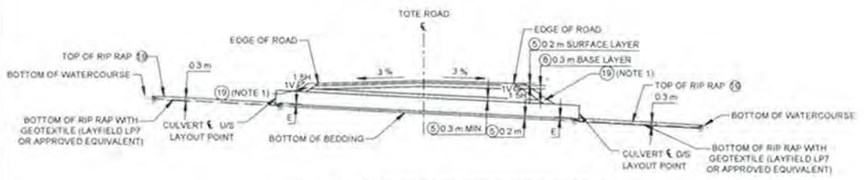
TITLE
TITLE SHEET - CV059

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

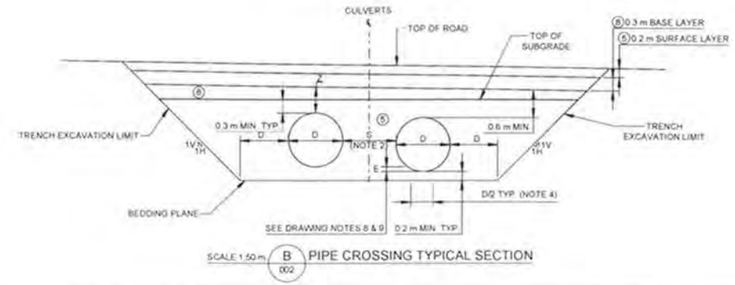
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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



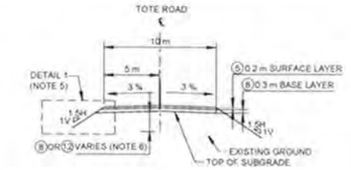
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

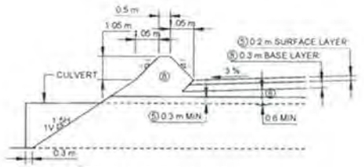
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(6)	JAW RUN	(19)	EROSION PROTECTION

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,L,C,L', AND G CAN BE FOUND IN DESIGN TABLES ON DRAWING 001.
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

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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.
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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.

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 17-Apr-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

Baffinland

Golder Associates

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

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

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

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 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 (%) (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	1.85	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	

1CULVERT 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 2.2 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	7929397.8	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

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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
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

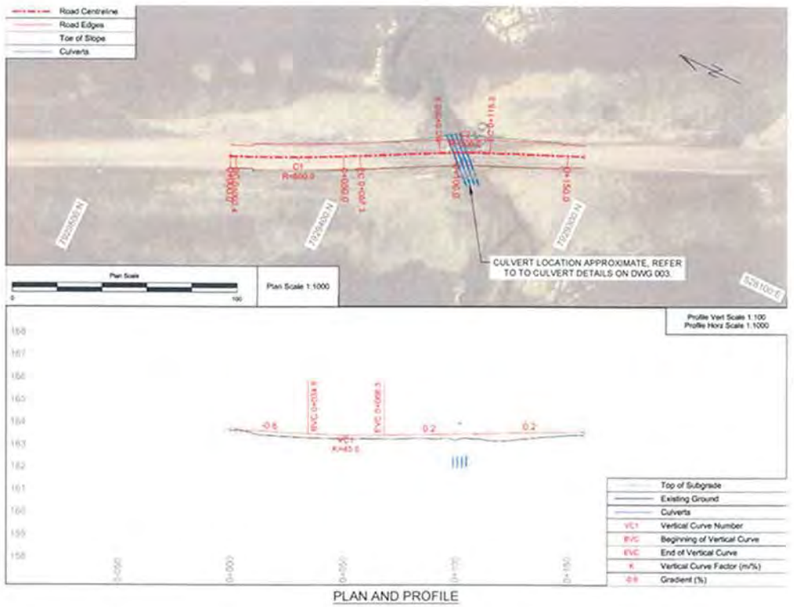
MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
MISSISSAUGA, ON
CANADA
905-567-4444
www.golder.com

PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

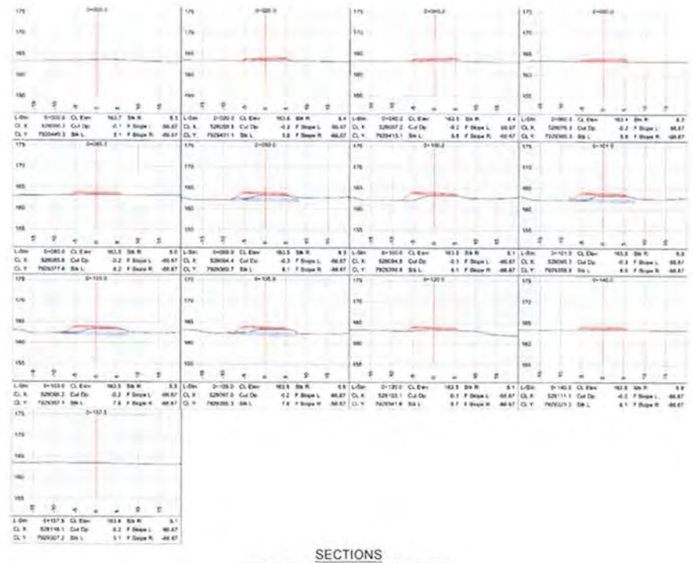
TITLE
CULVERT INSTALLATION DESIGN RECOMMENDATIONS & DESIGN TABLES - CV059

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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MISSISSAUGA OFFICE
6925 CENTURY AVENUE, SUITE 100
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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.
1667706-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
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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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NORTHWEST TERRITORIES
APPROVED

CLIENT: Baffinland

CONSULTANT: Golder Associates

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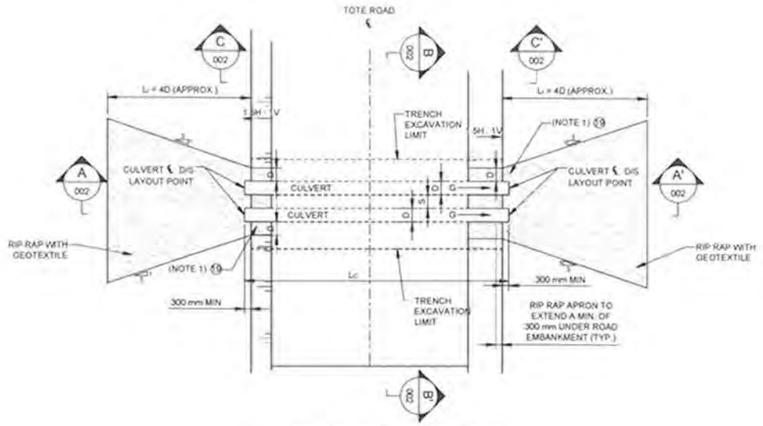
PROJECT
MARY RIVER PROJECT
TOTE ROAD EARTHWORKS

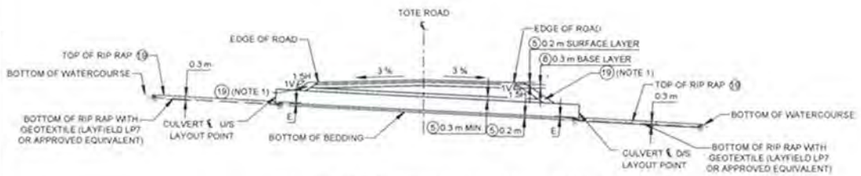
TITLE
TITLE SHEET - CV099

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

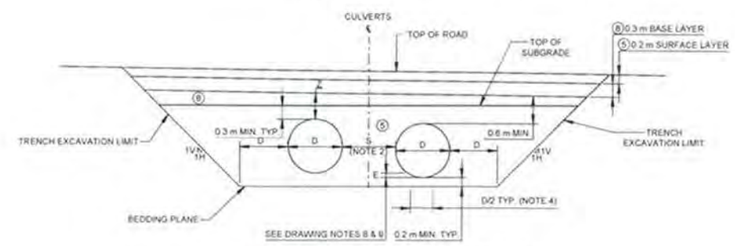
Reduced Size
NOT TO SCALE



PIPE CROSSING PLAN VIEW
SCALE 1:200 m



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



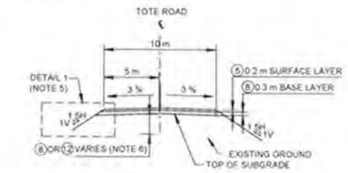
SCALE 1:50 m (B 002) PIPE CROSSING TYPICAL SECTION

LEGEND

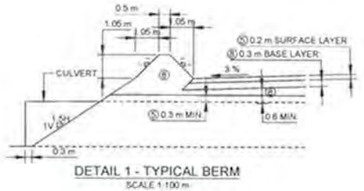
(5)	SCREENED MATERIAL	(12)	RUN OF QUARRY (ROQ)
(8)	JAW RUN	(19)	EROSION PROTECTION

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 0.8 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_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.
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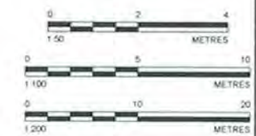

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R.A. DOUGLAS
LICENSEE
2017-04-21
NWT/NU

CLIENT: Baffinland

CONSULTANT: Golder Associates

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MISSISSAUGA, ON
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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	4.6
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. 002)

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 EASTING (m)	CENTRELINE NORTHING (m)	CENTRELINE ELEVATION (m)	CENTRELINE CUT DEPTH* (TOP OF SUBGRADE TO EXISTING ROAD SURFACE) (m)	TOE OF EMBANKMENT SLOPE: 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	5.6	6.2	1.3
0+020.0	521858.8	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	6.6	3.6
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	521939.6	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: [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

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 - CV099

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