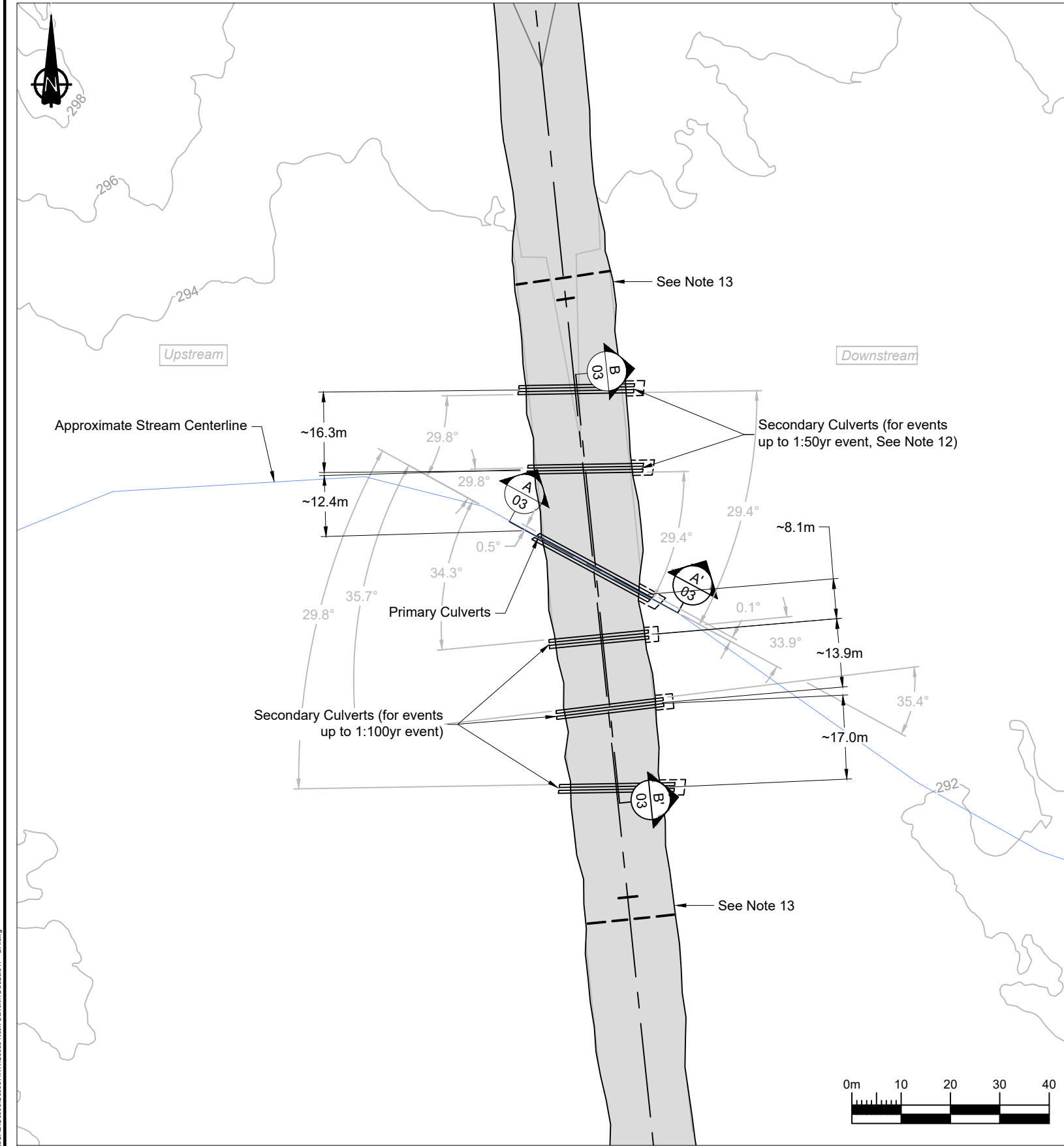


Engineering Drawings for the Goose All-Weather Road (Type A License) - Goose Neck Crossing Back River Project, Nunavut, Canada

ACTIVE DRAWING STATUS

SABINA DWG NUMBER	SRK DWG NUMBER	DRAWING TITLE	REVISION	DATE	STATUS
SBR6SRK-23-C-PLN-011	GN-01	Goose Neck Crossing Location Plan	0	March 12, 2020	Issued for Permitting
SBR6SRK-23-C-PLN-012	GN-02	Goose Neck Crossing Culvert Plan	1	June 16, 2020	Issued for Permitting
SBR6SRK-23-C-DET-006	GN-03	Goose Neck Crossing Profile and Sections	1	June 16, 2020	Issued for Permitting





LEGEND

- Double Culvert Location
Stream Centerline (Approximate)
All-Weather Road (To be built)
Coconut Matting

GENERAL NOTES

- Contours shown at 2.0m intervals.
- All units are in meters unless otherwise stated.
- This drawing set relates only to the Goose Neck crossing culverts and not to the Goose All-Weather road.
- The designs are based on the LiDAR contour information shown on these drawings. It is however the Contractor's responsibility to confirm that the contours are a fair reflection of the ground levels in the vicinity of the works, and to advise the Client and Engineer of any differences. No ground survey data in the Goose Neck area was available at the time these drawings were issued.
- The Engineer has been informed from Sabina that the Goose Neck crossing is non-fish bearing and in creek construction is therefore able to result at this location. Total Suspended Solids (TSS) levels will still be required to be monitored on site. Sabina Environmental group to be consulted for further guidance / information.
- Where thickness of the roads (including the culvert locations) are greater than 3m, safety barriers should be installed.
- All notes on this drawing package, in addition to the technical specifications outlined in document 'Technical Specifications - Earthworks and Geotechnical Engineering - Back River Gold Project, Nunavut, Canada - Issued for Construction', should be followed



DESIGN CONSIDERATIONS

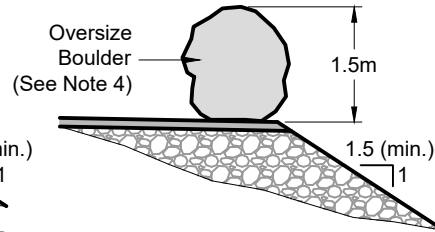
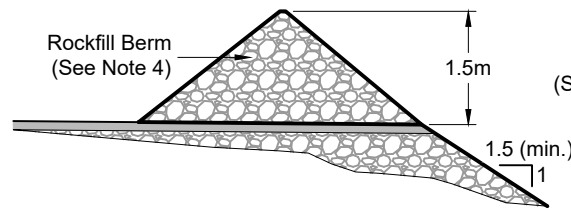
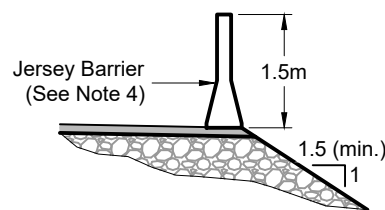
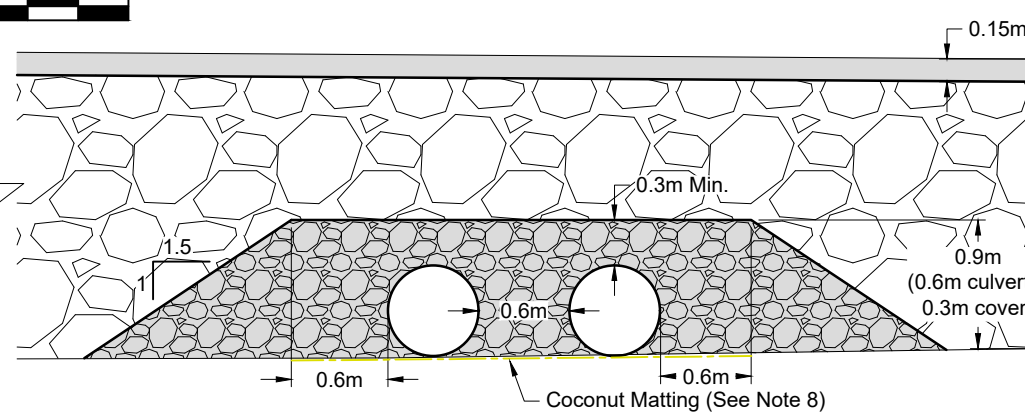
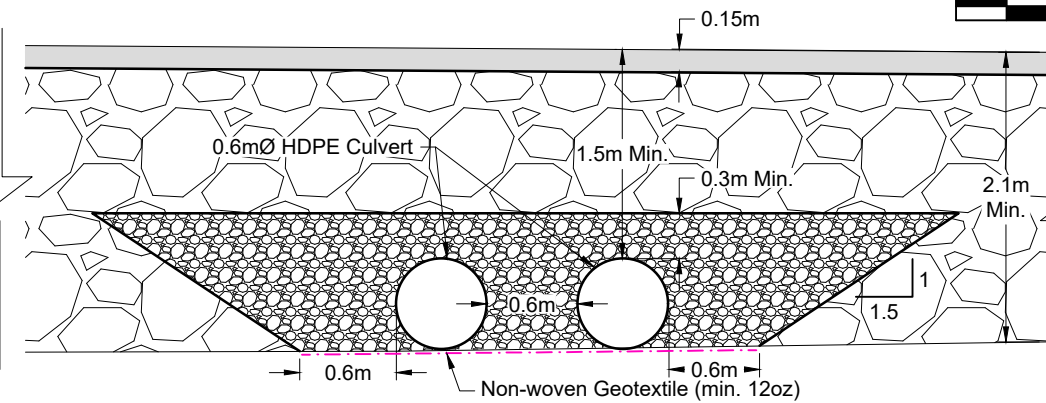
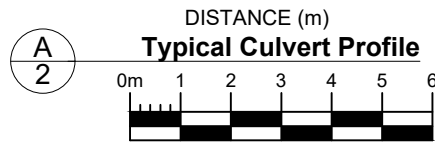
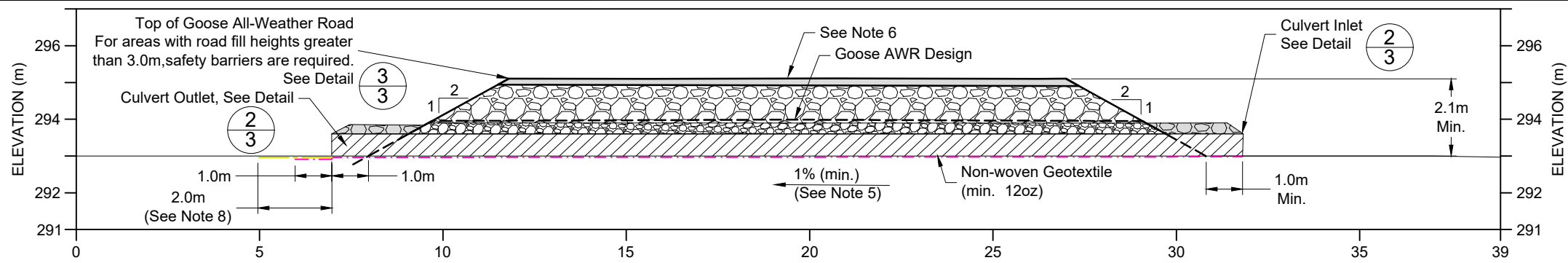
- Exact location of the culverts to be confirmed in the field based on ground survey of existing conditions. Locations of culverts to be placed with the goal of best following existing stream and ephemeral flow paths. The road alignment over culvert crossings to be adjusted so skew angles are minimized. Note that culverts with larger skew angles will have longer overall installed lengths. As shown on GN-03 base slopes of culverts will be installed at 1% or greater grades.
- Erosion protection measures will be required around the outlet of the culverts. These erosion control measures are expected to consist of a small patch of non-woven geotextile at the immediate outlet of the culvert (approximately 1.0m in length by 0.7m in width) that is covered by a larger layer (larger extents) of coconut matting. The coconut matting material would be placed approximately 2.0m beyond the culvert outlet and at least one culvert diameter in width beyond each side of the culvert. Coconut matting will help to limit erosion by still allowing the top vegetative tundra mat to live. Not that a thin layer of rip rap fill material is not planned to be placed on the downstream. Placement of thin lifts of fill material (less than 1.5m) should be avoided as this may lead to deepening of the active layer and increased rates of permafrost degradation at the culvert outlet. Conditions at the inlet and outlet of the culvert should be monitored to ensure permafrost conditions are stable immediately after construction, and culvert monitoring will be completed in line with Sabina's Environmental Protection Plan (EMPP; 2AM-BRP1831 Supporting Document 20).
- Ongoing performance monitoring of the road should be completed throughout the life of mine. Ongoing maintenance of the culverts may occur if the roads are not constructed to design thicknesses (typically 2+m). If excessive deformation of the HDPE culverts are noted then the culverts may need to be excavated out and replaced.
- No fill material should be placed on top of frozen creek ice and/or snow. Fill materials should be placed over an unfrozen creek or any massive ice in the stream channel should be removed.
- The culvert should be placed on the current grade (i.e. no excavation into the foundation except to remove ice in the stream channel as described in point 9).
- The largest design load (assuming the minimum 1.5m cover over the top of the culverts have been maintained) is one (single) loaded CAT777 Haul Truck (smaller or equivalent).
- Based on the very flat topography and large catchment of the Goose Neck area, ponding against the road is expected for any flows larger than the 1:20 year event. Specifically, simplified hydraulic calculations show:
 - Limited ponding expected up to the 1:20 year event against the road (typically more localized based on topography).
 - In the range of 0.2m of ponding against the full upstream portion of the road during the 1:50 year event
 - In the range of 1.2+m of ponding against the road, and flow through coarse rockfill during the 1:100 year event.
- The portion of the roads by the culverts will be at a lower elevation than the surrounding roads. This will be done to limit any impacts from any potential road overtopping during a large (greater than 1:50 year) event. During any large rain events care should be taken around the Goose Neck culverts and the supervisors on site should assess if the road is suitable to travel or if it needs to be blocked off. If excessive ponding is noted on either side of the road, or if flow is going over the road during a storm event then caution should be taken and vehicle access should be restricted.
- Final locations of culverts to be determined in the field. Presented culvert locations are based on the LiDAR information and the ground survey information provided at the end of 2018 to SRK at the road alignment toes.

ENGINEER (RECORD) SIGN-OFF

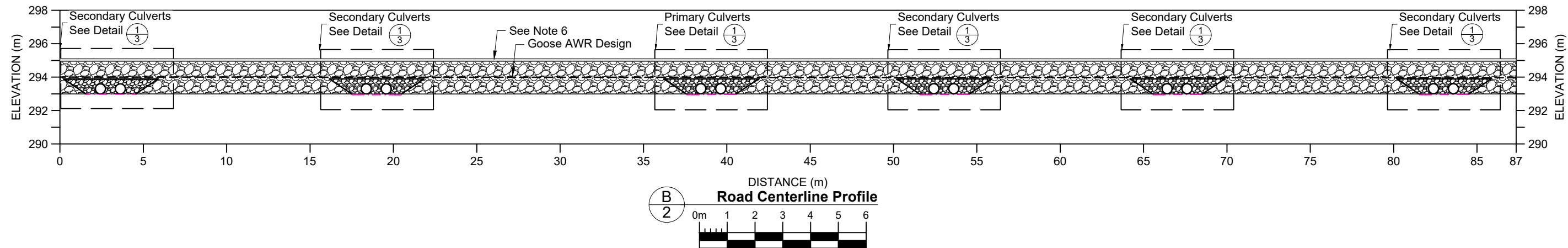
- If the client wishes to have Engineering sign-off on the Goose Neck Crossing Area then the details outlined in the project Technical Specifications document must be followed. See the Technical Specifications - 'Earthworks and Geotechnical Engineering - Back River Gold Project, Nunavut, Canada - Issued for Construction' document for additional details. As a minimum the following will be required.:
 - QC and QA documentation confirming that the material specification have been followed and met. This would include manufacturer certificates for all the non-woven geotextile material, QC documentation and photos of all geotextile seams, manufacturer certificate for each culvert, QC documentation for any joings or welds in the culverts, QC material testing for all crush (bedding) materials; as per the site Technical Specifications.
 - As-Built survey information for all layers and components of the design (i.e. survey data for original ground, stream centerline and banks, bedding and ROQ above the culvert, riprap on the face of the culvert, and top surfacing layer.
 - Survey information for the as-built placed volumes as well as daily truck load counts.
 - Engineer site supervision during construction. This would consist of at least one site visit during construction and photos from the Client and Contractor throughout construction of the Goose Neck crossing.

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										Original Drawings Stamped and Signed by Engineer						Goose All-Weather Road				
																DRAWING TITLE: Goose Neck Crossing Culvert Plan				
										This drawing is uncontrolled when printed unless stamped / certified in accordance with the requirements of the applicable jurisdiction and recorded on a Distribution Register.		DESIGN: JBK		DRAWN: TAH		REVIEWED: MS		Back River Project		
												CHECKED: RW		APPROVED: JBK		DATE: 2020/06/16				
												FILE NAME: 1CS020.017 - GA.dwg		SRK JOB NO.: 1CS020.017		SABINA DRAWING NO. SBR6SRK-23-C-PLN-012				
										PROFESSIONAL ENGINEERS STAMP										
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3/3 Typical Safety Barrier Details
Not to Scale



LEGEND

- Coconut Matting
- Non-woven Geotextile (Min. 12oz.)
- Bedding Material
- Rip Rap
- Run of Quarry (ROQ) Material
- Surfacing Material

NOTES

- All dimensions in meters unless otherwise stated.
- Installation of culverts to follow the manufacturers assembly and installation guide.
- Total depth of cover above culvert, including bedding material, surfacing material, and ROQ material, will be 1.5m minimum. Road to be built up to a minimum height of 1.5m above the top of the installed culverts (typical road thickness 2.1m above the original ground).
- For safety barrier sizing, height to be a minimum $\frac{2}{3}$ the diameter of the largest vehicle tire.
- If natural ground is less than 1% grade, fill material (surfacing material) to be placed below culvert to establish minimum 1% grade.
- All fill material compaction effort to be done in accordance with the site Technical Specifications document (see reference on dwg. GN-02). Bedding material to be compacted in thin lifts (max. 0.2m) to 95% of standard proctor testing densities.
- Non-woven geotextile is suggested to be placed below all culvert pipes to help slow rates of permafrost degradation from surface water flow, and to help reduce differential settlement.
- Erosion protection measures will be required around the outlet of the culverts. These erosion control measures are expected to not consist of placed rip rap but instead consist of a small patch of non-woven geotextile at the immediate outlet of the culvert (approximately 1.0m in length by 0.7m in width) that is covered by a larger layer (larger extents) of coconut matting. The coconut matting material would be placed approximately 2.0m beyond the culvert outlet and at least one culvert diameter in width beyond each side of the culvert. Coconut matting will help to limit erosion by still allowing the top vegetative tundra mat to live. Note that a thin layer of rip rap fill material is not planned to be placed on the downstream. Placement of thin lifts of fill material (less than 1.5m,) should be avoided as this may lead to deepening of the active layer and increased rates of permafrost degradation at the culvert outlet. Conditions at the inlet and outlet of the culvert should be monitored to ensure permafrost conditions are stable immediately after construction. Monitoring observations at each culvert should be documented annually to allow for better tracking of performance, resulting change near the outlet, and scheduling of required maintenance if / as required.
- Maintenance and grading to be done at the upstream inlet of the culvert if / as required to limit the potential for ponding water; which could help to accelerated permafrost degradation / deepen the active layer.

REFERENCE DRAWINGS	NO.	DESCRIPTION	CHKD	APPD	DATE	NO.	DESCRIPTION	CHKD	APPD	DATE
ECHO-02		Echo Crossing Culvert Plan	--	--	--	0	Issued for Permitting	JBK	CP	20/06/16
DRAWING NO.		DRAWING TITLE				0	Issued for Permitting	MS	JBK	20/03/18

Original Drawings Stamped and Signed by Engineer	This drawing is uncontrolled when printed unless stamped / certified in accordance with the requirements of the applicable jurisdiction and recorded on a Distribution Register.
PROFESSIONAL ENGINEERS STAMP	

DESIGN: JBK	DRAWN: TAH	REVIEWED: MS
CHECKED: RW	APPROVED: JBK	DATE: 2020/06/16
FILE NAME: 1CS020.017 - GA.dwg		

Sabina GOLD & SILVER CORP.	Back River Project
SRK JOB NO.: 1CS020.017	SABINA DRAWING NO. SBR6SRK-23-C-DET-006

Goose All-Weather Road	DRAWING TITLE: Goose Neck Crossing Profile and Sections
DRAWING NO. GN-03	SHEET 3 OF 3
REVISION NO. 1	