APPENDIX B

Issued for Construction Drawings

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN

DRAWING NO.	REVISION	TITLE
700	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - DRAWING LIST
703	3	PERMANENT CROSSING PLAN - CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
705	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-114 - GENERAL ARRANGEMENT
706	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-114 - PLAN AND SECTION
710	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-112 - GENERAL ARRANGEMENT
711	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-112 - PLAN AND SECTION - SHEET 1
712	1	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-112 - PLAN AND SECTION - SHEET 2
715	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-106 - GENERAL ARRANGEMENT
716	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-106 - PLAN AND SECTION
720	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-102 - GENERAL ARRANGEMENT
721	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-102 - PLAN AND SECTION
725	4	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-059 - GENERAL ARRANGEMENT
726	4	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-059 - PLAN AND SECTION
730	3	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-057 - GENERAL ARRANGEMENT
731	3	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-057 - PLAN AND SECTION
735	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-216 - GENERAL ARRANGEMENT
736	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-216 - PLAN AND SECTION
740	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - BG-27 - GENERAL ARRANGEMENT
741	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - BG-27 - PLAN AND SECTION
745	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - BG-04 - GENERAL ARRANGEMENT
746	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - BG-04 - PLAN AND SECTION
750	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-001 - GENERAL ARRANGEMENT
751	2	PERMANENT CROSSING PLAN - ROUND CSP CULVERTS - CV-001 - PLAN AND SECTION
780	1	TOTE ROAD CULVERT REMEDIATION - IN CULVERT WORKS - TYPICAL DETAILS
781	1	TOTE ROAD CULVERT REMEDIATION - CULVERT INLET AND OUTLET WORKS - TYPICAL PLAN AND DETAILS
782	0	TOTE ROAD CULVERT REMEDIATION - EXTERNAL CULVERT WORKS - TYPICAL DETAILS

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Signature
Date 2024-02-08
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

ISSUED FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS
DRAWING LIST

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	700	2

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	AS	DP	
1	06SEP'23	ISSUED FOR CONSTRUCTION	GMJ	MJC/EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH

REVISIONS

DRG. NO.	DESCRIPTION

REFERENCE DRAWINGS

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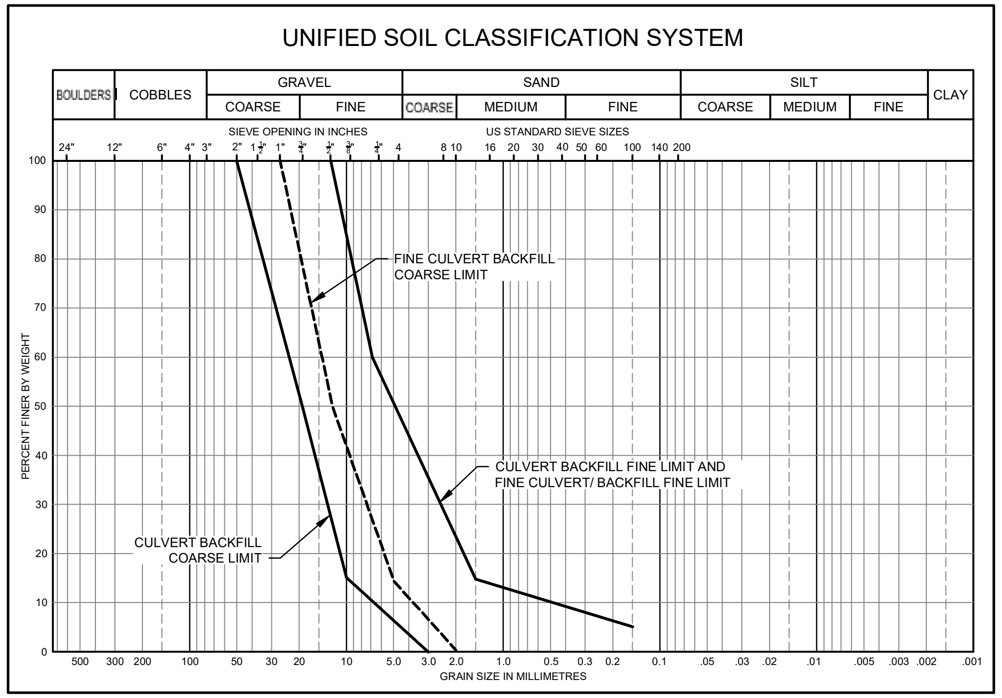
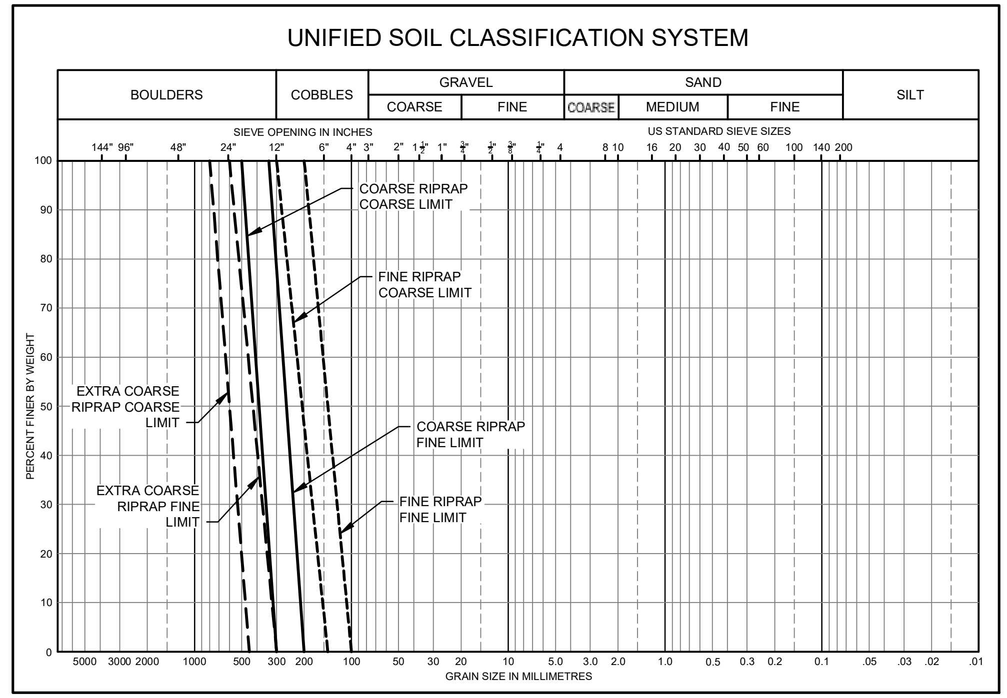
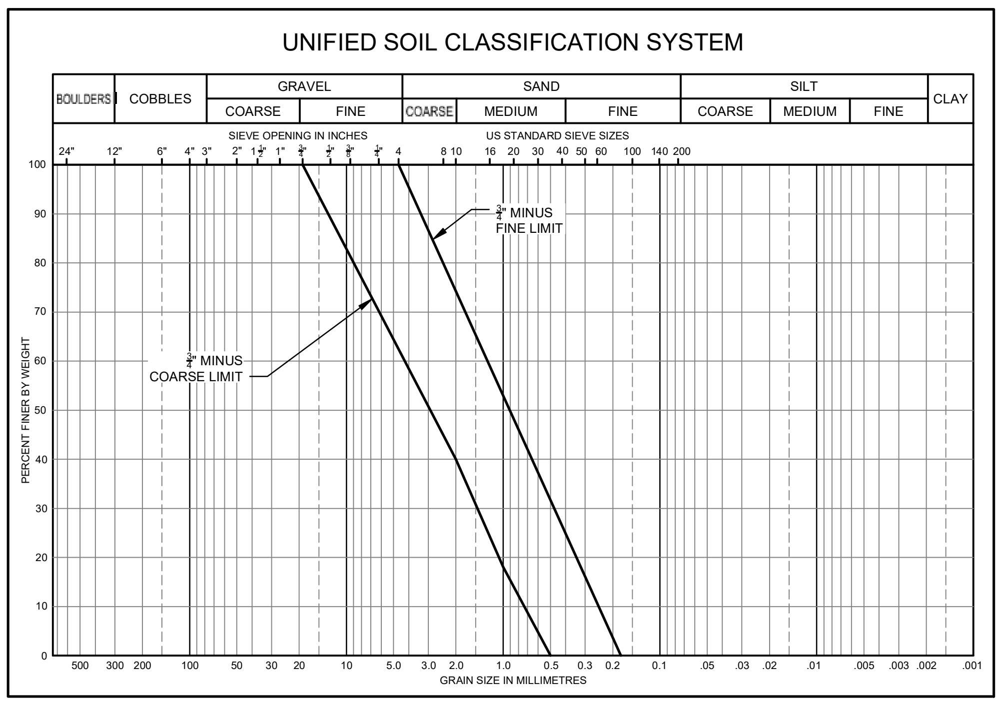
XREF FILE(S): XG-INIT-KEH, X-G-INIT-TJP IMAGE FILE(S): GJohnstone_NU Seal KHawton_PTP.NT



CULVERT BACKFILL AND FINE CULVERT BACKFILL



EXTRA COARSE, COARSE AND FINE RIPRAP



3/4" MINUS

MATERIAL PLACEMENT AND COMPACTION REQUIREMENTS

ZONE AND MATERIAL TYPE	PLACING AND COMPACTION REQUIREMENTS
ROAD TOPPING	MATERIAL SHALL CONSIST OF WELL GRADED, CLEAN, DURABLE AND ANGULAR, SAND AND GRAVEL FREE OF CLAY, LOAM, ORGANICS, AND OTHER DELETERIOUS MATERIAL. MATERIAL SHALL BE SUITABLE FOR ROAD SURFACE USE.
LOCAL BORROW AREA FILL	MATERIAL SHALL CONSIST OF WELL GRADED, CLEAN AND DURABLE LOCALLY BORROWED FILL FREE FROM ROOTS AND OTHER DELETERIOUS OR ORGANIC MATTER. MATERIAL TO BE PLACED, MOISTURE CONDITIONED AND COMPACTED.
CULVERT BACKFILL	MATERIAL SHALL CONSIST OF WELL GRADED, CLEAN, DURABLE AND ANGULAR SAND AND GRAVEL. THE MATERIAL SHOULD BE PLACED IN 200 mm LIFTS AND COMPACTED 8 TIMES WITH A MIKASA MVH-408DZ OR APPROVED EQUIVALENT.
FINE CULVERT BACKFILL	MATERIAL SHALL CONSIST OF WELL GRADED, CLEAN, DURABLE AND ANGULAR SAND AND GRAVEL. THE MATERIAL SHOULD BE PLACED IN 200 mm LIFTS AND COMPACTED 8 TIMES WITH A MIKASA MVH-408DZ OR APPROVED EQUIVALENT.
FINE RIPRAP	FINE RIPRAP SHALL CONSIST OF CLEAN, DURABLE AND ANGULAR NON-WEATHERED ROCKFILL, FREE OF CLAY, LOAM, ROOTS AND OTHER DELETERIOUS OR ORGANIC MATTER. PLACED AND SPREAD IN MAXIMUM 2 x D_{50} LAYER. PLACED SELECTIVELY TO FORM A TIGHT INTERLOCKING LAYER.
COARSE RIPRAP	COARSE RIPRAP SHALL CONSIST OF CLEAN, DURABLE AND ANGULAR NON-WEATHERED ROCKFILL, FREE OF CLAY, LOAM, ROOTS AND OTHER DELETERIOUS OR ORGANIC MATTER. PLACED SELECTIVELY TO FORM A TIGHT INTERLOCKING LAYER.
EXTRA COARSE RIPRAP	EXTRA COARSE RIPRAP SHALL CONSIST OF CLEAN, DURABLE AND ANGULAR NON-WEATHERED ROCKFILL, FREE OF CLAY, LOAM, ROOTS AND OTHER DELETERIOUS OR ORGANIC MATTER. PLACED SELECTIVELY TO FORM A TIGHT INTERLOCKING LAYER.
NATURAL STREAM SUBSTRATE MATERIAL	SHALL CONSIST OF CLEAN, WELL GRADED, DURABLE MATERIAL SIMILAR TO NATURAL SUBSTRATE, FREE OF SILT, CLAY, LOAM, ROOTS AND OTHER DELETERIOUS OR ORGANIC MATTER.
¾" MINUS	MATERIAL SHALL CONSIST OF WELL GRADED, CLEAN, DURABLE AND ANGULAR, SAND AND GRAVEL FREE OF CLAY, LOAM, ORGANICS, AND OTHER DELETERIOUS MATERIAL.

GEOSYNTHETICS:

SUBGRADE PREPARATION

1. SUBGRADE PREPARATION SHALL BE CARRIED OUT IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND INSTALLATION GUIDELINES.
2. PLACEMENT AND COMPACTION OF BEDDING OVER SUBGRADE SHALL BE CONDUCTED USING PLACEMENT AND COMPACTION METHODS TO SUIT THE SPECIFIC FIELD CONDITIONS. WHERE COMPACTION WITH A STANDARD VIBRATORY ROLLER IS NOT POSSIBLE, ALTERNATIVE COMPACTION EQUIPMENT MAY BE ACCEPTED. THE PLACEMENT AND COMPACTION METHODS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO THEIR IMPLEMENTATION.

DELIVERY, HANDLING AND STORAGE

1. DELIVERY, HANDLING AND STORAGE OF GEOSYNTHETICS MATERIAL SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S PRINTED INSTRUCTIONS.

GEOSYNTHETICS INSTALLATION

1. THE GEOTEXTILE SHALL BE NON-WOVEN, 7 oz/yd² GEOTEXTILE, OR APPROVED EQUIVALENT.
2. THE GEOTEXTILE SHALL BE HANDLED IN SUCH A MANNER AS TO ENSURE THAT IT IS NOT DAMAGED IN ANY WAY. SHOULD THE CONTRACTOR DAMAGE THE GEOSYNTHETICS TO THE EXTENT THAT IT IS NO LONGER USABLE AS DETERMINED BY THESE SPECIFICATIONS OR BY THE ENGINEER, THE CONTRACTOR SHALL REPLACE THE GEOSYNTHETICS AT THEIR EXPENSE.
3. THE SUBGRADE UNDERLYING THE GEOSYNTHETICS SHALL BE APPROVED BY THE ENGINEER AND SHALL BE SMOOTH AND FREE OF RUTS OR PROTRUSIONS WHICH COULD DAMAGE THE GEOSYNTHETICS. THE GEOTEXTILE SHALL BE LAID FLAT AND SMOOTH SO THAT THEY ARE IN DIRECT CONTACT WITH THE SUBGRADE. THE GEOSYNTHETICS SHALL BE FREE OF TENSILE STRESSES, FOLDS AND WRINKLES SO THAT THE OVERLYING MATERIALS WILL NOT EXCESSIVELY STRETCH OR TEAR THE FABRIC. ON SLOPES STEEPER THAN 10H:1V, THE GEOTEXTILE SHALL BE LAID WITH THE MACHINE DIRECTION OF THE FABRIC PARALLEL TO THE SLOPE DIRECTION. ANCHORING OF THE TERMINAL ENDS OF THE GEOTEXTILE SHALL BE ACCOMPLISHED THROUGH THE USE OF ANCHOR TRENCHES, ANCHOR BERMS OR APRONS AT THE CREST AND TOE OF THE SLOPE. THE GEOTEXTILE SHALL BE PLACED DIRECTLY ON THE PREPARED SUBGRADE WITH SEAMS UPWARD.
4. SUCCESSIVE AND ADJACENT GEOTEXTILE SHEETS SHALL BE OVERLAPPED A MINIMUM OF 0.3 m IN SUCH A MANNER THAT THE UPSTREAM SHEET IS PLACED OVER THE DOWNSTREAM SHEET AND/OR THE UPSLOPE OVER THE DOWNSLOPE.
5. THE GEOSYNTHETICS SHALL BE COVERED AS SOON AS POSSIBLE AFTER INSTALLATION AND APPROVAL. INSTALLED GEOSYNTHETICS SHALL NOT BE LEFT EXPOSED FOR MORE THAN 15 DAYS. MATERIAL OVERLAYING THE GEOSYTHETICS SHALL BE CAREFULLY PLACED TO AVOID WRINKLING OR DAMAGE TO THE GEOSYNTHETICS. THE OVERLAYING MATERIAL PLACEMENT SHALL BEGIN AT THE TOE AND PROCEED UP THE SLOPE. ANY SEAMS THAT ARE FLAWED SHALL BE REPAIRED BY THE CONTRACTOR AT THEIR EXPENSE.
6. UNLESS OTHERWISE NOTED INSTALLATION OF GEOSYNTHETICS SHALL BE IN ACCORDANCE WITH THE FOLLOWING:
   • APPLICABLE GEOSYNTHETICS RESEARCH INSTITUTE STANDARDS.
7. THE GEOSYNTHETICS SHALL BE INSTALLED ON THE AREA SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
8. THESE DRAWINGS SHOULD BE READ IN CONJUNCTION WITH THE EROSION AND SEDIMENT CONTROL PLAN - PRIORITY CULVERT REPLACEMENTS, RELEVANT BAFFINLAND MANAGEMENT PLANS AND APPLICABLE LEGISLATION.

ISSUED FOR CONSTRUCTION

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2024-02-08
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

NOTES:

1. THE DRAWING SHALL BE READ IN CONJUNCTION WITH THE ACCOMPANYING CONTRACT DOCUMENTS AND APPLICABLE TECHNICAL SPECIFICATIONS.
2. FILL MATERIALS USED FOR CONSTRUCTION SHALL NOT BE POTENTIALLY ACID GENERATING (PAG) OR METAL LEACHING (ML). THROUGHOUT CONSTRUCTION, ADEQUATE INSPECTION AND PERIODIC TESTING SHOULD BE CARRIED OUT TO DEMONSTRATE THE SUITABILITY OF THE FILL MATERIALS.
3. UNLESS OTHERWISE NOTED ALL MATERIALS SHALL CONSIST OF HARD, DURABLE FILL MATERIAL, FREE OF CLAY, LOAM, ROOTS AND OTHER DELETERIOUS MATERIALS OR ORGANIC MATTER, AND CONTAIN NO SNOW OR MASSIVE ICE.

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
CULVERT FILL MATERIALS AND
GEOSYNTHETICS SPECIFICATIONS

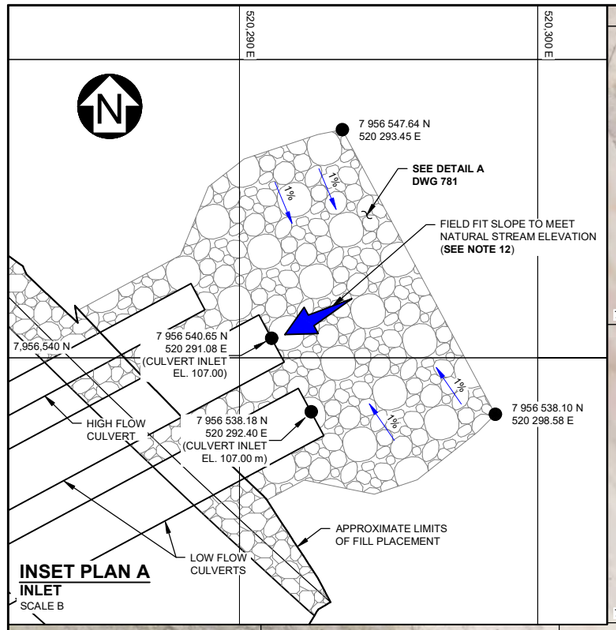
DRG. NO.	DESCRIPTION
REFERENCE DRAWINGS	

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
REVISIONS						

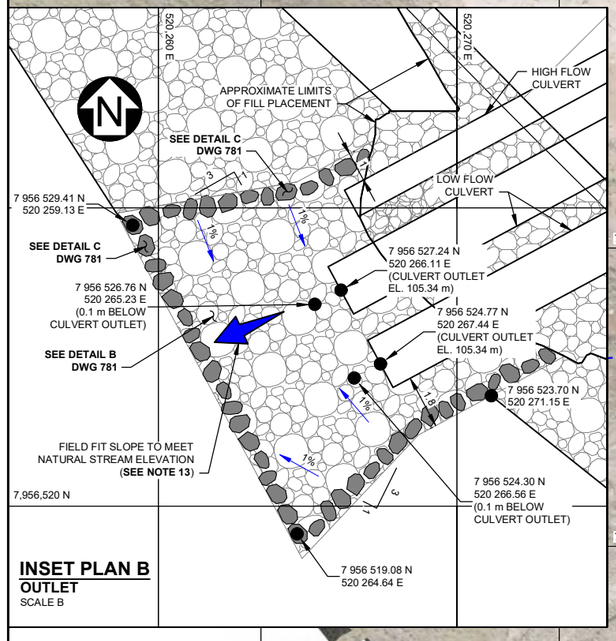
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
3	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	AS	TJP	
2	24OCT'23	ISSUED FOR CONSTRUCTION	GMJ	EDW/AS	CAP	KEH
1	06SEP'23	ISSUED FOR CONSTRUCTION	GMJ	MJC/EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH

REVISIONS

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	703	3

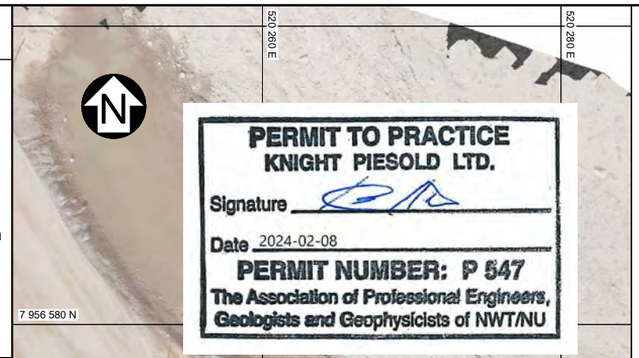


INSET PLAN A
INLET
SCALE B



INSET PLAN B
OUTLET
SCALE B

PLAN
SCALE A



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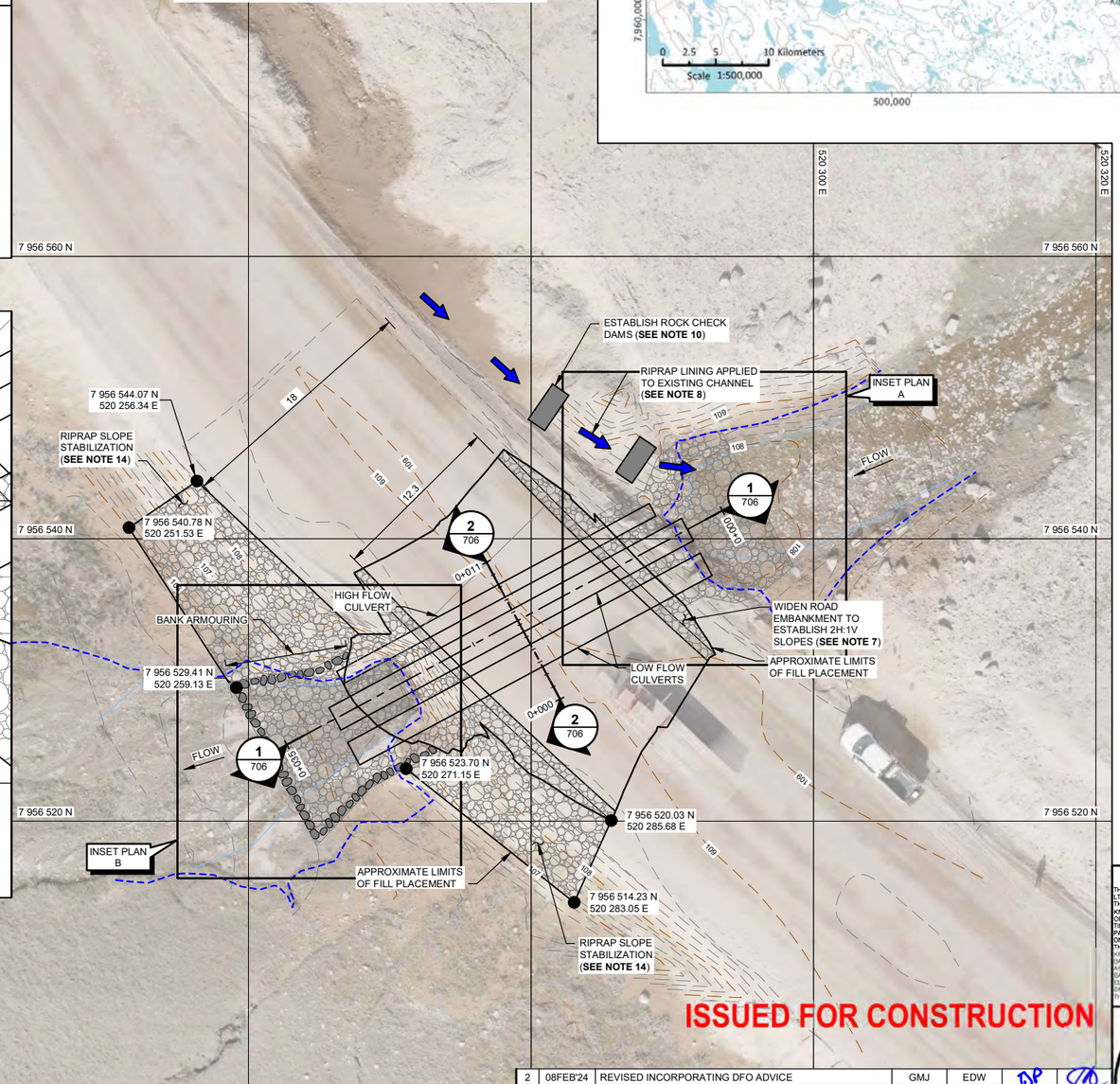
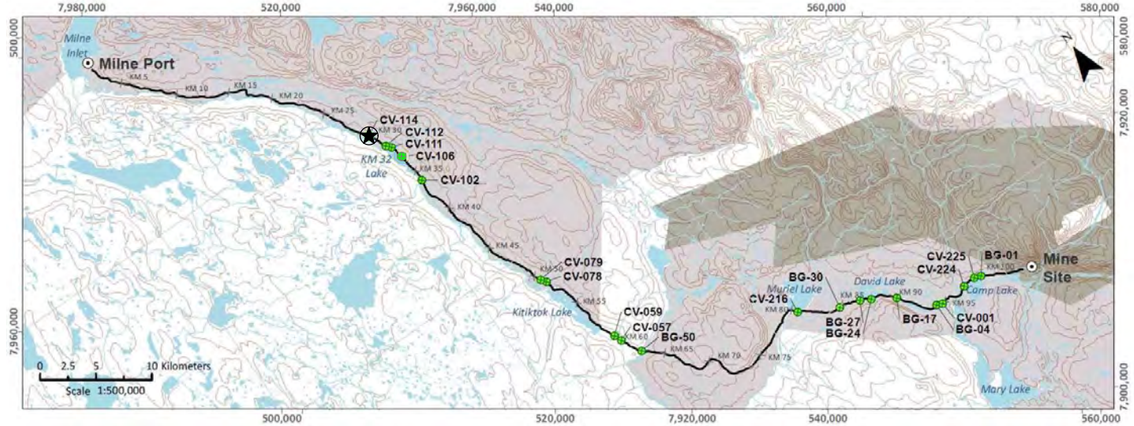




LEGEND:

- COARSE RIPRAP
- FINE RIPRAP
- ROCK CHECK DAM
- APPROXIMATE LIMITS OF FILL PLACEMENT
- APPROXIMATE HIGH WATER MARK (HWM)
- SURVEYED WETTED WIDTH
- RIPRAP LINED EXISTING CHANNEL
- SETTING OUT POINT
- RIPRAP FOR BANK ARMOURING AND FIELD FIT CHANNEL OUTLET
- FIELD FIT SLOPE

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. ALL WORK TO BE COMPLETED DURING FROZEN CONDITIONS.
5. BLASTING MATS MAY BE USED, IF REQUIRED, FOR BLASTING OF SOIL TO REMOVE THE EXISTING CULVERTS. MITIGATION WILL BE IMPLEMENTED AS PER BAFFINLAND'S SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN AND ENVIRONMENTAL PROTECTION PLAN. ONCE EXCAVATION HAS REACHED THE CULVERTS, THEY WILL BE REMOVED AND THE NEW CULVERTS INSTALLED AS PER THE WORK PLAN.
6. ALL BLASTING SPOILS TO BE REMOVED FROM SITE AND DISPOSED AT APPROPRIATE LOCATIONS.
7. CULVERTS TO BE BACKFILLED TO ESTABLISH ROAD SIDE SLOPES AT 2H:1V. ALL SLOPES WILL BE STABILIZED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE AS SHOWN ON **DRAWING 706 (SECTION 1)**.
8. EXISTING DRAINAGE CHANNELS TO BE LINED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE. GEOMETRY TO BE FIELD FIT TO PROVIDE POSITIVE DRAINAGE.
9. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
10. ROCK CHECK DAMS TO BE CONSTRUCTED OF FINE RIPRAP THAT IS FREE OF FINE AND DELETERIOUS MATERIALS. THE STRUCTURES ARE TO BE CONSTRUCTED IN A STABLE MANNER TO REDUCE RUNOFF WATER FLOW VELOCITIES AND PROMOTE SETTLING OF SUSPENDED PARTICLES. PERIODIC MAINTENANCE WILL BE REQUIRED TO REMOVE ACCUMULATED SEDIMENT.
11. EROSION AND SEDIMENT CONTROL MEASURES INCLUDED ARE LIMITED TO THE WATER CROSSING AND THE IMMEDIATE SURROUNDING AREA. THE DESIGN OF OTHER TOTE ROAD EROSION AND SEDIMENT CONTROL MEASURES WILL BE REPORTED SEPARATELY.
12. FIELD FIT INLET TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS CULVERT INLET.
13. FIELD FIT OUTLET SLOPE TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS THE STREAM.
14. STABILIZE SLOPE WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE.

SCALE A: 4 2 0 4 8 12 16 20 m
SCALE B: 2 1 0 2 4 6 8 10 m

DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
706	ROUND CSP CULVERTS - CV-114 PLAN AND SECTION
781	CULVERT INLET AND OUTLET WORKS - TYPICAL PLAN AND DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	DSP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EL/EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW/AS	CAP	KEH

REVISIONS

ISSUED FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

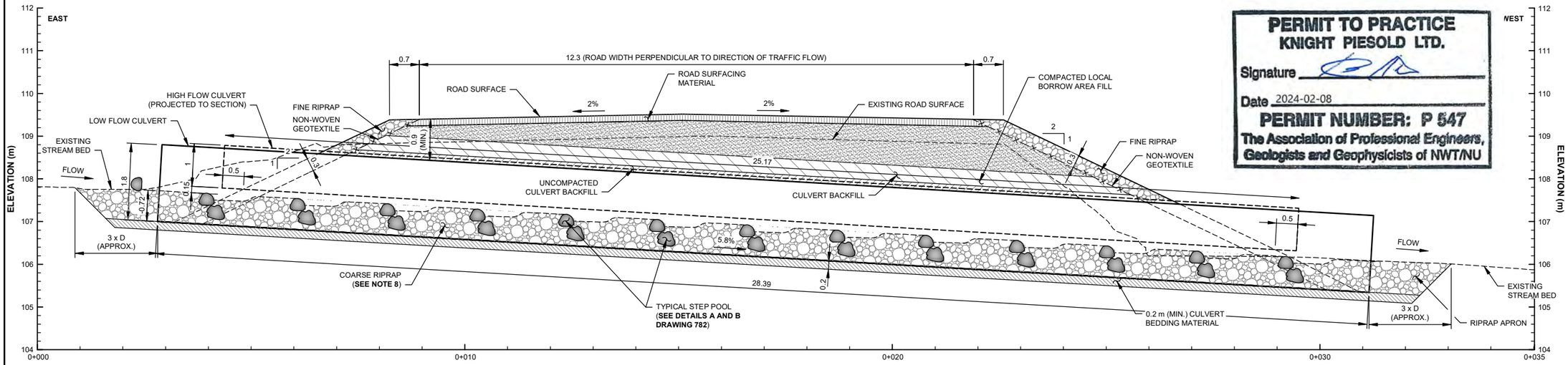
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

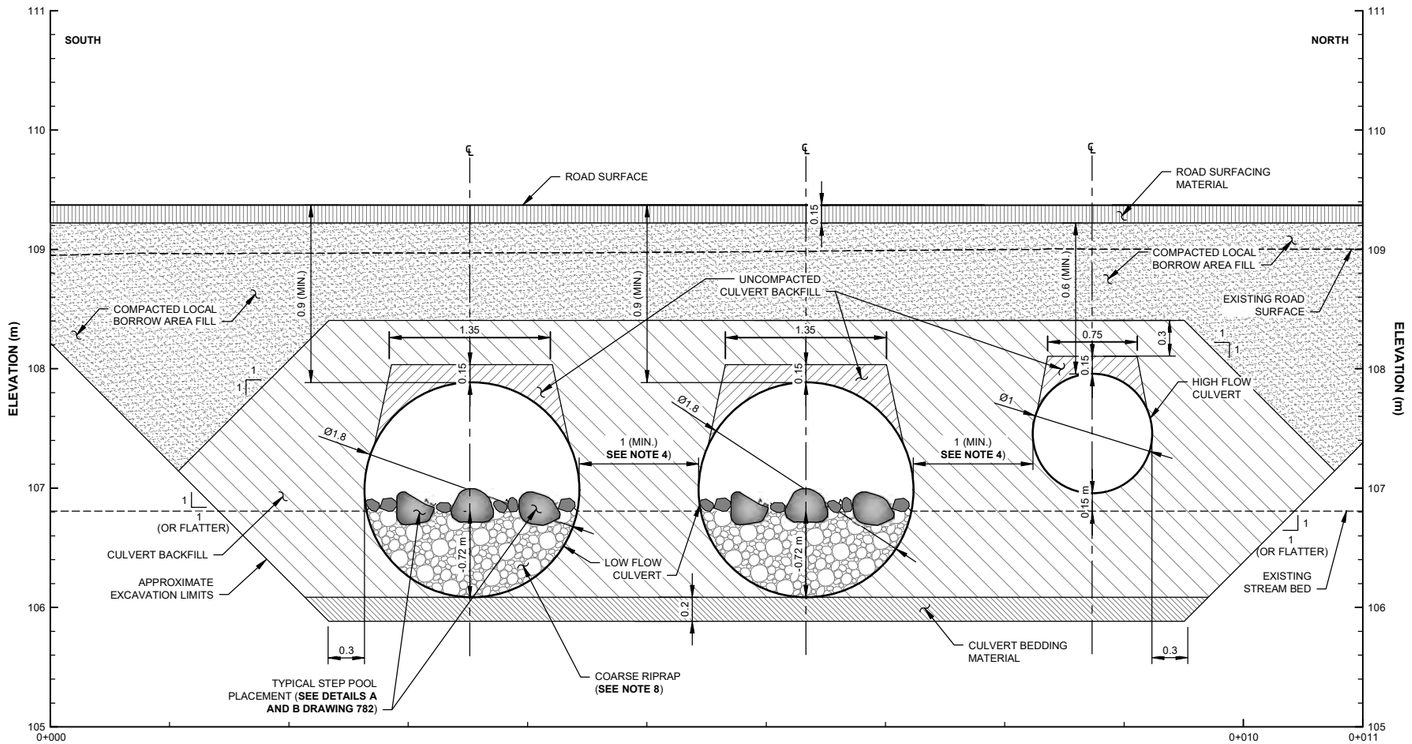
PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-114
GENERAL ARRANGEMENT

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	705	2

SAVED: I:\1102\00181177\A\Acad\DWGS\705 706\705 706 R2, 2/8/2024 1:44:14 PM, , ASIMPSON PRINTED: 2/8/2024 1:44:34 PM, 705, ASIMPSON ACAD VERSION: 24.2S (LMS TECH)



2 1 705 **SECTION**
CV-114 PROFILE
SCALE A



2 2 705 **SECTION**
CV-114 INSTALLATION DETAILS
SCALE B

FISH PASSAGE PARAMETERS	
MODELLED CULVERT JULY OUTLET VELOCITY (m/s)	0.83
MODELLED CULVERT AUGUST OUTLET VELOCITY (m/s)	0.67
MAXIMUM SWIM DISTANCE (m)	3
STEP POOL SPACING (m)	2

RIPRAP LOCATIONS	RIPRAP SIZE (mm)	MATERIAL
INLET/OUTLET APRON	300 (D_{50})	COARSE RIPRAP
BANK STABILIZATION	300 (D_{50})	COARSE RIPRAP
CULVERT INFILLING	300 (D_{50})	COARSE RIPRAP
IN-CULVERT BOULDERS	400 (MIN.)	COARSE RIPRAP
STEP POOL	400 (MIN.)	COARSE RIPRAP
BOULDER CLUSTER	NOT REQUIRED BY DFO SPOT TOOL	N/A

LEGEND:
- COMPACTED LOCAL BORROW AREA FILL
- UNCOMPACTED CULVERT BACKFILL
- CULVERT BACKFILL
- ROAD SURFACING MATERIAL
- COARSE RIPRAP
- FINE RIPRAP
- CULVERT BEDDING MATERIAL
- EXISTING STREAM BED
- NON-WOVEN GEOTEXTILE

SCALE A 1 0.5 0 1 2 3 4 5 m
SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

NOTES:
1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. 1 m (MIN.) OR A SUITABLE WIDTH TO ALLOW SPACE FOR COMPACTOR TO PASS BETWEEN CULVERTS.
5. VEHICLE SAFETY BERMS ARE REQUIRED IN AREAS WITH A DROP OFF GREATER THAN 3.0 m.
6. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
7. CULVERT INFILL MATERIAL TO BE INSPECTED DURING AND AFTER FIRST FRESHET FOLLOWING CONSTRUCTION TO DETERMINE IF ADDITIONAL MATERIAL IS REQUIRED.
8. INTERSTITIAL SPACES OF THE RIPRAP ON THE CHANNEL BED SHALL BE FILLED WITH CREEK BED MATERIAL (OR OTHER MATERIAL APPROVED BY THE ENGINEER) AND GRADED TO MATCH THE ADJACENT CHANNEL BED ELEVATION. THE CONTRACTOR SHALL MINIMIZE VOID SPACE BETWEEN RIPRAP STONES SUCH THAT CREEK FLOWS ARE MAINTAINED ABOVE THE CHANNEL BED DURING LOW-FLOW CONDITIONS. THE FINISHED SURFACE TO BE ROUGHENED TO MIMIC ADJACENT STREAM BED CONDITIONS.

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Signature
Date 2024-02-08
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

REFERENCE DRAWINGS	
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
705	ROUND CSP CULVERTS - CV-114 GENERAL ARRANGEMENT
782	EXTERNAL CULVERT WORKS - TYPICAL DETAILS

ISSUED FOR CONSTRUCTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	AS	CAP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EL	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW/AS	CAP	KEH

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REGISTERED PROFESSIONAL ENGINEER G.M. JOHNSTONE LICENSEE 2024-02-08 NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-114
PLAN AND SECTION

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	706	2

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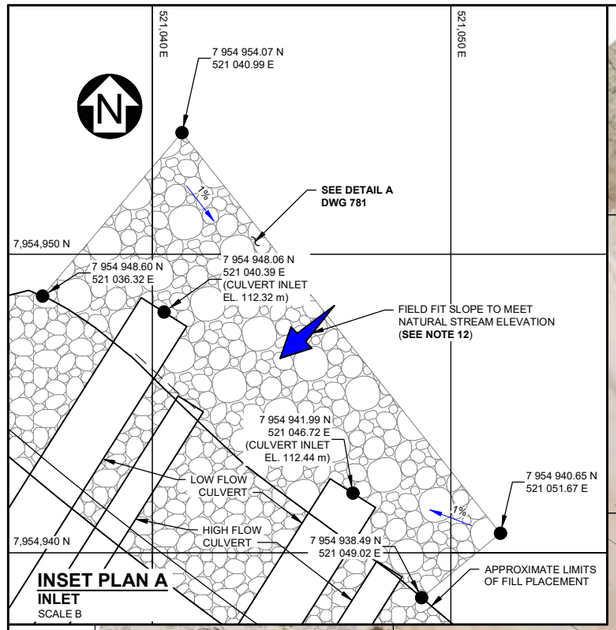
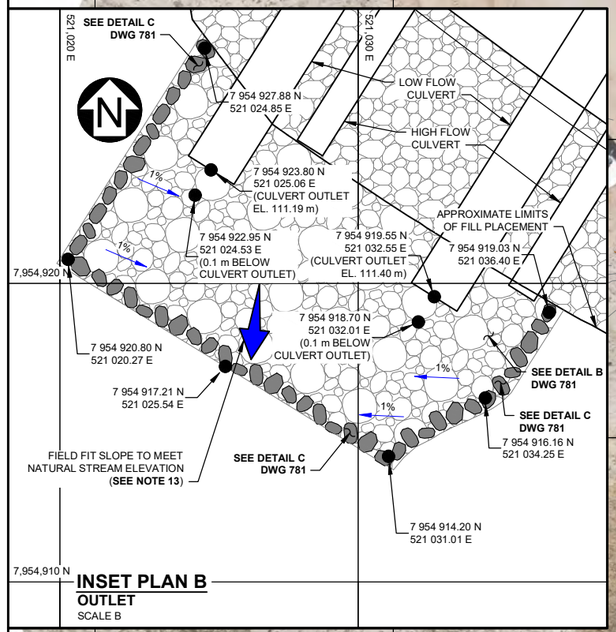


INSET PLAN A
INLET
SCALE B



INSET PLAN B
OUTLET
SCALE B

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Date 2024-02-08
PERMIT NUMBER: P 547
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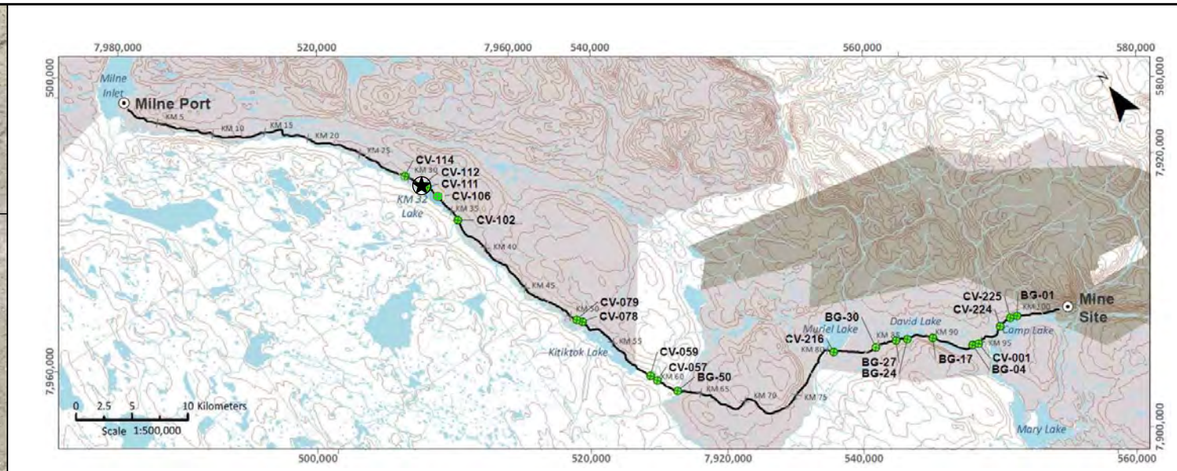
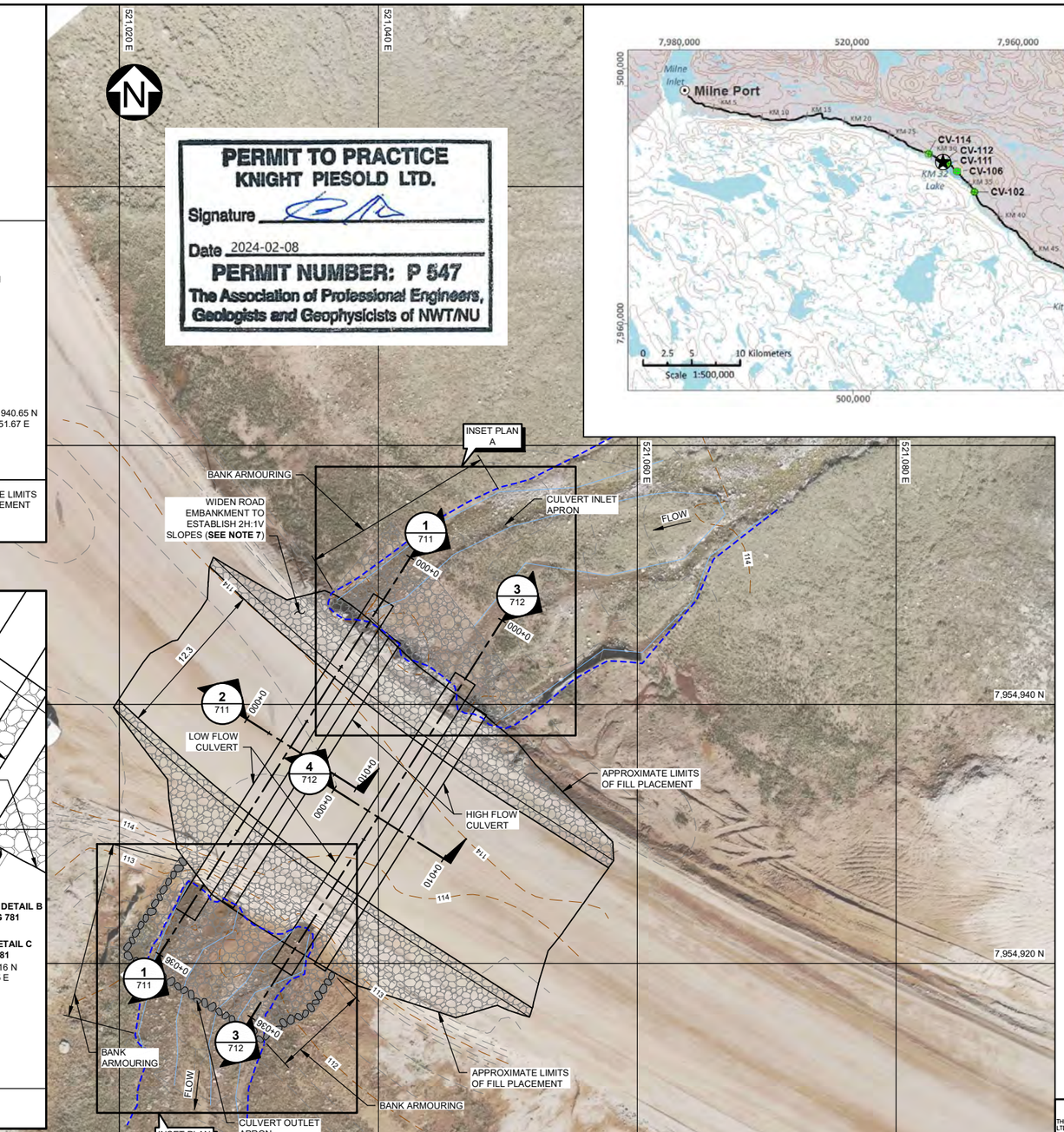




ISSUED FOR CONSTRUCTION

LEGEND:

- COARSE RIPRAP
- FINE RIPRAP
- APPROXIMATE LIMITS OF FILL PLACEMENT
- APPROXIMATE HIGH WATER MARK (HWM)
- SURVEYED WETTED WIDTH
- SETTING OUT POINT
- RIPRAP FOR BANK ARMOURING AND FIELD FIT CHANNEL OUTLET
- FIELD FIT SLOPE

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. IT IS ASSUMED ALL WORK WILL COMPLETED DURING FROZEN CONDITIONS.
5. BLASTING MATS MAY BE USED, IF REQUIRED, FOR BLASTING OF FROZEN SOIL/FILL TO REMOVE THE EXISTING CULVERTS. MITIGATION WILL BE IMPLEMENTED AS PER BAFFINLAND'S SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN AND ENVIRONMENTAL PROTECTION PLAN. ONCE EXCAVATION HAS REACHED THE CULVERTS, THEY WILL BE REMOVED AND THE NEW CULVERTS INSTALLED AS PER THE WORK PLAN.
6. ALL BLASTING SPOILS TO BE REMOVED FROM SITE AND DISPOSED OF AT APPROPRIATE LOCATIONS.
7. CULVERTS TO BE BACKFILLED TO ESTABLISH ROAD SIDE SLOPES AT 2H:1V. ALL SLOPES WILL BE STABILIZED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE AS SHOWN ON **DRAWING 711 (SECTION 1) AND DRAWING 712 (SECTION 3)**.
8. EXISTING DRAINAGE CHANNELS TO BE LINED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE. GEOMETRY TO BE FIELD FIT TO PROVIDE POSITIVE DRAINAGE.
9. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
10. STABILIZE SLOPE WITH FINE RIPRAP OVERLAYING NON-WOVEN GEOTEXTILE.
11. EROSION AND SEDIMENT CONTROL MEASURES INCLUDED ARE LIMITED TO THE WATER CROSSING AND THE IMMEDIATE SURROUNDING AREA. THE DESIGN OF OTHER TOTE ROAD EROSION AND SEDIMENT CONTROL MEASURES WILL BE REPORTED SEPARATELY.
12. FIELD FIT INLET SLOPE TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS CULVERT INLET.
13. FIELD FIT OUTLET SLOPE TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS THE STREAM.

SCALE A 4 2 0 4 8 12 16 20 m

SCALE B 2 1 0 2 4 6 8 10 m

PLAN
SCALE A

DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
711	CSP CULVERTS - CV-112 PLAN AND SECTION - SHEET 1
712	CSP CULVERTS - CV-112 PLAN AND SECTION - SHEET 2
781	CULVERT INLET AND OUTLET WORKS - TYPICAL PLAN AND DETAILS

REFERENCE DRAWINGS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	DSP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	NSD/EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW/AS	CAP	KEH

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

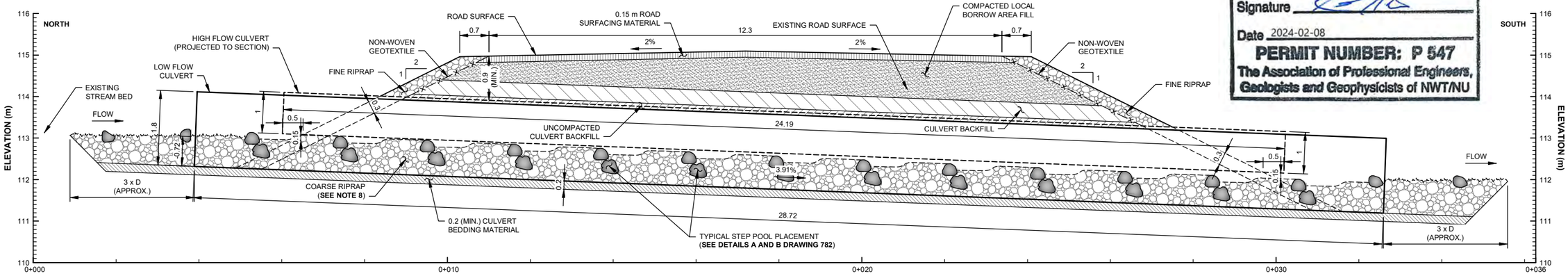
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

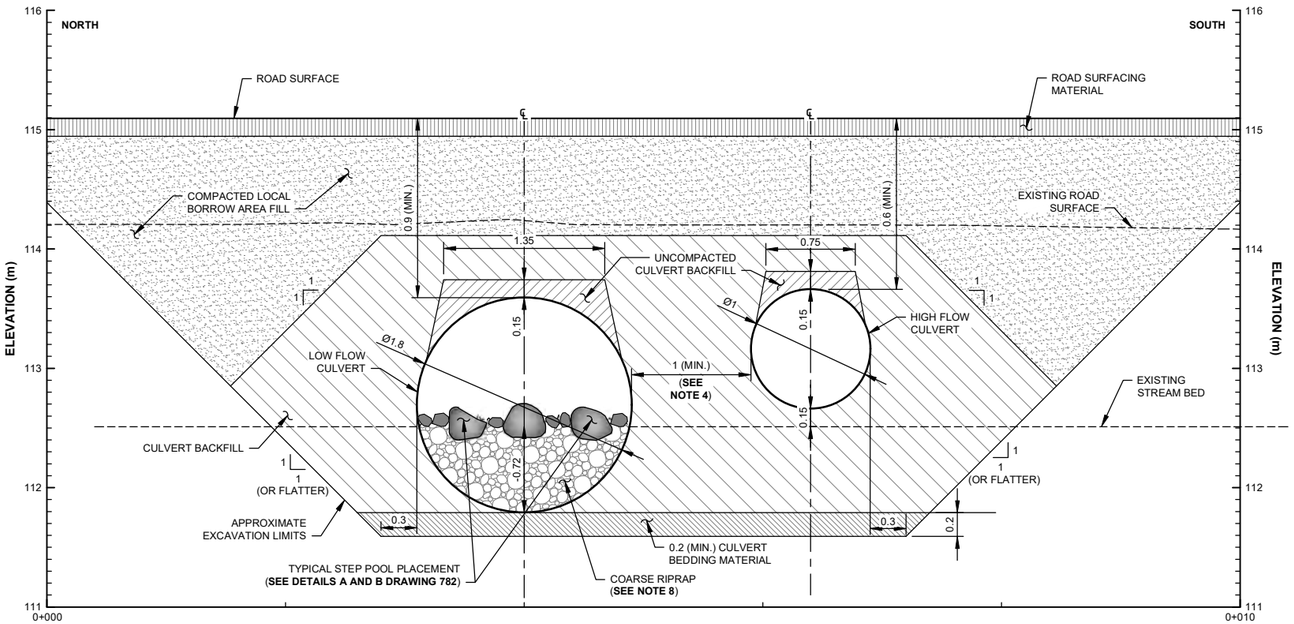
PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-112
GENERAL ARRANGEMENT

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	710	2

SAVED: I:\102\00181\177\A\Acad\DWGS\710 711 712\710 711 R2 712 R1, 2/8/2024 1:46:25 PM, , ASIMPSON PRINTED: 2/8/2024 1:46:52 PM, 710, ASIMPSON ACAD VERSION: 24.2S (LMS TECH)



1/710 **SECTION**
CV-112 PROFILE
SCALE A



2/710 **SECTION**
CV-112 INSTALLATION DETAILS
SCALE B

FISH PASSAGE PARAMETERS	
MODELLED CULVERT JULY OUTLET VELOCITY (m/s)	0.76
MODELLED CULVERT AUGUST OUTLET VELOCITY (m/s)	0.61
MAXIMUM SWIM DISTANCE (m)	3
STEP POOL SPACING (m)	2

RIPRAP LOCATIONS	RIPRAP SIZE (mm)	MATERIAL
INLET/OUTLET APRON	300 (D_{50})	COARSE RIPRAP
BANK STABILIZATION	150 (D_{50})	FINE RIPRAP
CULVERT INFILLING	300 (D_{50})	COARSE RIPRAP
IN-CULVERT BOULDERS	300 (MIN.)	COARSE RIPRAP
STEP POOL	300 (MIN.)	COARSE RIPRAP
BOULDER CLUSTER	NOT REQUIRED BY DFO SPOT TOOL	N/A

LEGEND:
- COMPACTED LOCAL BORROW AREA FILL
- UNCOMPACTED CULVERT BACKFILL
- CULVERT BACKFILL
- ROAD SURFACING MATERIAL
- COARSE RIPRAP
- FINE RIPRAP
- CULVERT BEDDING MATERIAL
- EXISTING STREAM BED
- NON-WOVEN GEOTEXTILE

SCALE A 1 0.5 0 1 2 3 4 5 m
SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

NOTES:
1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. 1 m (MIN.) OR A SUITABLE WIDTH TO ALLOW SPACE FOR COMPACTOR TO PASS BETWEEN CULVERTS.
5. VEHICLE SAFETY BERMS ARE REQUIRED IN AREAS WITH A DROP OFF GREATER THAN 3.0 m.
6. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
7. CULVERT INFILL MATERIAL TO BE INSPECTED DURING AND AFTER FIRST FRESHET FOLLOWING CONSTRUCTION TO DETERMINE IF ADDITIONAL MATERIAL IS REQUIRED.
8. INTERSTITIAL SPACES OF THE RIPRAP ON THE CHANNEL BED SHALL BE FILLED WITH CREEK BED MATERIAL (OR OTHER MATERIAL APPROVED BY THE ENGINEER) AND GRADED TO MATCH THE ADJACENT CHANNEL BED ELEVATION. THE CONTRACTOR SHALL MINIMIZE VOID SPACE BETWEEN RIPRAP STONES SUCH THAT CREEK FLOWS ARE MAINTAINED ABOVE THE CHANNEL BED DURING LOW-FLOW CONDITIONS. THE FINISHED SURFACE TO BE ROUGHENED TO MIMIC ADJACENT STREAM BED CONDITIONS.

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DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
710	CSP CULVERTS - CV-112 GENERAL ARRANGEMENT
782	EXTERNAL CULVERT WORKS - TYPICAL DETAILS

REFERENCE DRAWINGS

ISSUED FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	DJP	
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	NSD/EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW/AS	CAP	KEH

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-112
PLAN AND SECTION
SHEET 1

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	711	2

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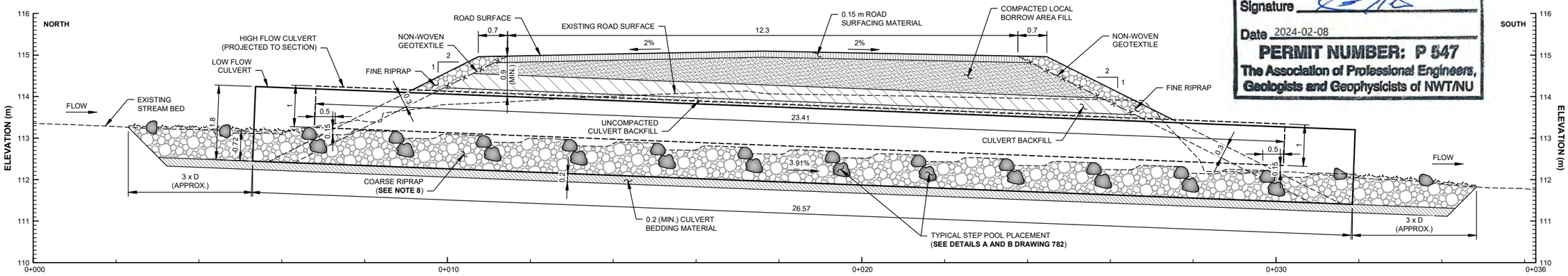
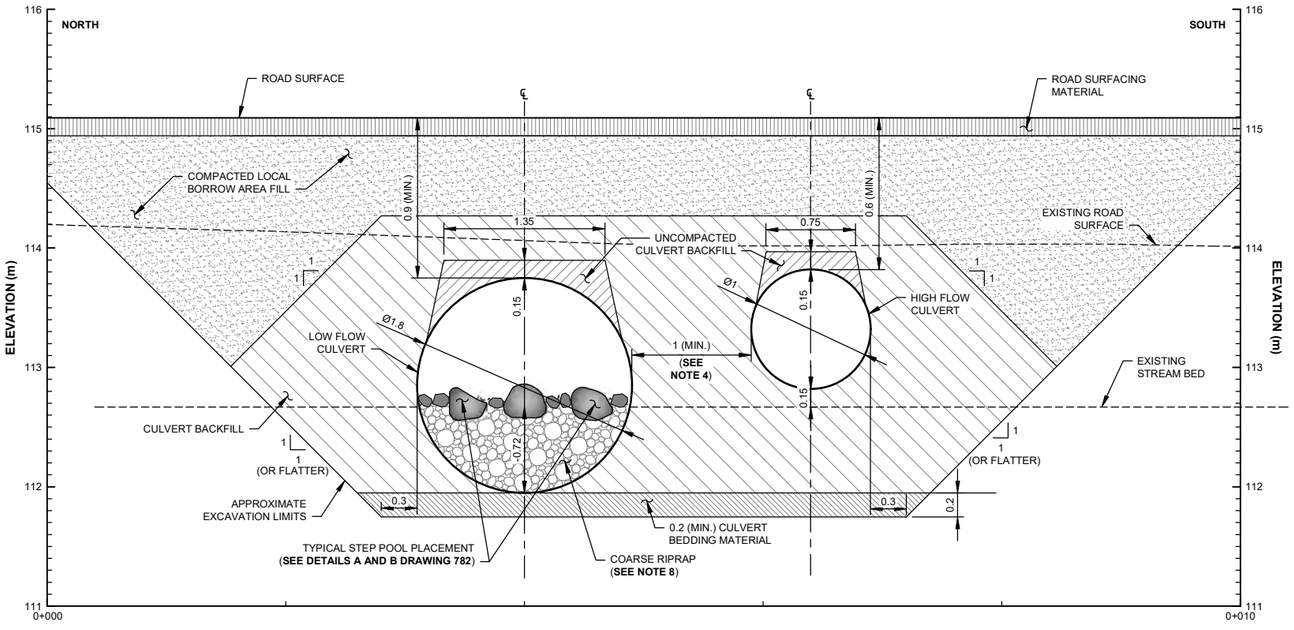


3 / 710 **SECTION**
CV-112 PROFILE
SCALE A



4 / 710 **SECTION**
CV-112 INSTALLATION DETAILS
SCALE B

FISH PASSAGE PARAMETERS	
MODELLED CULVERT JULY OUTLET VELOCITY (m/s)	0.76
MODELLED CULVERT AUGUST OUTLET VELOCITY (m/s)	0.61
MAXIMUM SWIM DISTANCE (m)	3
STEP POOL SPACING (m)	2

RIPRAP LOCATIONS	RIPRAP SIZE (mm)	MATERIAL
INLET/OUTLET APRON	300 (D_{50})	COARSE RIPRAP
BANK STABILIZATION	150 (D_{50})	FINE RIPRAP
CULVERT INFILLING	300 (D_{50})	COARSE RIPRAP
IN-CULVERT BOULDERS	300 (D_{50})	COARSE RIPRAP
STEP POOL	300 (MIN.)	COARSE RIPRAP
BOULDER CLUSTER	NOT REQUIRED BY DFO SPOT TOOL	N/A

LEGEND:
- COMPACTED LOCAL BORROW AREA FILL
- UNCOMPACTED CULVERT BACKFILL
- CULVERT BACKFILL
- ROAD SURFACING MATERIAL
- COARSE RIPRAP
- FINE RIPRAP
- CULVERT BEDDING MATERIAL
- EXISTING STREAM BED
- NON-WOVEN GEOTEXTILE

SCALE A 1 0.5 0 1 2 3 4 5 m
SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

NOTES:
1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. 1 m (MIN.) OR A SUITABLE WIDTH TO ALLOW SPACE FOR COMPACTOR TO PASS BETWEEN CULVERTS.
5. VEHICLE SAFETY BERMS ARE REQUIRED IN AREAS WITH A DROP OFF GREATER THAN 3.0 m.
6. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
7. CULVERT INFILL MATERIAL TO BE INSPECTED DURING AND AFTER FIRST FRESHET FOLLOWING CONSTRUCTION TO DETERMINE IF ADDITIONAL MATERIAL IS REQUIRED.
8. INTERSTITIAL SPACES OF THE RIPRAP ON THE CHANNEL BED SHALL BE FILLED WITH CREEK BED MATERIAL (OR OTHER MATERIAL APPROVED BY THE ENGINEER) AND GRADED TO MATCH THE ADJACENT CHANNEL BED ELEVATION. THE CONTRACTOR SHALL MINIMIZE VOID SPACE BETWEEN RIPRAP STONES SUCH THAT CREEK FLOWS ARE MAINTAINED ABOVE THE CHANNEL BED DURING LOW-FLOW CONDITIONS. THE FINISHED SURFACE TO BE ROUGHENED TO MIMIC ADJACENT STREAM BED CONDITIONS.

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DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
710	CSP CULVERTS - CV-112 GENERAL ARRANGEMENT
782	EXTERNAL CULVERT WORKS - TYPICAL DETAILS

REFERENCE DRAWINGS

ISSUED FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
1	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	CAP	KEH
0	06SEP'23	ISSUED FOR CONSTRUCTION	GMJ	NSD/EDW	CAP	KEH

REVISIONS

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-112
PLAN AND SECTION
SHEET 2

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	712	1

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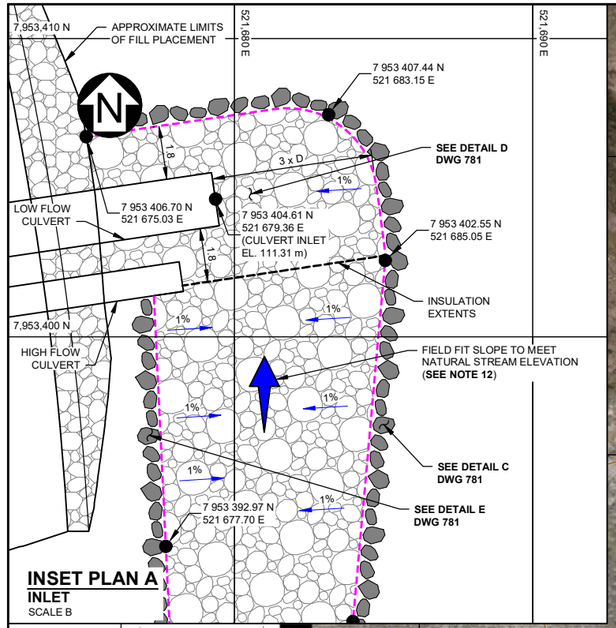

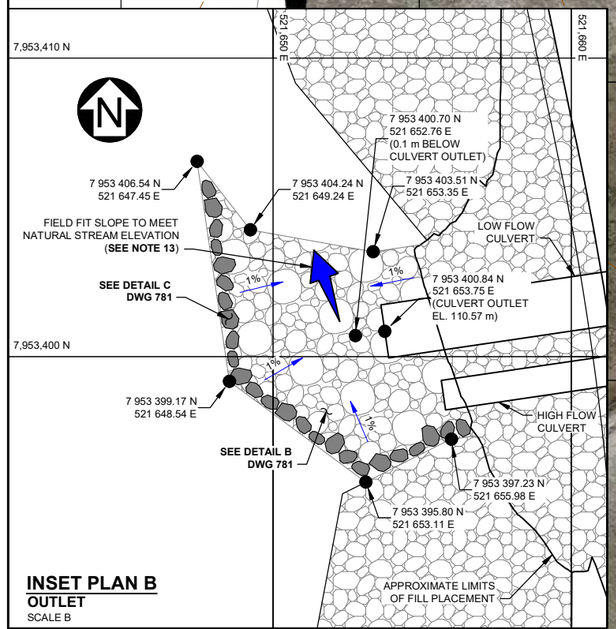

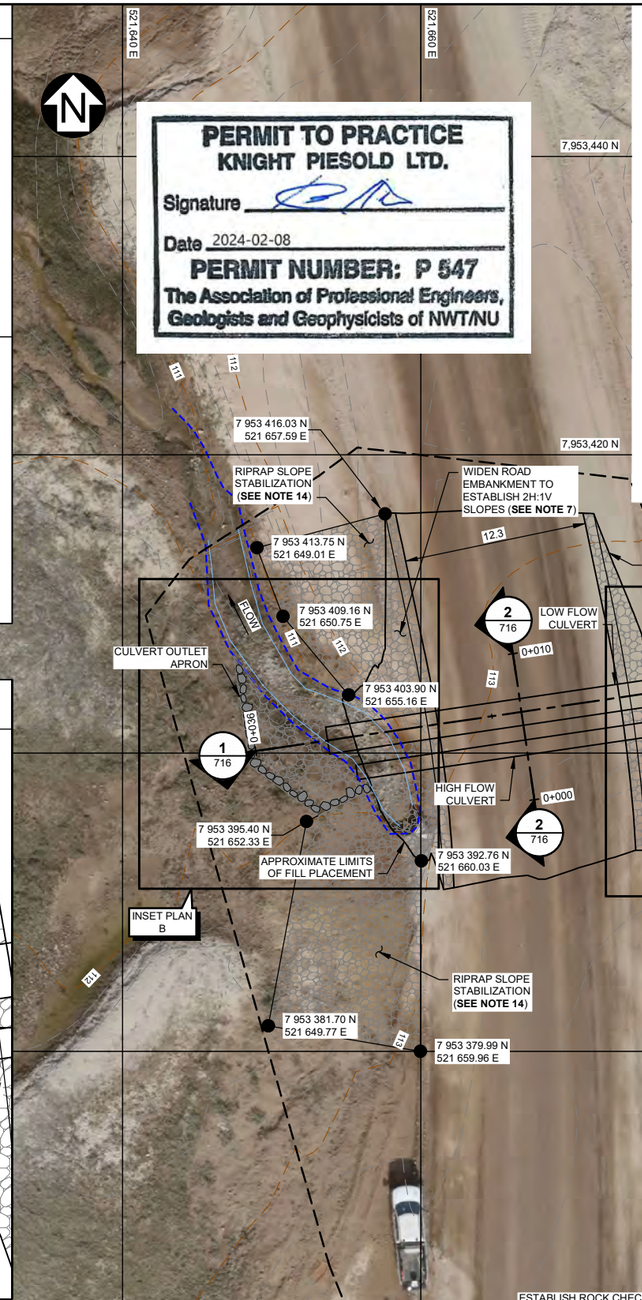

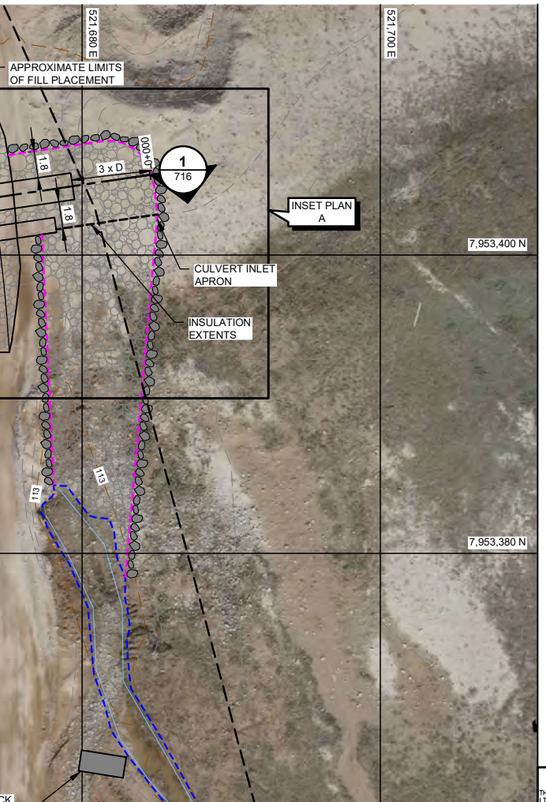

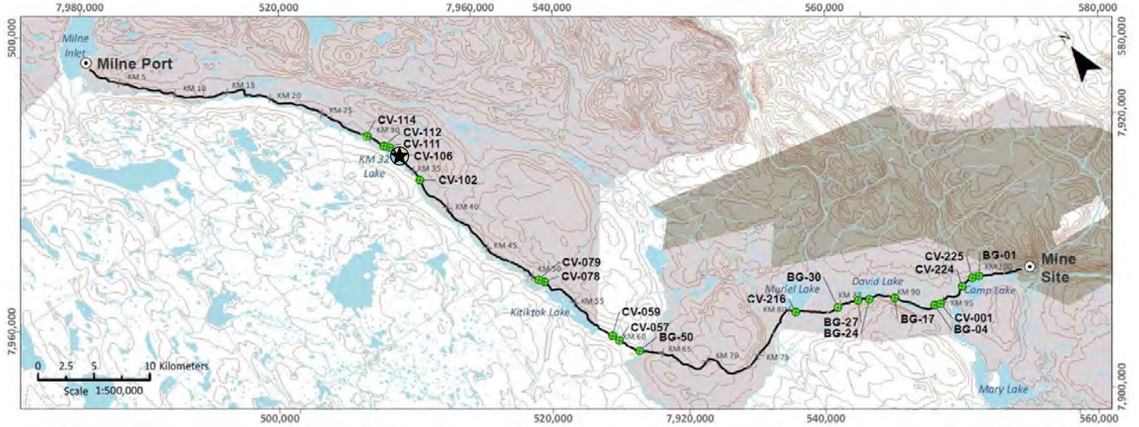

LEGEND:

- COARSE RIPRAP
- FINE RIPRAP
- ROCK CHECK DAM
- APPROXIMATE LIMITS OF FILL PLACEMENT
- APPROXIMATE HIGH WATER MARK (HWM)
- INSULATION EXTENTS
- PROPOSED STREAM EXCAVATION EXTENTS
- EXTENTS OF DETAILED TOPOGRAPHY
- SURVEYED WETTED WIDTH
- RIPRAP LINED EXISTING CHANNEL
- SETTING OUT POINT
- RIPRAP FOR BANK ARMOURING AND FIELD FIT CHANNEL OUTLET
- FIELD FIT SLOPE

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. ALL WORK TO BE COMPLETED DURING FROZEN CONDITIONS.
5. BLASTING MATS MAY BE USED, IF REQUIRED, FOR BLASTING OF SOIL TO REMOVE THE EXISTING CULVERTS. MITIGATION WILL BE IMPLEMENTED AS PER BAFFINLAND'S SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN AND ENVIRONMENTAL PROTECTION PLAN. ONCE EXCAVATION HAS REACHED THE CULVERTS, THEY WILL BE REMOVED AND THE NEW CULVERTS INSTALLED AS PER THE WORK PLAN.
6. ALL BLASTING SPOILS TO BE REMOVED FROM SITE AND DISPOSED AT APPROPRIATE LOCATIONS.
7. CULVERTS TO BE BACKFILLED TO ESTABLISH ROAD SIDE SLOPES AT 2H:1V. ALL SLOPES WILL BE STABILIZED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE AS SHOWN ON **DRAWING 716 (SECTION 1)**.
8. EXISTING DRAINAGE CHANNELS TO BE LINED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE. GEOMETRY TO BE FIELD FIT TO PROVIDE POSITIVE DRAINAGE.
9. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
10. ROCK CHECK DAMS TO BE CONSTRUCTED OF FINE RIPRAP THAT IS FREE OF FINE AND DELETERIOUS MATERIALS. THE STRUCTURES ARE TO BE CONSTRUCTED IN A STABLE MANNER TO REDUCE RUNOFF WATER FLOW VELOCITIES AND PROMOTE SETTLING OF SUSPENDED PARTICLES. PERIODIC MAINTENANCE WILL BE REQUIRED TO REMOVE ACCUMULATED SEDIMENT.
11. EROSION AND SEDIMENT CONTROL MEASURES INCLUDED ARE LIMITED TO THE WATER CROSSING AND THE IMMEDIATE SURROUNDING AREA. THE DESIGN OF OTHER TOTE ROAD EROSION AND SEDIMENT CONTROL MEASURES WILL BE REPORTED SEPARATELY.
12. FIELD FIT INLET TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS CULVERT INLET.
13. FIELD FIT OUTLET SLOPE TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS THE STREAM.
14. STABILIZATION SLOPE WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE.

SCALE A: 4 2 0 4 8 12 16 20 m

SCALE B: 2 1 0 2 4 6 8 10 m

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REFERENCE DRAWINGS	
DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
716	CSP CULVERTS - CV-106 PLAN AND SECTION
781	CULVERT INLET AND OUTLET WORKS - TYPICAL PLAN AND DETAILS

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED	
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW/AS	CAP	KEH	
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EDW	CAP	KEH	
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH	

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

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MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-106
GENERAL ARRANGEMENT

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	715	2

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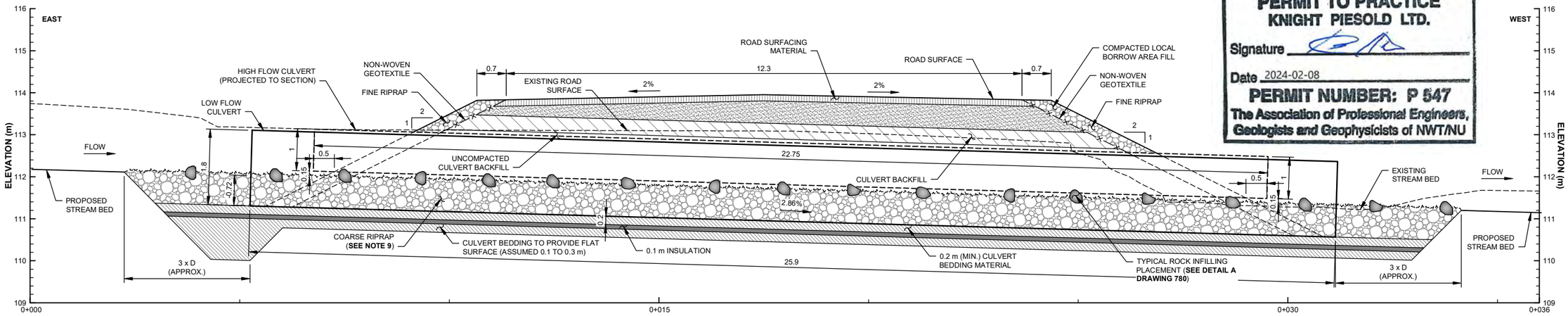
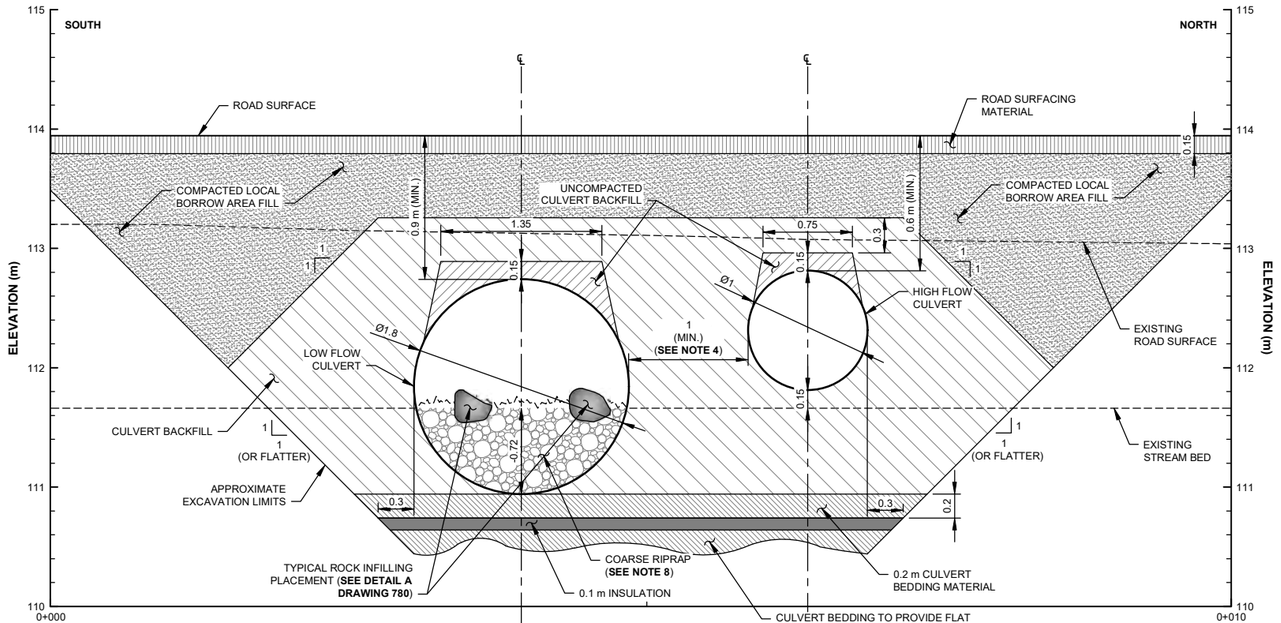


1/715 **SECTION**
CV-106 PROFILE
SCALE A



2/715 **SECTION**
CV-106 INSTALLATION DETAILS
SCALE B

FISH PASSAGE PARAMETERS	
MODELLED CULVERT JULY OUTLET VELOCITY (m/s)	0.63
MODELLED CULVERT AUGUST OUTLET VELOCITY (m/s)	0.5
MAXIMUM SWIM DISTANCE (m)	3.7
BOULDER CLUSTER SPACING (m)	3.5

RIPRAP LOCATIONS	RIPRAP SIZE (mm)	MATERIAL
INLET/OUTLET APRON	300 (D_{50})	COARSE RIPRAP
BANK STABILIZATION	400 (D_{50})	EXTRA COARSE RIPRAP
CULVERT INFILLING	300 (D_{50})	COARSE RIPRAP
IN-CULVERT BOULDERS	300 (MIN.)	COARSE RIPRAP
STEP POOL	NOT REQUIRED	N/A
BOULDER CLUSTER	300 (MIN.)	COARSE RIPRAP

LEGEND:
- COMPACTED LOCAL BORROW AREA FILL
- UNCOMPACTED CULVERT BACKFILL
- CULVERT BACKFILL
- ROAD SURFACING MATERIAL
- COARSE RIPRAP
- FINE RIPRAP
- CULVERT BEDDING MATERIAL
- INSULATION
- EXISTING STREAM BED
- NON-WOVEN GEOTEXTILE

SCALE A 1 0.5 0 1 2 3 4 5 m
SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

NOTES:
1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. 1 m (MIN.) OR A SUITABLE WIDTH TO ALLOW SPACE FOR COMPACTOR TO PASS BETWEEN CULVERTS.
5. VEHICLE SAFETY BERMS ARE REQUIRED IN AREAS WITH A DROP OFF GREATER THAN 3.0 m.
6. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
7. CULVERT INFILL MATERIAL TO BE INSPECTED DURING AND AFTER FIRST FRESHET FOLLOWING CONSTRUCTION TO DETERMINE IF ADDITIONAL MATERIAL IS REQUIRED.
8. INTERSTITIAL SPACES OF THE RIPRAP ON THE CHANNEL BED SHALL BE FILLED WITH CREEK BED MATERIAL (OR OTHER MATERIAL APPROVED BY THE ENGINEER) AND GRADED TO MATCH THE ADJACENT CHANNEL BED ELEVATION. THE CONTRACTOR SHALL MINIMIZE VOID SPACE BETWEEN RIPRAP STONES SUCH THAT CREEK FLOWS ARE MAINTAINED ABOVE THE CHANNEL BED DURING LOW-FLOW CONDITIONS. THE FINISHED SURFACE TO BE ROUGHENED TO MIMIC ADJACENT STREAM BED CONDITIONS.

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Signature
Date 2024-02-08
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
715	CSP CULVERTS - CV-106 GENERAL ARRANGEMENT
780	CULVERT WORKS - TYPICAL DETAILS

REFERENCE DRAWINGS

ISSUED FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	CAP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH

REVISIONS

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THIS DRAWING WAS PREPARED BY KNIGHT PIESOLD LTD. FOR THE ACCOUNT OF THE CLIENT LISTED ON THIS DRAWING. THE MATERIAL ON IT REFLECTS KNIGHT PIESOLD'S BEST JUDGEMENT IN THE LIGHT OF THE INFORMATION AVAILABLE TO IT AT THE TIME OF PREPARATION. ANY USE WHICH A THIRD PARTY MAKES OF THIS DRAWING, OR ANY RELIANCE ON OR DECISIONS TO BE MADE BASED ON IT, ARE THE RESPONSIBILITY OF SUCH THIRD PARTIES. KNIGHT PIESOLD ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY THE THIRD PARTY AS A RESULT OF DECISIONS MADE OR ACTIONS BASED ON THIS DRAWING. COPIES RESULTING FROM ELECTRONIC TRANSFER OR REPRODUCTION OF THIS DRAWING ARE UNCONTROLLED AND MAY NOT BE THE MOST RECENT REVISION OF THIS DRAWING.

REGISTERED PROFESSIONAL ENGINEER G.M. JOHNSTONE LICENSEE 2024-02-08 NT/NU

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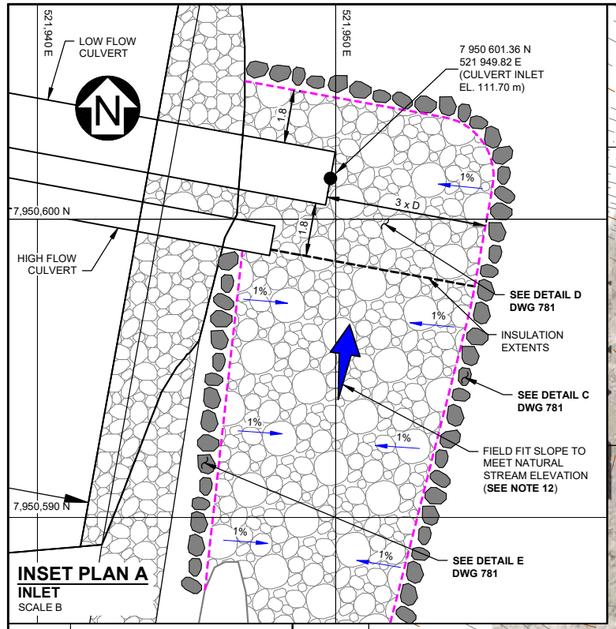
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

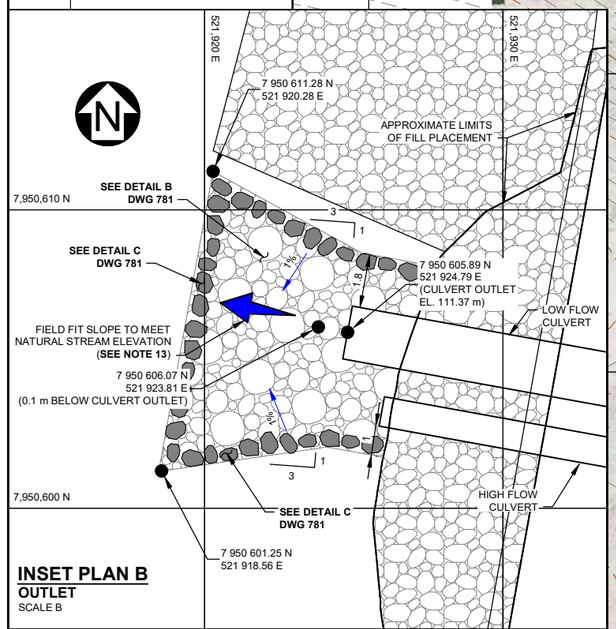
PERMANENT CROSSING PLAN
CULVERT CSP CULVERTS - CV-106
PLAN AND SECTION

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	716	2

SAVED: I:\1\02\00181\177\A\Acad\DWGS\715 716\715 716 R2. 2/8/2024 1:48:54 PM. ASIMPSON. PRINTED: 2/8/2024 1:49:16 PM. 716. ASIMPSON ACAD VERSION: 24.2S (LMS TECH)

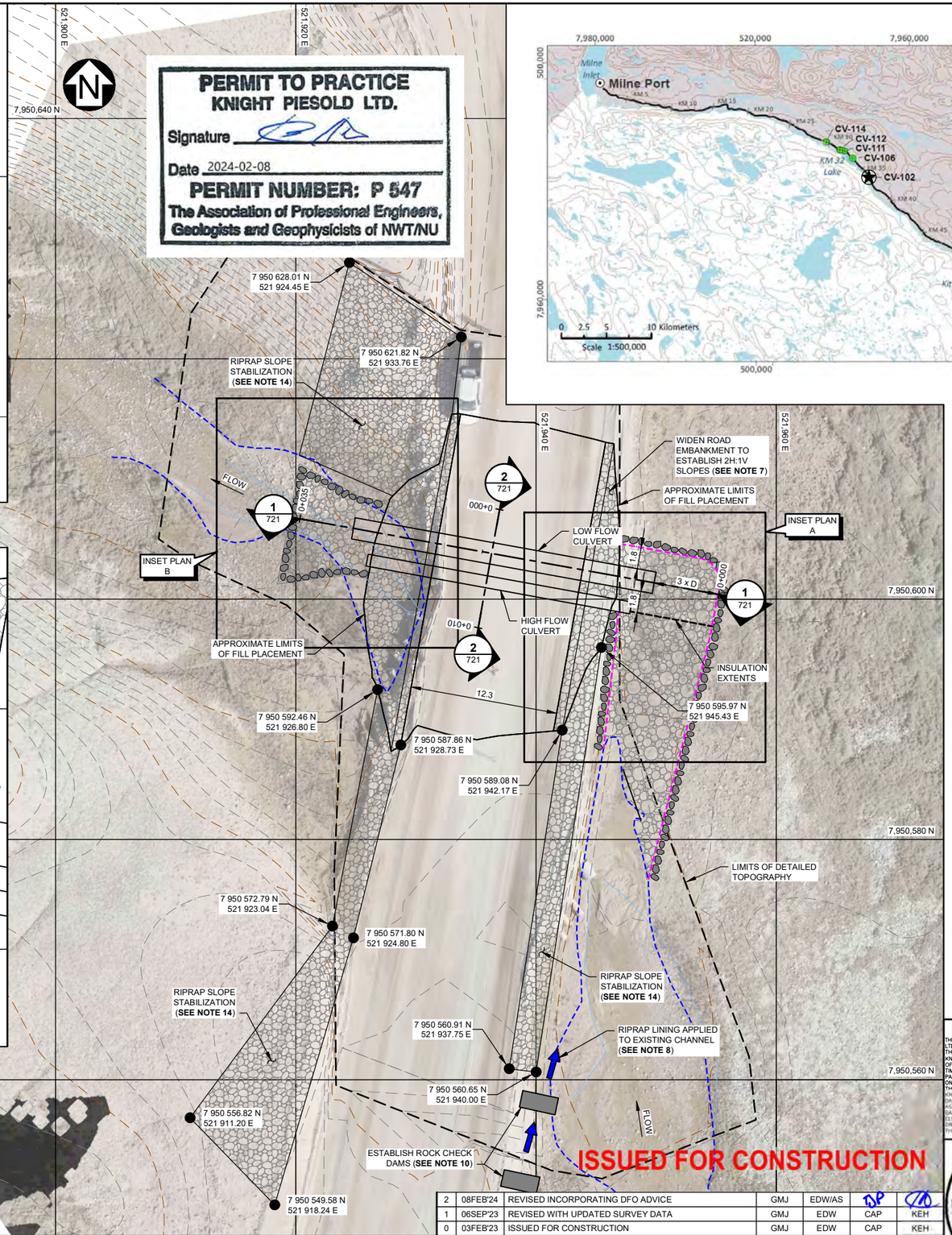


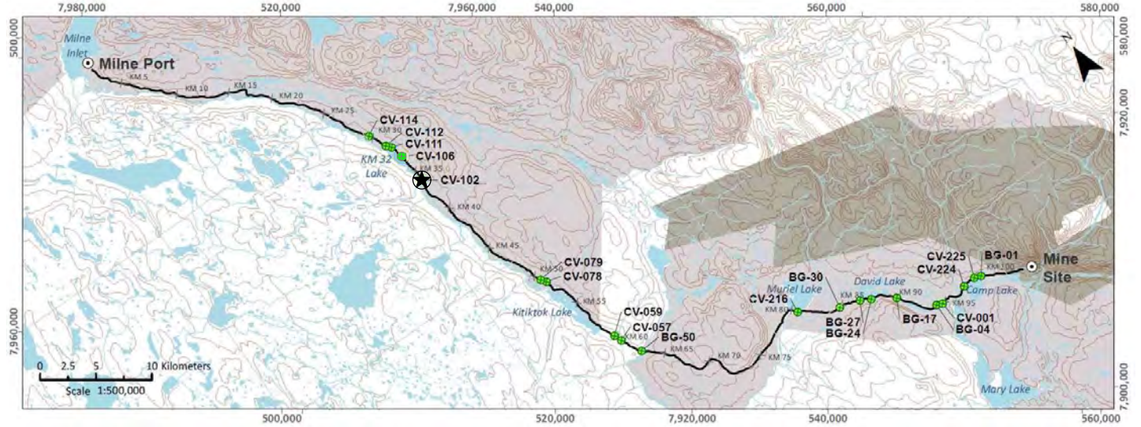
INSET PLAN A
INLET
SCALE B



INSET PLAN B
OUTLET
SCALE B

PLAN
SCALE A





LEGEND:

- COARSE RIPRAP
- FINE RIPRAP
- ROCK CHECK DAM
- APPROXIMATE LIMITS OF FILL PLACEMENT
- APPROXIMATE HIGH WATER MARK (HWM)
- INSULATION EXTENTS
- PROPOSED STREAM EXCAVATION EXTENTS
- EXTENTS OF DETAILED TOPOGRAPHY
- SURVEYED WETTED WIDTH
- RIPRAP LINED EXISTING CHANNEL
- SETTING OUT POINT
- RIPRAP FOR BANK ARMOURING AND FIELD FIT CHANNEL OUTLET
- FIELD FIT SLOPE

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. ALL WORK TO BE COMPLETED DURING FROZEN CONDITIONS.
5. BLASTING MATS MAY BE USED, IF REQUIRED, FOR BLASTING OF SOIL TO REMOVE THE EXISTING CULVERTS. MITIGATION WILL BE IMPLEMENTED AS PER BAFFINLAND'S SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN AND ENVIRONMENTAL PROTECTION PLAN. ONCE EXCAVATION HAS REACHED THE CULVERTS, THEY WILL BE REMOVED AND THE NEW CULVERTS INSTALLED AS PER THE WORK PLAN.
6. ALL BLASTING SPOILS TO BE REMOVED FROM SITE AND DISPOSED AT APPROPRIATE LOCATIONS.
7. CULVERTS TO BE BACKFILLED TO ESTABLISH ROAD SIDE SLOPES AT 2H:1V. ALL SLOPES WILL BE STABILIZED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE AS SHOWN ON **DRAWING 721 (SECTION 1)**.
8. EXISTING DRAINAGE CHANNELS TO BE LINED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE. GEOMETRY TO BE FIELD FIT TO PROVIDE POSITIVE DRAINAGE.
9. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
10. ROCK CHECK DAMS TO BE CONSTRUCTED OF FINE RIPRAP THAT IS FREE OF FINE AND DELETERIOUS MATERIALS. THE STRUCTURES ARE TO BE CONSTRUCTED IN A STABLE MANNER TO REDUCE RUNOFF WATER FLOW VELOCITIES AND PROMOTE SETTLING OF SUSPENDED PARTICLES. PERIODIC MAINTENANCE WILL BE REQUIRED TO REMOVE ACCUMULATED SEDIMENT.
11. EROSION AND SEDIMENT CONTROL MEASURES INCLUDED ARE LIMITED TO THE WATER CROSSING AND THE IMMEDIATE SURROUNDING AREA. THE DESIGN OF OTHER TOTE ROAD EROSION AND SEDIMENT CONTROL MEASURES WILL BE REPORTED SEPARATELY.
12. FIELD FIT INLET TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS CULVERT INLET.
13. FIELD FIT OUTLET SLOPE TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS THE STREAM.
14. STABILIZATION SLOPE WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE.

SCALE A: 4 2 0 4 8 12 16 20 m
SCALE B: 2 1 0 2 4 6 8 10 m

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

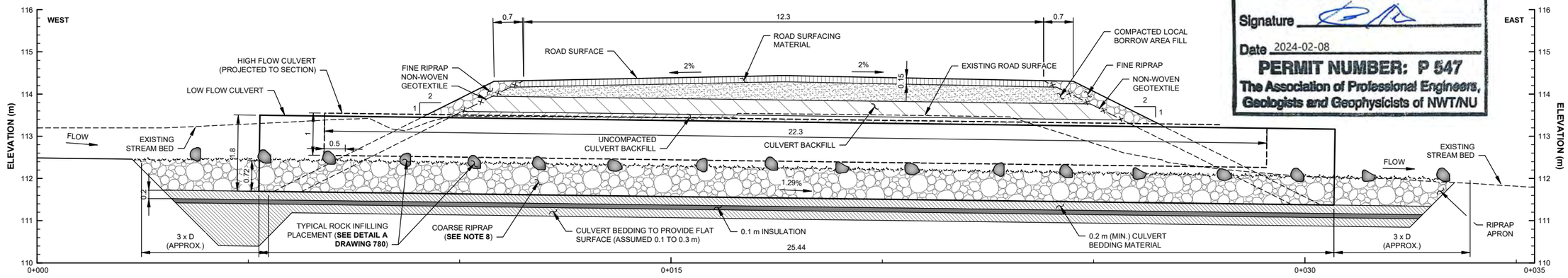
PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-102
GENERAL ARRANGEMENT

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	720	2

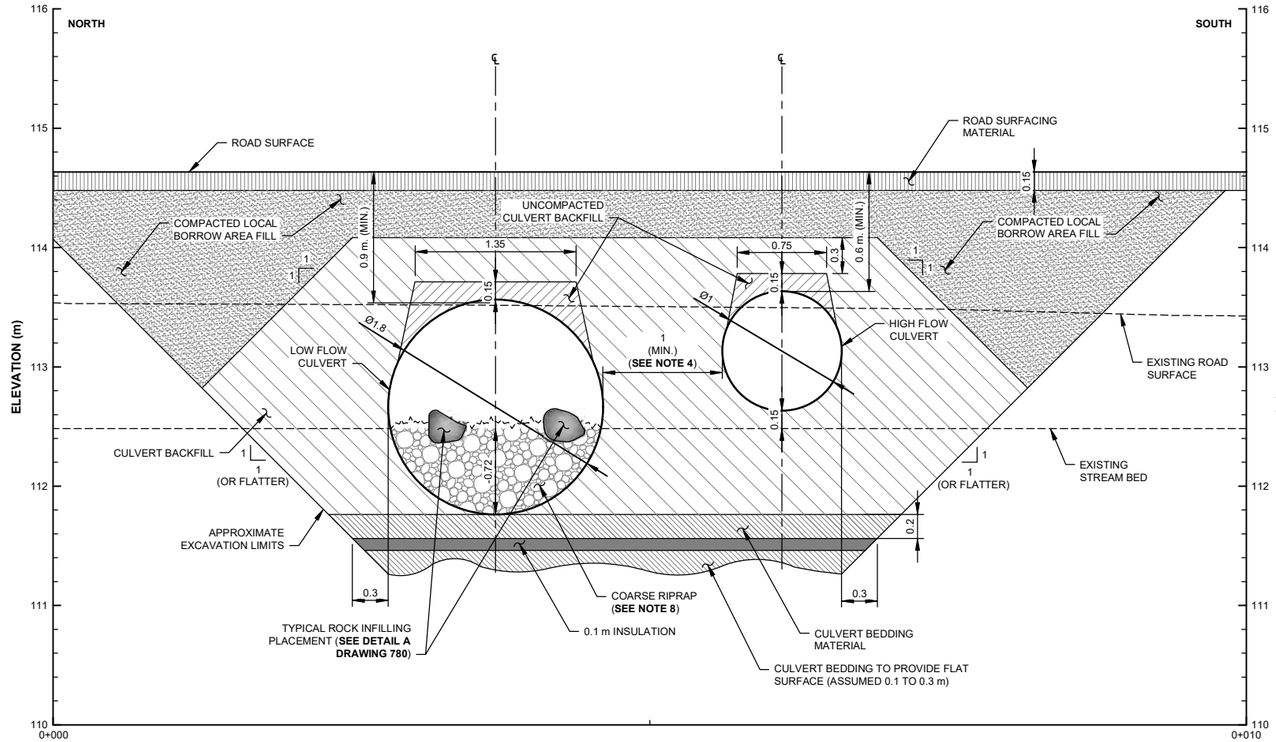
ISSUED FOR CONSTRUCTION

REFERENCE DRAWINGS	
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
721	CSP CULVERTS - CV-102 PLAN AND SECTION
781	CULVERT INLET AND OUTLET WORKS - TYPICAL PLAN AND DETAILS

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW/AS	DP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH



2 1/720 **SECTION**
CV-102 PROFILE
SCALE A



2 2/720 **SECTION**
CV-102 INSTALLATION DETAILS
SCALE B

FISH PASSAGE PARAMETERS	
MODELLED CULVERT JULY OUTLET VELOCITY (m/s)	0.55
MODELLED CULVERT AUGUST OUTLET VELOCITY (m/s)	0.44
MAXIMUM SWIM DISTANCE (m)	5.4
BOULDER CLUSTER SPACING (m)	5

RIPRAP LOCATIONS	RIPRAP SIZE (mm)	MATERIAL
INLET/OUTLET APRON	300 (D_{50})	COARSE RIPRAP
BANK STABILIZATION	300 (D_{50})	COARSE RIPRAP
CULVERT INFILLING	300 (D_{50})	COARSE RIPRAP
IN-CULVERT BOULDERS	300 (MIN.)	COARSE RIPRAP
STEP POOL	NOT REQUIRED	N/A
BOULDER CLUSTER	300 (MIN.)	COARSE RIPRAP

LEGEND:
- COMPACTED LOCAL BORROW AREA FILL
- UNCOMPACTED CULVERT BACKFILL
- CULVERT BACKFILL
- ROAD SURFACING MATERIAL
- COARSE RIPRAP
- FINE RIPRAP
- CULVERT BEDDING MATERIAL
- INSULATION
- EXISTING STREAM BED
- NON-WOVEN GEOTEXTILE

SCALE A 1 0.5 0 1 2 3 4 5 m
SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

NOTES:
1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. 1 m (MIN.) OR A SUITABLE WIDTH TO ALLOW SPACE FOR COMPACTOR TO PASS BETWEEN CULVERTS.
5. VEHICLE SAFETY BERMS ARE REQUIRED IN AREAS WITH A DROP OFF GREATER THAN 3.0 m.
6. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
7. CULVERT INFILL MATERIAL TO BE INSPECTED DURING AND AFTER FIRST FRESHET FOLLOWING CONSTRUCTION TO DETERMINE IF ADDITIONAL MATERIAL IS REQUIRED.
8. INTERSTITIAL SPACES OF THE RIPRAP ON THE CHANNEL BED SHALL BE FILLED WITH CREEK BED MATERIAL (OR OTHER MATERIAL APPROVED BY THE ENGINEER) AND GRADED TO MATCH THE ADJACENT CHANNEL BED ELEVATION. THE CONTRACTOR SHALL MINIMIZE VOID SPACE BETWEEN RIPRAP STONES SUCH THAT CREEK FLOWS ARE MAINTAINED ABOVE THE CHANNEL BED DURING LOW-FLOW CONDITIONS. THE FINISHED SURFACE TO BE ROUGHENED TO MIMIC ADJACENT STREAM BED CONDITIONS.

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Date 2024-02-08
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

REFERENCE DRAWINGS	
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
720	ROUND CSP CULVERTS - CV-102 GENERAL ARRANGEMENT
780	CULVERT WORKS - TYPICAL DETAILS

ISSUED FOR CONSTRUCTION

REVISIONS							
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
2	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW/AS	CAP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH

REGISTERED PROFESSIONAL ENGINEER G.M. JOHNSTONE LICENSEE 2024-02-08 NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-102
PLAN AND SECTION

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	721	2

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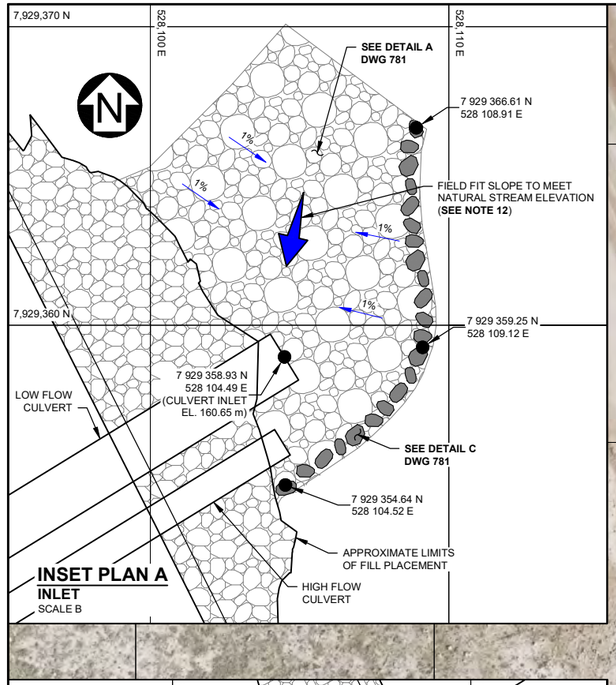

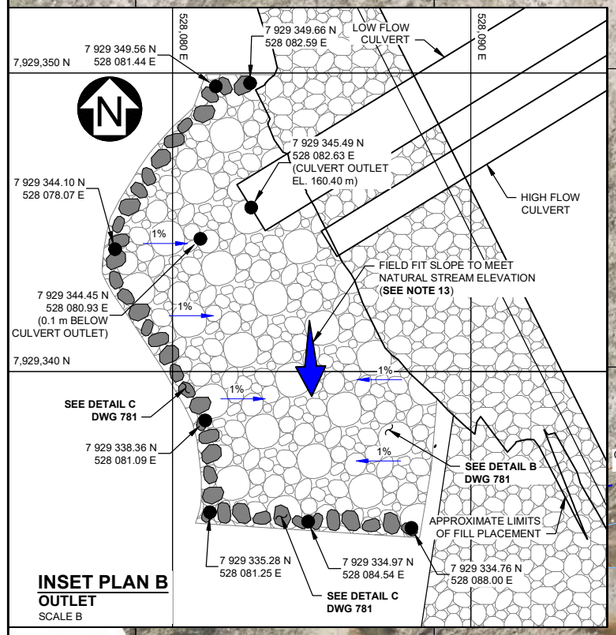

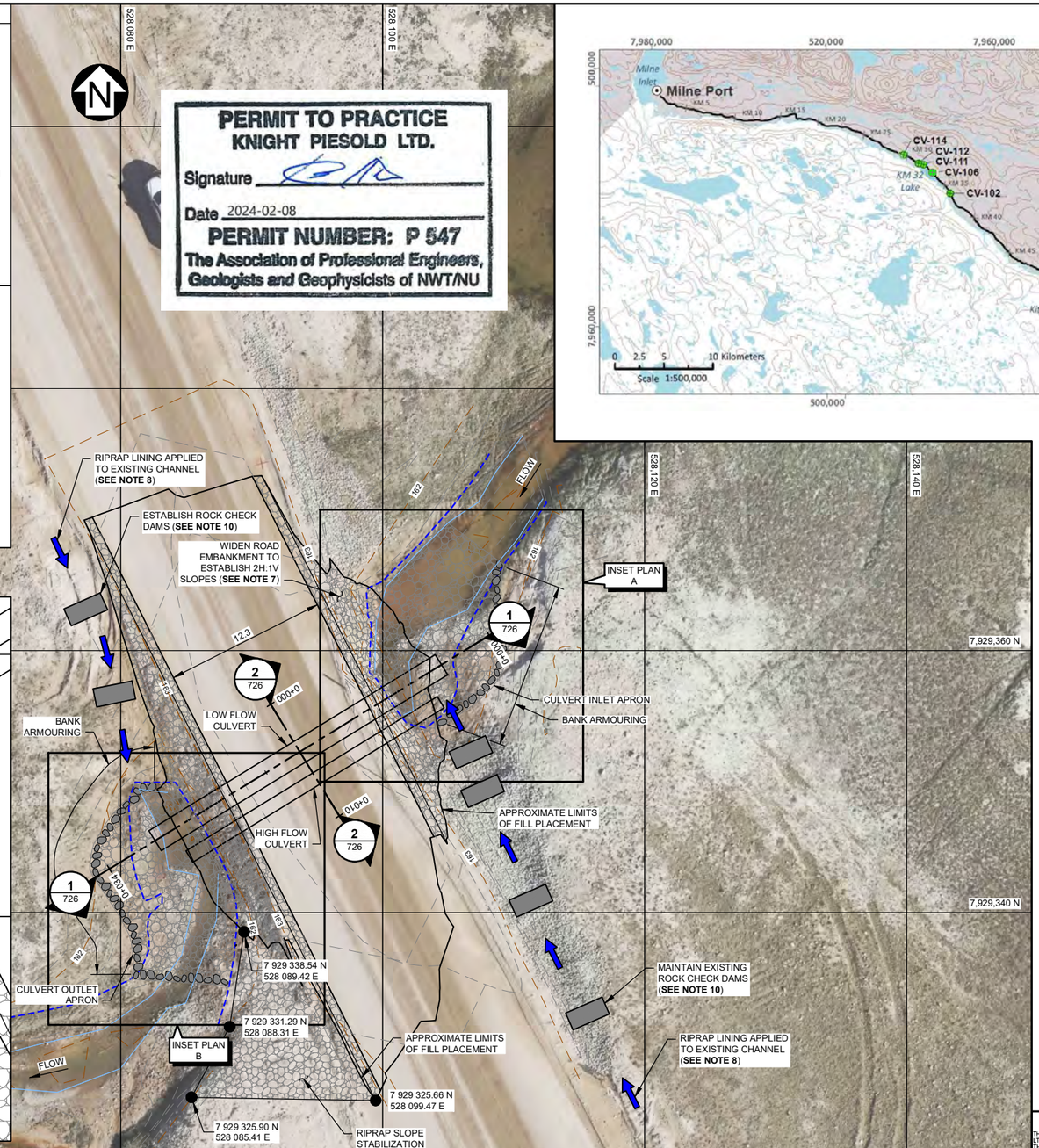

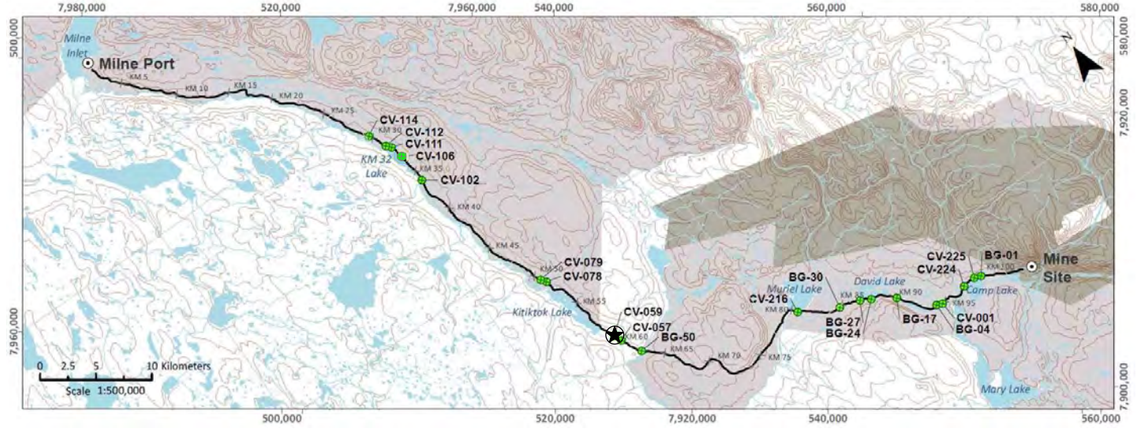

LEGEND:

- COARSE RIPRAP
- FINE RIPRAP
- ROCK CHECK DAM
- APPROXIMATE LIMITS OF FILL PLACEMENT
- APPROXIMATE HIGH WATER MARK (HWM)
- SURVEYED WETTED WIDTH
- RIPRAP LINED EXISTING CHANNEL
- SETTING OUT POINT
- RIPRAP FOR BANK ARMOURING AND FIELD FIT CHANNEL OUTLET
- FIELD FIT SLOPE

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE.
4. IT IS ASSUMED ALL WORK WILL BE COMPLETED DURING FROZEN CONDITIONS.
5. BLASTING MATS MAY BE USED, IF REQUIRED, FOR BLASTING OF FROZEN SOIL/FILL TO REMOVE THE EXISTING CULVERTS. MITIGATION WILL BE IMPLEMENTED AS PER BAFFINLAND'S SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN AND ENVIRONMENTAL PROTECTION PLAN. ONCE EXCAVATION HAS REACHED THE CULVERTS, THEY WILL BE REMOVED AND THE NEW CULVERTS INSTALLED AS PER THE WORK PLAN.
6. ALL BLASTING SPOILS TO BE REMOVED FROM SITE AND DISPOSED OF AT APPROPRIATE LOCATIONS.
7. CULVERTS TO BE BACKFILLED TO ESTABLISH ROAD SIDE SLOPES AT 2H:1V. ALL SLOPES WILL BE STABILIZED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE AS SHOWN ON **DRAWING 726 (SECTION 1)**.
8. EXISTING DRAINAGE CHANNELS TO BE LINED WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE. GEOMETRY TO BE FIELD FIT TO PROVIDE POSITIVE DRAINAGE.
9. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
10. ROCK CHECK DAMS TO BE CONSTRUCTED OF FINE RIPRAP THAT IS FREE OF FINE AND DELETERIOUS MATERIALS. THE STRUCTURES ARE TO BE CONSTRUCTED IN A STABLE MANNER TO REDUCE RUNOFF WATER FLOW VELOCITIES AND PROMOTE SETTLING OF SUSPENDED PARTICLES. PERIODIC MAINTENANCE WILL BE REQUIRED TO REMOVE ACCUMULATED SEDIMENT.
11. EROSION AND SEDIMENT CONTROL MEASURES INCLUDED ARE LIMITED TO THE WATER CROSSING AND THE IMMEDIATE SURROUNDING AREA. THE DESIGN OF OTHER TOTE ROAD EROSION AND SEDIMENT CONTROL MEASURES WILL BE REPORTED SEPARATELY.
12. FIELD FIT INLET TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS CULVERT INLET.
13. FIELD FIT OUTLET SLOPE TO BE CONSTRUCTED OF RIPRAP MIXED WITH MATERIAL SIMILAR TO NATURAL STREAM SUBSTRATE WITH POSITIVE DRAINAGE TOWARDS THE STREAM.
14. STABILIZE SLOPE WITH FINE RIPRAP OVERLYING NON-WOVEN GEOTEXTILE.

SCALE A: 4 2 0 4 8 12 16 20 m

SCALE B: 2 1 0 2 4 6 8 10 m

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REFERENCE DRAWINGS	
DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
726	CSP CULVERTS - CV-059 PLAN AND SECTION
781	CULVERT INLET AND OUTLET WORKS - TYPICAL PLAN AND DETAILS

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED

REVISIONS						
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
4	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	DP	KEH
3	23JAN'24	DESIGNS MODIFIED - ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH
2	26OCT'23	REVISED OUTLET ELEVATION	GMJ	AS	CAP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH

REGISTERED PROFESSIONAL ENGINEER
G.M. JOHNSTONE
LICENSEE
2024-02-08
NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-059
GENERAL ARRANGEMENT

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	725	4

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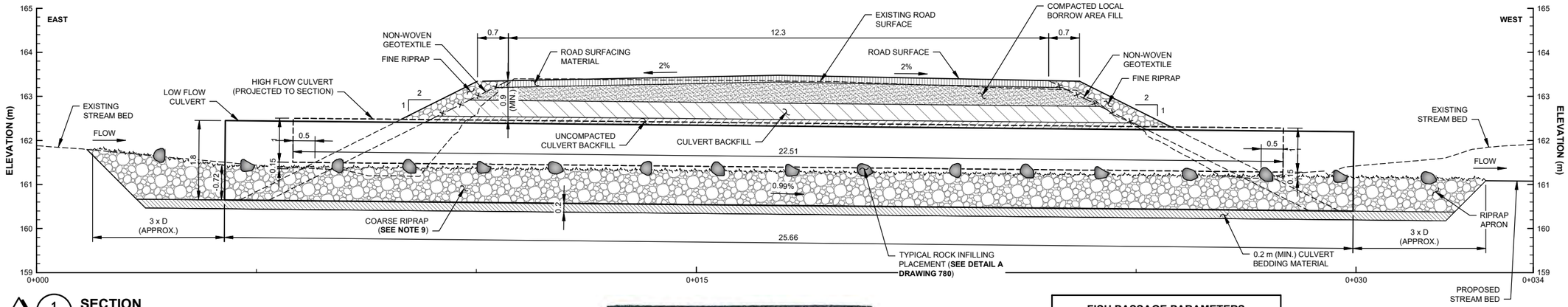
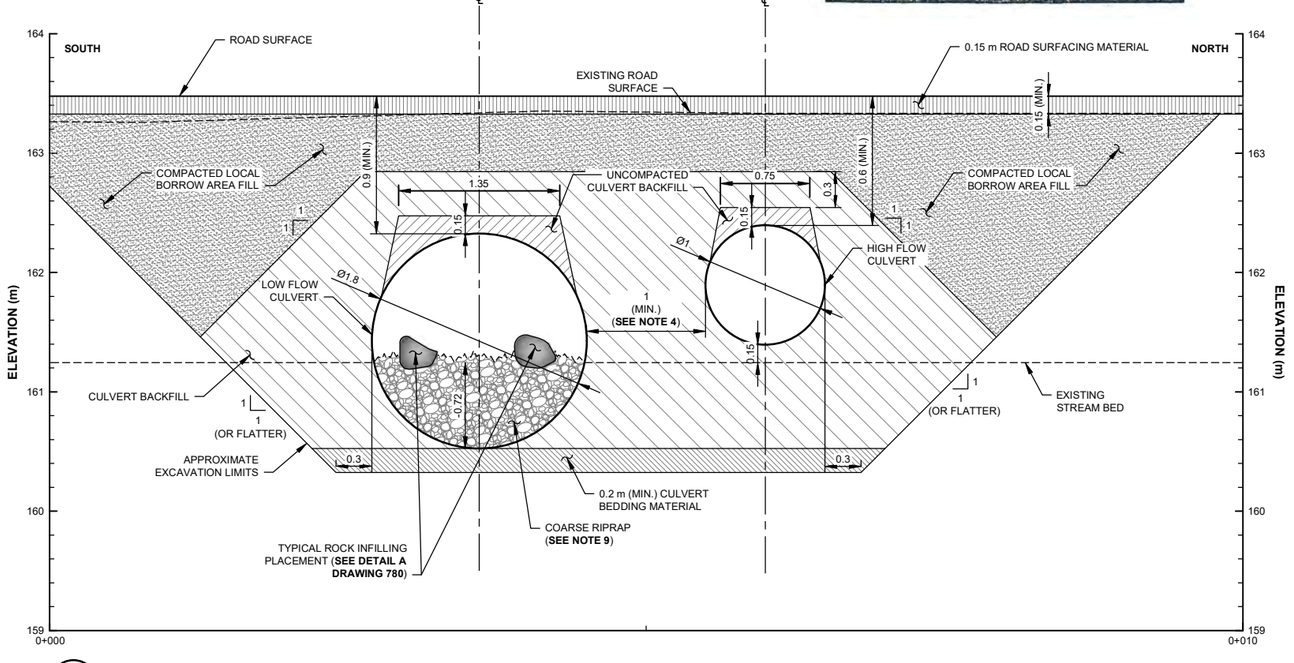


4 1/725 **SECTION**
CV-059 PROFILE
SCALE A



4 2/725 **SECTION**
CV-059 INSTALLATION DETAILS
SCALE B

DRG. NO.	DESCRIPTION
703	CULVERT FILL MATERIALS AND GEOSYNTHETICS SPECIFICATIONS
725	CSP CULVERTS - CV-059 GENERAL ARRANGEMENT
780	CULVERT WORKS - TYPICAL DETAILS

REFERENCE DRAWINGS

PERMIT TO PRACTICE
KNIGHT PIESOLD LTD.
Signature
Date 2024-02-08
PERMIT NUMBER: P 547
The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU

FISH PASSAGE PARAMETERS	
MODELLED CULVERT JULY OUTLET VELOCITY (m/s)	0.36
MODELLED CULVERT AUGUST OUTLET VELOCITY (m/s)	0.28
MAXIMUM SWIM DISTANCE (m)	33

RIPRAP LOCATIONS	RIPRAP SIZE (mm)	MATERIAL
INLET/OUTLET APRON	300 (D_{50})	COARSE RIPRAP
BANK STABILIZATION	150 (D_{50})	FINE RIPRAP
CULVERT INFILLING	300 (D_{50})	COARSE RIPRAP
IN-CULVERT BOULDERS	300 (MIN.)	COARSE RIPRAP
STEP POOL	NOT REQUIRED	N/A
BOULDER CLUSTER	NOT REQUIRED BY DFO SPOT TOOL	N/A

LEGEND:
- COMPACTED LOCAL BORROW AREA FILL
- UNCOMPACTED CULVERT BACKFILL
- CULVERT BACKFILL
- ROAD SURFACING MATERIAL
- COARSE RIPRAP
- FINE RIPRAP
- CULVERT BEDDING MATERIAL
- EXISTING STREAM BED
- NON-WOVEN GEOTEXTILE

ISSUED FOR CONSTRUCTION

NOTES:
1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. CULVERT SURVEYS AND DRONE IMAGERY PROVIDED BY KITIKMEOT CHALLENGER, AUGUST 2023.
3. DIMENSIONS AND ELEVATIONS ARE IN METRES, UNLESS NOTED OTHERWISE .
4. 1 m (MIN.) OR A SUITABLE WIDTH TO ALLOW SPACE FOR COMPACTOR TO PASS BETWEEN CULVERTS.
5. VEHICLE SAFETY BERMS ARE REQUIRED IN AREAS WITH A DROP OFF GREATER THAN 3.0 m.
6. MATERIAL SPECIFICATIONS INCLUDED ON **DRAWING 703**.
7. MINIMUM CULVERT SLOPE TO BE 0.3%.
8. CULVERT INFILL MATERIAL TO BE INSPECTED DURING AND AFTER FIRST FRESHET FOLLOWING CONSTRUCTION TO DETERMINE IF ADDITIONAL MATERIAL IS REQUIRED.
9. INTERSTITIAL SPACES OF THE RIPRAP ON THE CHANNEL BED SHALL BE FILLED WITH CREEK BED MATERIAL (OR OTHER MATERIAL APPROVED BY THE ENGINEER) AND GRADED TO MATCH THE ADJACENT CHANNEL BED ELEVATION. THE CONTRACTOR SHALL MINIMIZE VOID SPACE BETWEEN RIPRAP STONES SUCH THAT CREEK FLOWS ARE MAINTAINED ABOVE THE CHANNEL BED DURING LOW-FLOW CONDITIONS. THE FINISHED SURFACE TO BE ROUGHENED TO MIMIC ADJACENT STREAM BED CONDITIONS.

SCALE A 1 0.5 0 1 2 3 4 5 m
SCALE B 0.5 0.25 0 0.5 1.0 1.5 2.0 2.5 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED	APPROVED
4	08FEB'24	REVISED INCORPORATING DFO ADVICE	GMJ	EDW	DP	KEH
3	23JAN'24	DESIGNS MODIFIED - ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH
2	26OCT'23	REVISED OUTLET ELEVATION	GMJ	AS	CAP	KEH
1	06SEP'23	REVISED WITH UPDATED SURVEY DATA	GMJ	EDW	CAP	KEH
0	03FEB'23	ISSUED FOR CONSTRUCTION	GMJ	EDW	CAP	KEH

REVISIONS

REGISTERED PROFESSIONAL ENGINEER G.M. JOHNSTONE LICENSEE 2024-02-08 NT/NU

Knight Piésold CONSULTING

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PERMANENT CROSSING PLAN
ROUND CSP CULVERTS - CV-059
PLAN AND SECTION

P/A NO.	DRAWING NO.	REVISION
NB102-181/77	726	4

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