

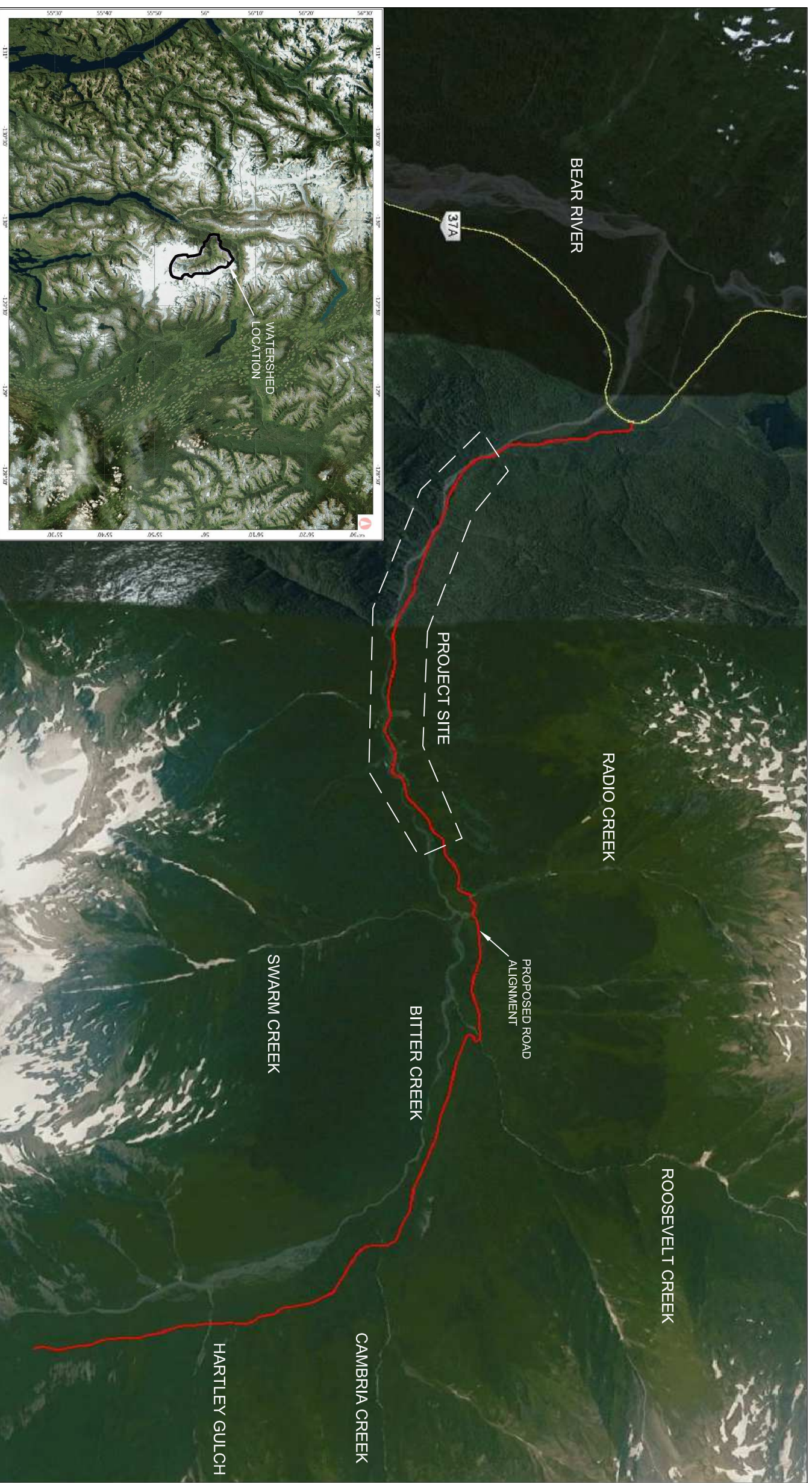
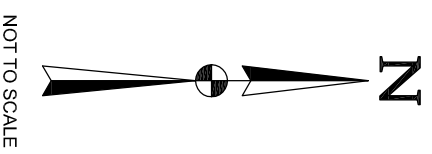


# Appendix IR1-11-B

## Access Road Hydrotechnical Drawings

Red Mountain Underground Gold Project  
IDM Mining Ltd. Responses to  
Canadian Environmental Assessment Information Request #1

# RED MOUNTAIN ACCESS ROAD HYDROTECHNICAL DRAWINGS BITTER CREEK



DWG No: BITTERCREEKHYPDROTECH-001

SHEET: 1 OF 22

PREPARED FOR:

PREPARED BY:



**ONSITE**  
ENGINEERING LTD.

NORTH VANCOUVER  
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PH.: 778-628-4968 FAX: 866-235-6943

DESIGN BY: MICHAEL FOSTER, P.ENG.

DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

RW / (BOB) ASKIN, P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYPDROTECH.DWG

SCALE: AS NOTED

REVISION NUMBER:

REVISION DATE:

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**DRAWING INDEX:**

- SHEET 2 OF 20 - NOTES
- SHEET 3 OF 20 - PLAN VIEWS - 0+770m TO 1+560m
- SHEET 4 OF 20 - PLAN VIEWS - 1+500m TO 2+310m
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- SHEET 6 OF 20 - PLAN VIEWS - 3+000m TO 3+760m
- SHEET 7 OF 20 - PLAN VIEWS - 3+700m TO 4+160m
- SHEET 8 OF 20 - CREEK PROFILES - 0+770m TO 2+980m
- SHEET 9 OF 20 - CREEK PROFILES - 2+980m TO 4+160m
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- SHEET 15 OF 22 - CROSS SECTIONS - 4+000m TO 4+200m
- SHEET 16 OF 22 - CROSS SECTIONS - 4+300m TO 4+500m
- SHEET 17 OF 22 - CROSS SECTIONS - 4+600m TO 4+800m
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**NOTES:****1. ROCK QUALITY:**

1.1. ROCK SHALL BE HARD, DURABLE, AND ANGULAR QUARRY ROCK OF A QUALITY THAT WILL NOT DISINTEGRATE ON EXPOSURE TO WATER OR THE ATMOSPHERE. THE GRADATION OF ROCK SIZES FOR EACH CLASS OF RIPRAP SHALL CONFORM TO MOTI SECTION 205 - RIPRAP - TABLE 205-A.

**2. GRADATION:**

2.1. THE GRADATION OF ROCKS SHALL BE WELL-GRADED, APPROXIMATELY THE SPECIFIED OR DIRECTED SIZES, AND INDIVIDUAL ROCKS MINIMUM DIMENSION SHALL BE GREATER THAN ONE-THIRD ITS MAXIMUM DIMENSION AND NONE SHALL HAVE A MASS GREATER THAN FIVE TIMES THAT OF THE SPECIFIED CLASS OF RIPRAP.

**3. PHYSICAL PROPERTIES:**

3.1. RECOMMENDED STANDARD TEST METHODS RELATING TO MATERIAL TYPE, CHARACTERISTICS, AND TESTING OF RIPRAP AND AGGREGATES TYPICALLY ASSOCIATED WITH RIPRAP INSTALLATIONS ARE PROVIDED IN MOTI SECTION 205 - RIPRAP - TABLE 205-C. THE TEST METHODS ARE INTENDED TO ENSURE THAT THE ROCK IS DENSE AND DURABLE, AND WILL NOT DEGRADE OVER TIME.

3.2. ROCKS USED FOR RIPRAP SHOULD ONLY BREAK WITH DIFFICULTY, HAVE NO EARTHY ODOR, NO CLOSELY SPACED DISCONTINUITIES, AND SHOULD NOT ABSORB WATER EASILY. ROCKS COMPOSED OF APPRECIABLE AMOUNTS OF CLAY OR SILT SHALL NOT BE ACCEPTED FOR USE AS RIPRAP.

3.3. ROCKS SHALL BE TESTED FOR ACID ROCK DRAINAGE AND METAL LEACHING AS REQUIRED BY THE MINISTRY REPRESENTATIVE. TESTING SHALL MEET THE MINISTRY REQUIREMENTS OUTLINED IN THE MINISTRY'S TECHNICAL CIRCULAR T-04/13. MINISTRY TECHNICAL CIRCULARS ARE AVAILABLE ON-LINE AT: [http://www.ih.gov.bc.ca/publications/Circulars/all\\_technical.asp](http://www.ih.gov.bc.ca/publications/Circulars/all_technical.asp)

**4. SLOPE PREPARATION:**

4.1. AREAS TO RECEIVE RIPRAP SHALL BE TRIMMED TO A UNIFORM SURFACE AND TO THE SLOPE(S) INDICATED ON THE DRAWINGS OR AS DIRECTED BY THE ONSITE ENGINEER OR A DESIGNATED REPRESENTATIVE.

4.2. BEFORE ROCK PLACEMENT COMMENCES, LOOSE MATERIAL SHALL BE REMOVED AND MINOR POT-HOLES AND HOLLOW FILLED WITH SELECTED MATERIALS WELL TAMPED-IN TO THE APPROVAL OF THE ONSITE ENGINEER OR A DESIGNATED REPRESENTATIVE.

**5. PLACEMENT PROCEDURES:**

5.1. TYPE 1 -RIPRAP IS TO BE USED FOR ROAD SECTIONS CONSTRUCTED WHERE THE BANKS WILL BE ON THE OUTSIDE OF CHANNEL BENDS (INCLUDING ROCK APRONS) WITH IMPINGING FLOW CONDITIONS.

5.2. TYPE 2 -RIPRAP IS TO BE USED FOR ROAD SECTIONS CONSTRUCTED WHERE THE BANKS WILL BE ESSENTIALLY PARALLEL TO THE DIRECTION OF FLOW ALONG CHANNEL SECTIONS WITH NO OR LIMITED IMPINGING FLOW CONDITIONS.

5.3. TRANSPORTATION - ROCK IS TO BE TRANSPORTED AND PLACED BY METHODS THAT AVOID SEGREGATION. END DUMPING AND/OR SPREADING BY BULLDOZERS ARE GENERALLY NOT ACCEPTABLE CONSTRUCTION PRACTICES. CARE SHOULD BE TAKEN TO PREVENT CRACKING OR BREAKING OF ROCK RIPRAP BY CRUSHING UNDER MACHINES TRACKS. EACH TRUCKLOAD OF ROCK BROUGHT TO THE SITE SHOULD PROVIDE A COMPLETE RANGE OF THE ROCK SIZES IN THE GRADATION.

5.4. FOUNDATIONS - TO PROVIDE A STABLE FOUNDATION AND PROTECTION AGAINST ANY UNDERCUTTING, THE RIPRAP SHALL BE THICKENED AT THE TOE, LAID HORIZONTALLY TO FORM AN APRON AND/OR KEED INTO THE BED OF THE WATERCOURSE, ALL AS INDICATED ON THE DRAWINGS AND AS DIRECTED BY THE ONSITE ENGINEER OR A DESIGNATED REPRESENTATIVE.

5.5. FOR ABOVE WATER WORK, STONES ARE PLACED FROM THE BASE OF THE SLOPE TO THE TOP IN ONE OPERATION. FOR HIGH BANKS, IT MAY BE MOST SUITABLE FOR TWO EXCAVATORS TO COMPLETE THE WORK, ONE AT THE BASE OF THE BANK AND ONE AT THE TOP. CARE IS REQUIRED IN PLACING ROCK TO AVOID DISTURBING FILTER LAYERS.

5.6. FOR UNDERWATER PLACEMENT, DUMPING OF ROCK IS NOT RECOMMENDED AS IT PRODUCES POOR DISTRIBUTION OF MATERIAL. QUALITY CONTROL, WHICH IS OFTEN BASED ON GPS-CONTROLLED SOUNDINGS OR DIVE INSPECTIONS, IS BEYOND THE SCOPE OF THIS DRAWING DUE TO THE DANGER INHERIT IN THESE ACTIVITIES CAUSED BY THE HIGH VELOCITY AND FLOWS ASSOCIATED WITH BITTER CREEK.

5.7. THE CONTROLLED PLACEMENT OF ROCK OF THE CLASS SPECIFIED SHALL PRODUCE A WELL-GRADED ROCK MASS OF THE NOMINAL OR REQUIRED THICKNESS OVER THE AREA INDICATED. THE ROCK SHALL BE MANIPULATED AS NECESSARY TO PROVIDE MASS STABILITY AND A REGULAR SURFACE WITH A MINIMUM OF VOIDS

**6. CONSTRUCTION STAKING:**

6.1 A PROFESSIONAL ENGINEER OR A DESIGNATED REPRESENTATIVE IS REQUIRED TO LAYOUT THE LOCATION OF RIPRAP PRIOR TO INITIAL EXCAVATION.

**7. CONSTRUCTION REVIEWS**

7.1 A PROFESSIONAL ENGINEER OR A DESIGNATED REPRESENTATIVE IS REQUIRED TO MONITOR THE FOLLOWING ACTIVITIES PRIOR TO AND/OR DURING CONSTRUCTION:

- ROCK QUALITY (HARDNESS AND GRADATION) (PRIOR)
- CLEARING AND GRUBBING (DURING)
- TOE / TERMINAL END-KEY EXCAVATIONS (DURING)
- PREPARATION OF BACK SLOPE / SURFACE (DURING)
- CONSTRUCTION AT TOE OF RIPRAP BANKS AND ROCK SCOUR APRONS (DURING)
- FRONT SLOPE / H-WIDTH / THICKNESS / GRADATION (DURING)
- DESIGN HEIGHT (DURING)
- ANY ADDITIONAL INSPECTION AT THE DISCRETION OF THE PROFESSIONAL ENGINEER OR THEIR DESIGNATE

**8. REFERENCES**

8.1 FOR ADDITIONAL INFORMATION ON RIPRAP SPECIFICATIONS FOR THIS DESIGN, SEE "BITTER CREEK HYDROTECHNICAL ASSESSMENT REPORT" COMPLETED BY INTEGRATED WATERSHEDS, DATED OCTOBER 2017.

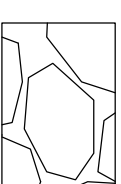
8.2 FOR ADDITIONAL INFORMATION ON RIPRAP FROM THE MINISTRY OF ENVIRONMENT, LAND AND PARKS, SEE [http://www.env.gov.bc.ca/wsd/public\\_safety/floodpdfs\\_word/riprap\\_guide.pdf](http://www.env.gov.bc.ca/wsd/public_safety/floodpdfs_word/riprap_guide.pdf)

8.3 FOR ADDITIONAL INFORMATION ON RIPRAP FROM THE MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE, SEE THE 2016 STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION VOLUME 1 - SECTION 205 - RIPRAP.

8.4 REFER TO THE ONSITE ENGINEERING LTD. GEOMETRIC ROAD DESIGN TITLED REDMOUNTAINACCESSROADIFP.dsn

**TYPE 1 -RIPRAP: CLEAN ANGULAR ROCK**

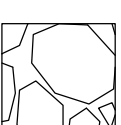
CLASS 1000kg RIPRAP  
ROCK GRADATION  
PERCENT SMALLER THAN GIVEN  
ROCK MASS kg(mm)  
15% 100(415)  
50% 1000(900)  
85% 3000(1295)  
NOMINAL THICKNESS OF RIPRAP  
1500mm



ALL ROCK TO BE PLACED TO MAXIMIZE INTERLOCKING BETWEEN PIECES. ALL ROCK TO BE UNDERLAIN WITH MIRAFI 180N OR APPROVED EQUIVALENT NON-WOVEN GEOTEXTILE. APPROXIMATELY 40 000m<sup>3</sup> ± 10% OF TYPE 1 RIPRAP REQUIRED.

**TYPE 2 -RIPRAP: CLEAN ANGULAR ROCK**

CLASS 250kg RIPRAP  
ROCK GRADATION  
PERCENT SMALLER THAN GIVEN  
ROCK MASS kg(mm)  
15% 25(250)  
50% 250(565)  
85% 750(815)  
NOMINAL THICKNESS OF RIPRAP  
1000mm



ALL ROCK TO BE PLACED TO MAXIMIZE INTERLOCKING BETWEEN PIECES. ALL ROCK TO BE UNDERLAIN WITH MIRAFI 180N OR APPROVED EQUIVALENT NON-WOVEN GEOTEXTILE. APPROXIMATELY 20,000m<sup>3</sup> ± 10% OF TYPE 2 RIPRAP REQUIRED.

BULK FILL: WELL GRADED COARSE GRANULAR MATERIAL

BULK FILL  
ROCK GRADATION  
PERCENT BY WEIGHT PASSING US STANDARD SIEVE SIZE (mm)

100%	300.0mm
85-100%	150.0mm
75-100%	75.0mm
80-100%	37.5mm
75-100%	19.0mm
64-100%	10.0mm

TABLE 205-C RECOMMENDED TESTS FOR RIPRAP QUALITY (FROM MOTI SECTION 205 - RIPRAP)

PROPERTY	TEST DESIGNATION	ALLOWABLE VALUE
SPECIFIC GRAVITY	ASTM D6437	≥2.80
ABSORPTION	ASTM D6437	≤1%
SOUNDNESS BY USE OF MAGNESIUM SULPHATE	ASTM D5240	≤10% (FOLLOWING 5 CYCLES)
MICRO-DEVAL ABRASION LOSS FACTOR	ASTM D6928	≤20%

DWG No.: BITTERCREEKHYPROTECH-002

SHEET: 2 OF 22

PREPARED FOR:

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DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

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DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYPROTECH.DWG

SCALE: AS NOTED

REVISION NUMBER:

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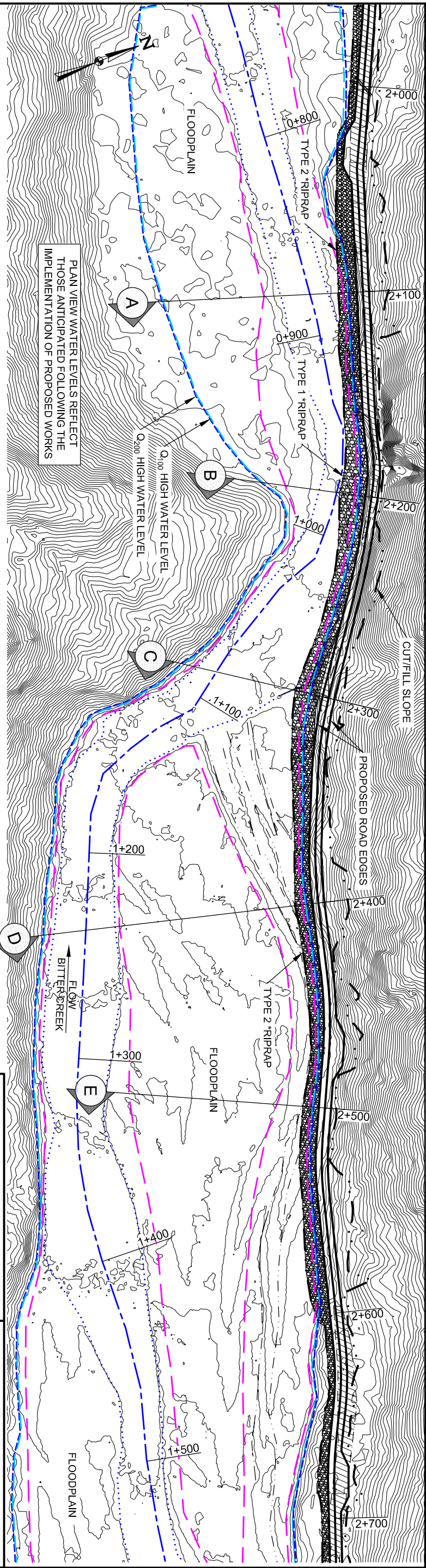
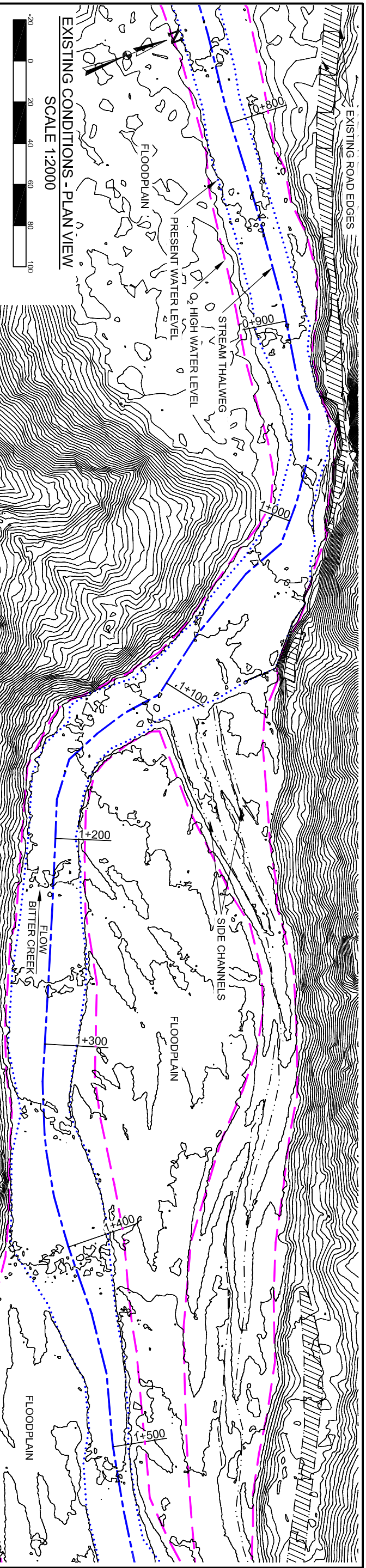
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

NOTES

SEAL OF B.C. P.ENG.

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CAUTION:  
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PLAN VIEW WATER LEVELS REFLECT  
THOSE ANTICIPATED FOLLOWING THE  
IMPLEMENTATION OF PROPOSED WORKS

PROPOSED CONDITIONS - PLAN VIEW  
SCALE 1:2000

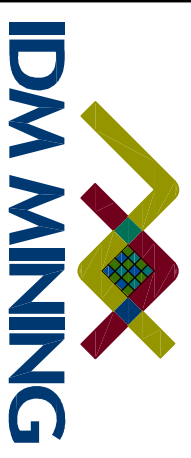
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PROPOSED ROAD CENTRELINE	—	Q <sub>200</sub> HIGH WATER LEVEL	—
CUT/FILL SLOPE	—	Q <sub>200</sub> HIGH WATER LEVEL	—
EXISTING ROAD EDGE	—	STREAM THALWEG	—
PRESENT WATER LEVEL	—	GRAVEL BAR	—
SIDE CHANNEL BANK	—		

DWG No: BITTERCREEKHYDROTECH-003

SHEET: 3 OF 22

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PREPARED BY:



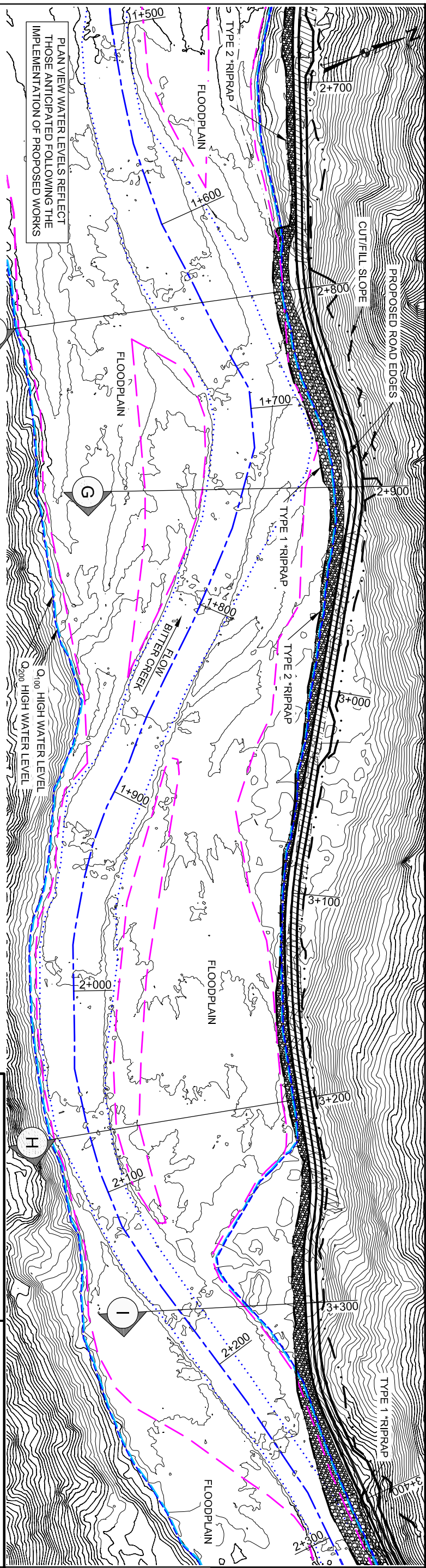
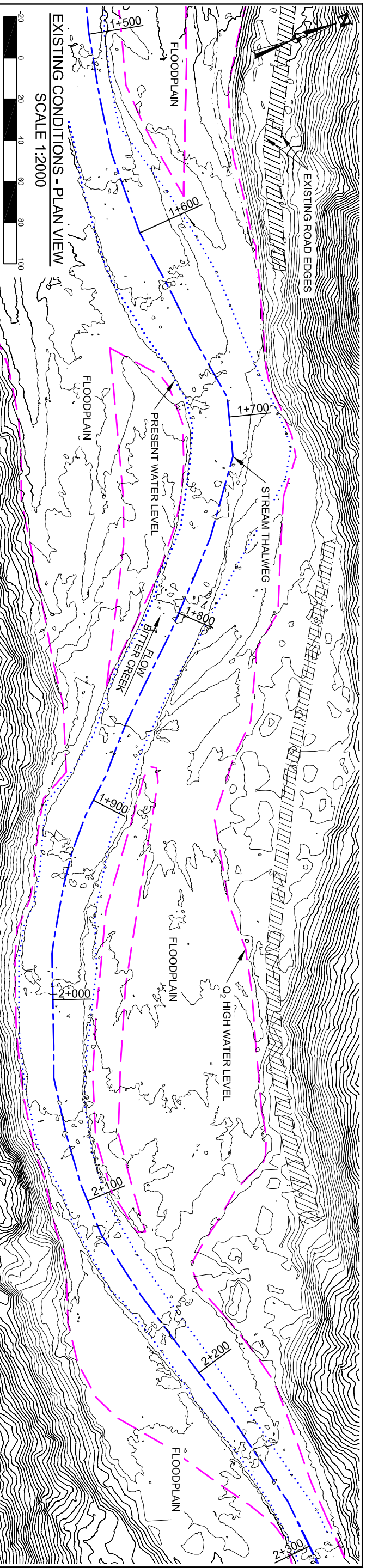
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DESIGN DATE: OCTOBER 31, 2017  
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DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
SCALE: AS NOTED  
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REVISION DATE:  
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RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
PLAN VIEWS  
STREAM STA 0+770m TO 1+560m

SEAL OF B.C. P.ENG.

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PLAN VIEW WATER LEVELS REFLECT  
THOSE ANTICIPATED FOLLOWING THE  
IMPLEMENTATION OF PROPOSED WORKS

PROPOSED ROAD EDGE	Q <sub>2</sub> HIGH WATER LEVEL
PROPOSED ROAD CENTRELINE	Q <sub>100</sub> HIGH WATER LEVEL
CUT/FILL SLOPE	Q <sub>200</sub> HIGH WATER LEVEL
EXISTING ROAD EDGE	STREAM THALWEG
PRESENT WATER LEVEL	GRAVEL BAR
SIDE CHANNEL BANK	

DWG No.: BITTERCREEKHYPOTTECH-004

SHEET: 4 OF 22

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

PREPARED FOR:

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RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
PLAN VIEWS

STREAM STA 1+500m TO 2+310m

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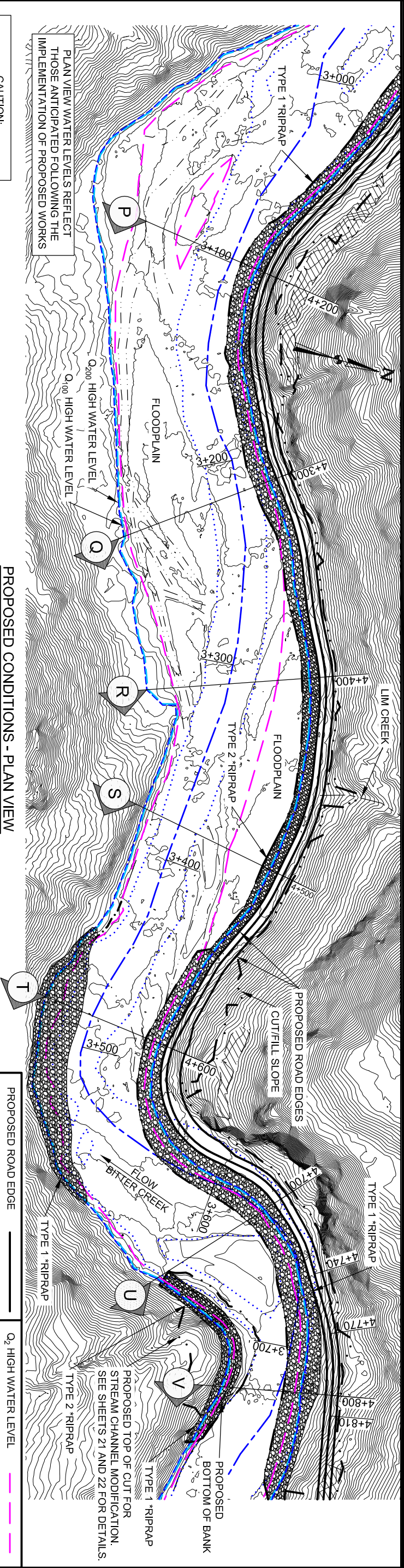
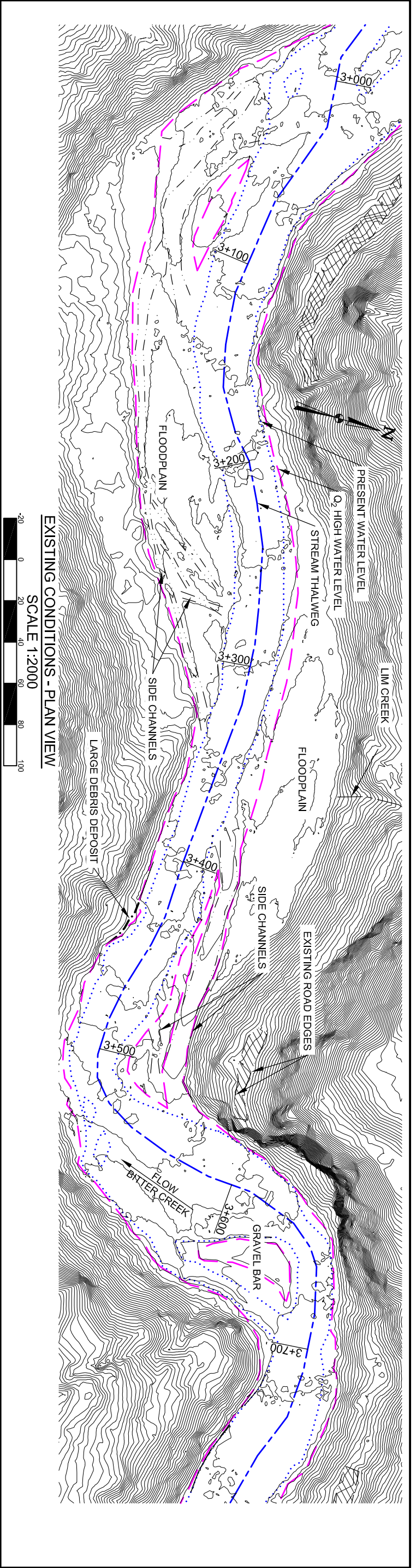
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PROPOSED ROAD EDGE	—	Q <sub>2</sub> HIGH WATER LEVEL	—
PROPOSED ROAD CENTRELINE	—	Q <sub>100</sub> HIGH WATER LEVEL	—
CUT/FILL SLOPE	—	Q <sub>200</sub> HIGH WATER LEVEL	—
EXISTING ROAD EDGE	—	STREAM THALWEG	—
PRESENT WATER LEVEL	—	GRAVEL BAR	—
SIDE CHANNEL BANK	—		

DWG No: BITTERCREEKHYPOTTECH-006 SHEET: 6 OF 22

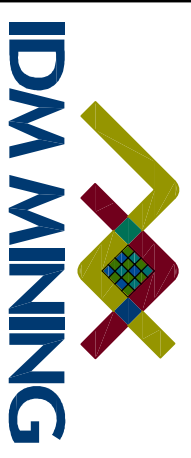
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DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017  
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RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYPOTTECH.DWG  
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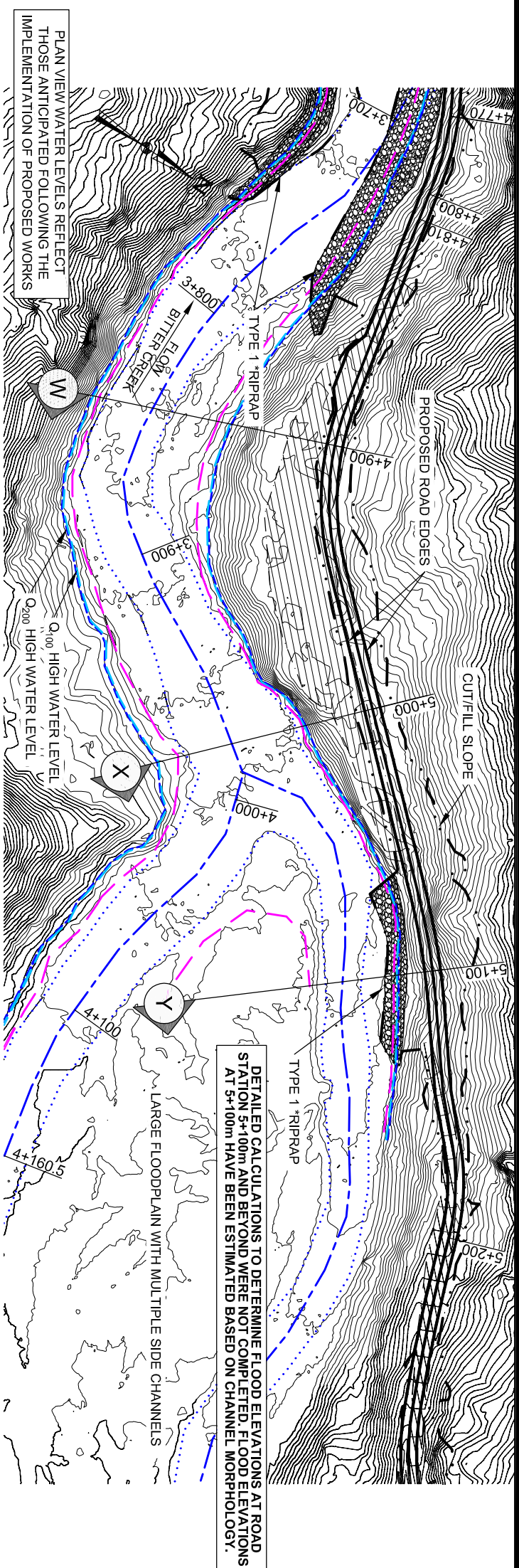
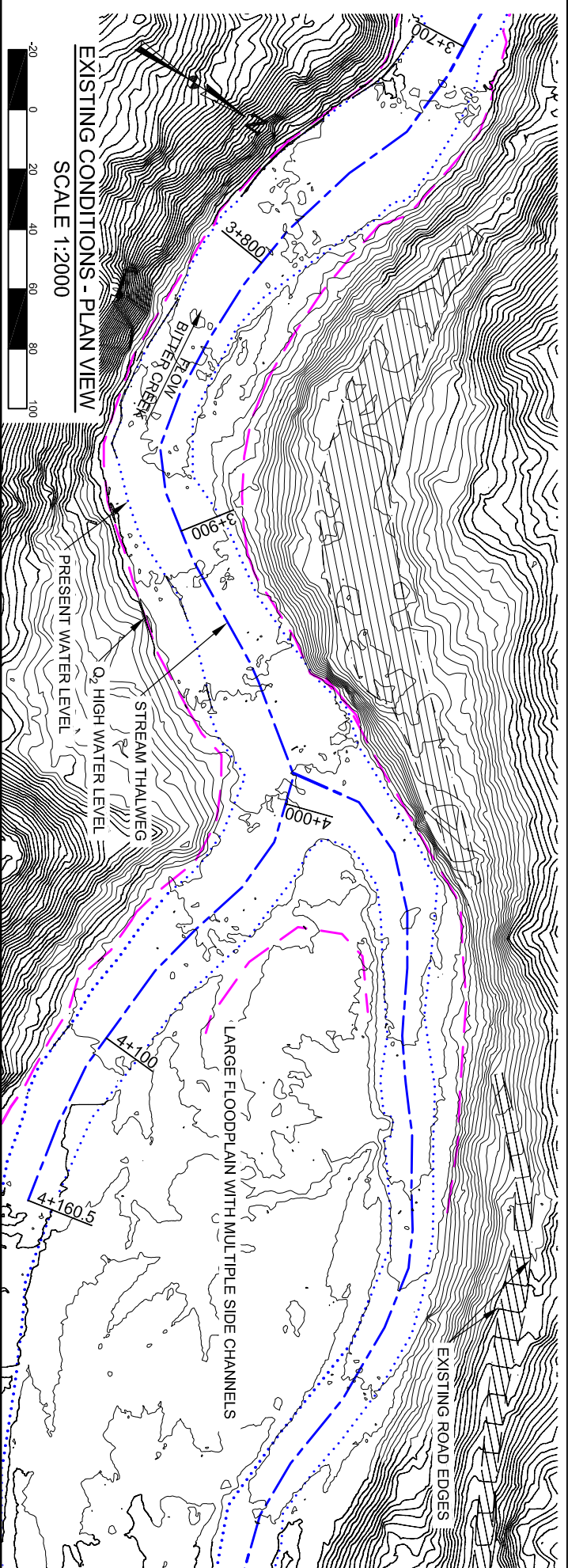
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
PLAN VIEWS  
STREAM STA 3+000m TO 3+780m

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DETAILED CALCULATIONS TO DETERMINE FLOOD ELEVATIONS AT ROAD STATION 5+100m AND BEYOND WERE NOT COMPLETED. FLOOD ELEVATIONS AT 5+100m HAVE BEEN ESTIMATED BASED ON CHANNEL MORPHOLOGY.

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PROPOSED ROAD EDGE	———	Q <sub>2</sub> HIGH WATER LEVEL	———
PROPOSED ROAD CENTRELINE	———	Q <sub>100</sub> HIGH WATER LEVEL	———
CUTFILL SLOPE	———	Q <sub>200</sub> HIGH WATER LEVEL	———
EXISTING ROAD EDGE	———	STREAM THALWEG	———
PRESENT WATER LEVEL	.....	GRAVEL BAR	.....
SIDE CHANNEL BANK	———		

DWG No: BITTERCREEKHYDROTECH-007

SHEET: 7 OF 22

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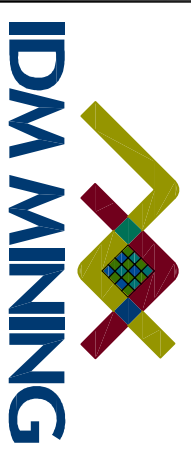
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DRAWN BY: ANDREW BRABANDT, C.TECH  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
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RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
PLAN VIEWS  
STREAM STA 3+700m TO 4+160m

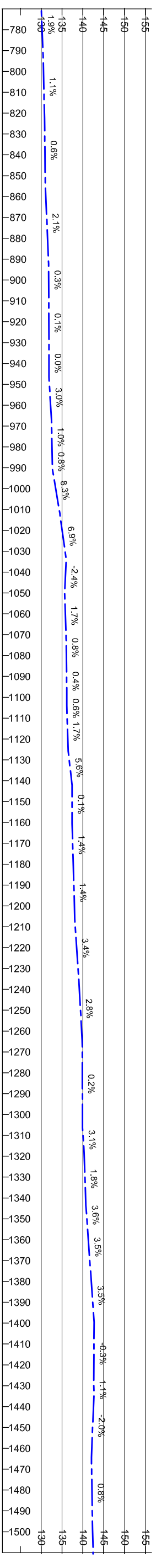
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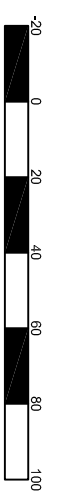
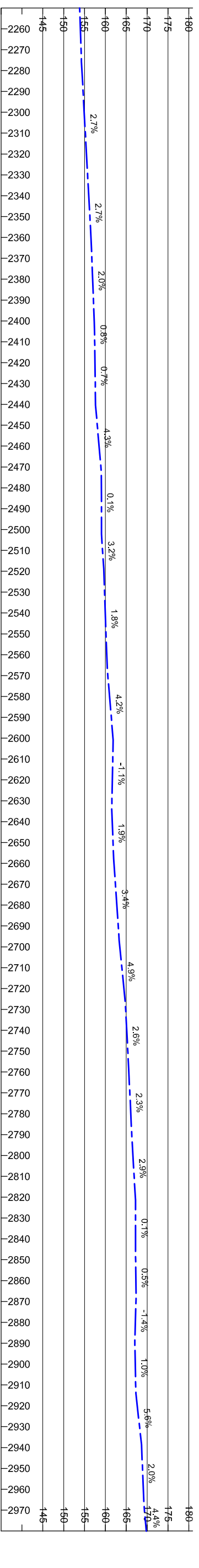
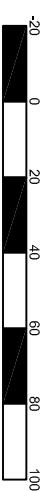
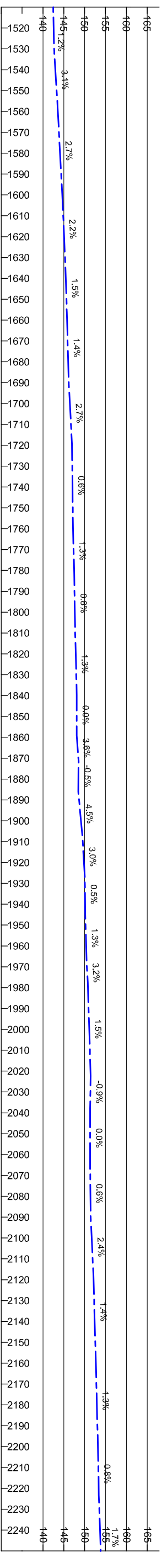
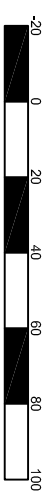


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NO SURVEY WAS COMPLETED ON THE STREAM THALWEG DUE TO STREAM VELOCITY AND FLOW INTENSITY. THALWEG ELEVATIONS HAVE BEEN ESTIMATED BASED ON PRESENT WATER LEVELS AND STREAM MORPHOLOGY.



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STREAM THALWEG

DWG No: BITTERCREEKHYDROTECH-008 SHEET: 8 OF 22

PREPARED FOR: PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

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BITTER CREEK

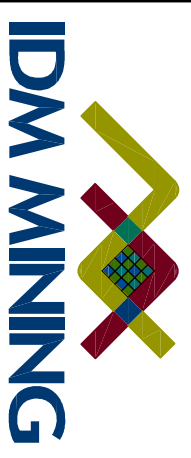
STREAM THALWEG PROFILES

STREAM STA 0+770m TO 2+980m

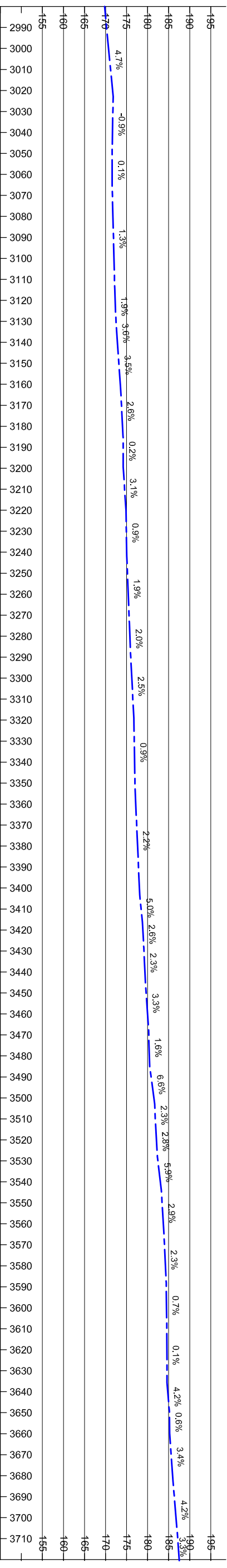
SEAL OF B.C. P.ENG.

**DRAFT**

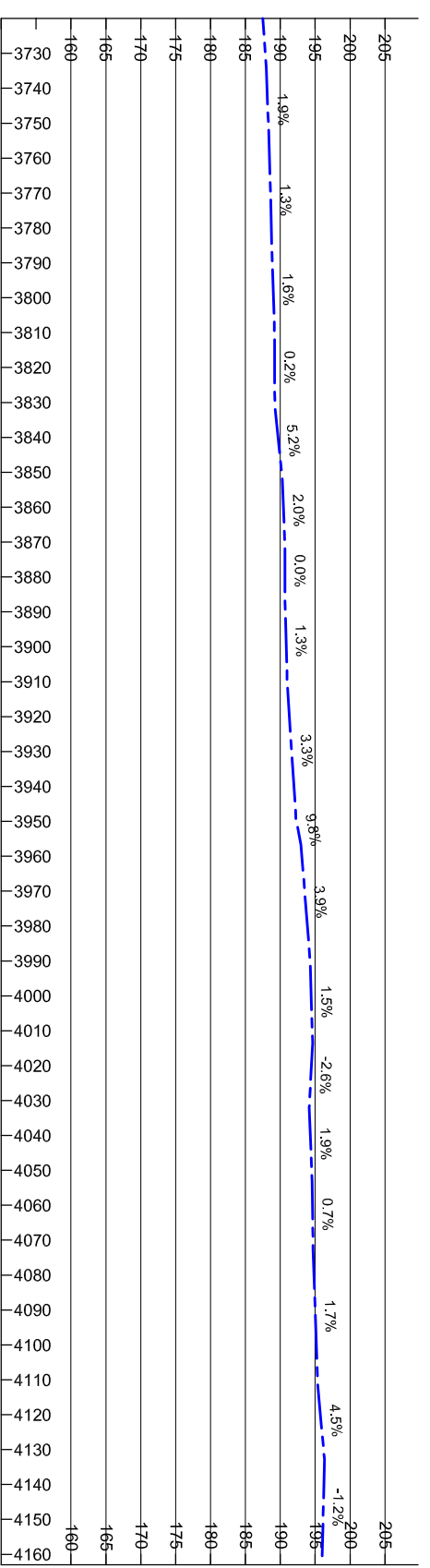
NOT FOR CONSTRUCTION



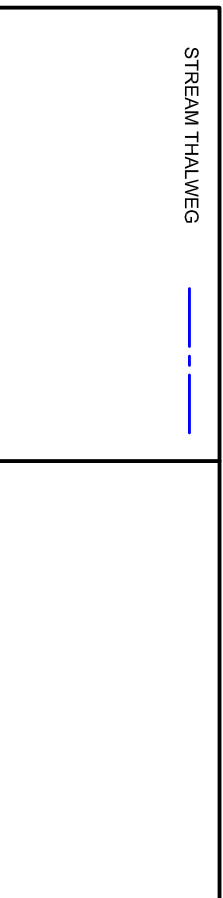
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PH.: 778-628-4968 FAX: 866-235-6943



NO SURVEY WAS COMPLETED ON THE STREAM THALWEG DUE TO STREAM VELOCITY AND FLOW INTENSITY. THALWEG ELEVATIONS HAVE BEEN ESTIMATED BASED ON PRESENT WATER LEVELS AND STREAM MORPHOLOGY.

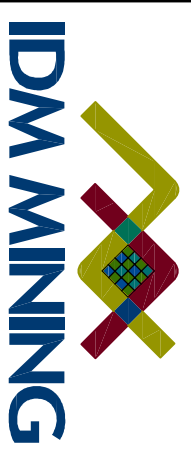


CAUTION:  
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DWG No: BITTERCREEKHYDROTECH-009 SHEET: 9 OF 22

PREPARED FOR: PREPARED BY:



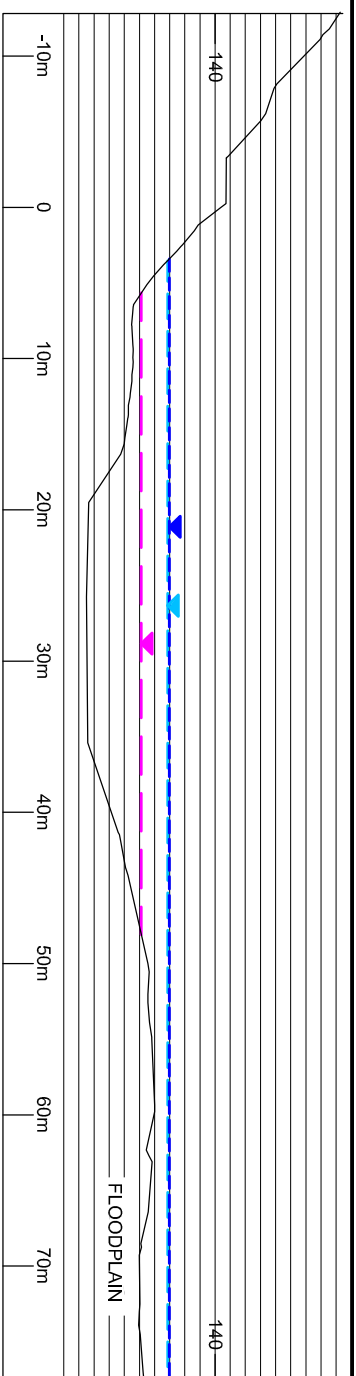
**ONSITE**  
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PH.: 778-628-4968 FAX: 866-235-6943

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017  
REVIEWED BY: MATT DICKIE, EIT.  
RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
SCALE: AS NOTED  
REVISION NUMBER:  
REVISION DATE:  
ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

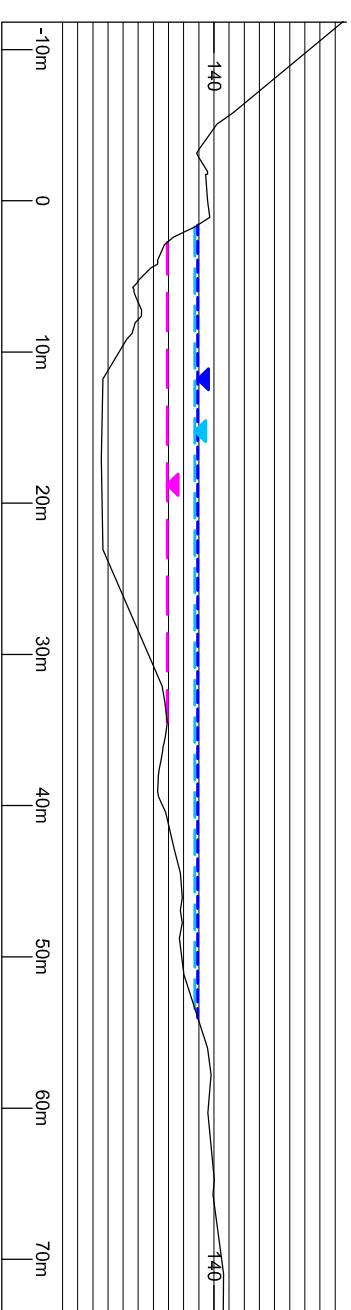
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
STREAM THALWEG PROFILES  
STREAM STA 2+980m TO 4+160m

SEAL OF B.C. P.ENG.

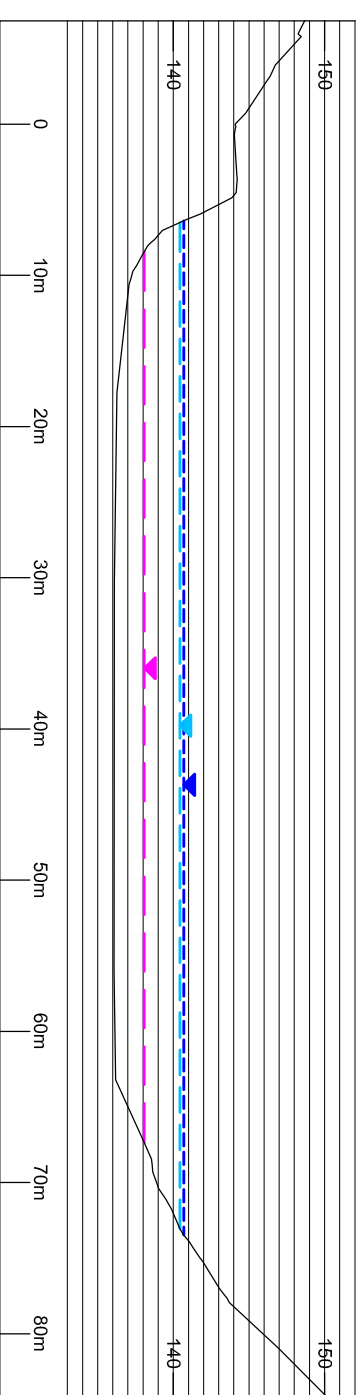
**DRAFT**  
NOT FOR CONSTRUCTION



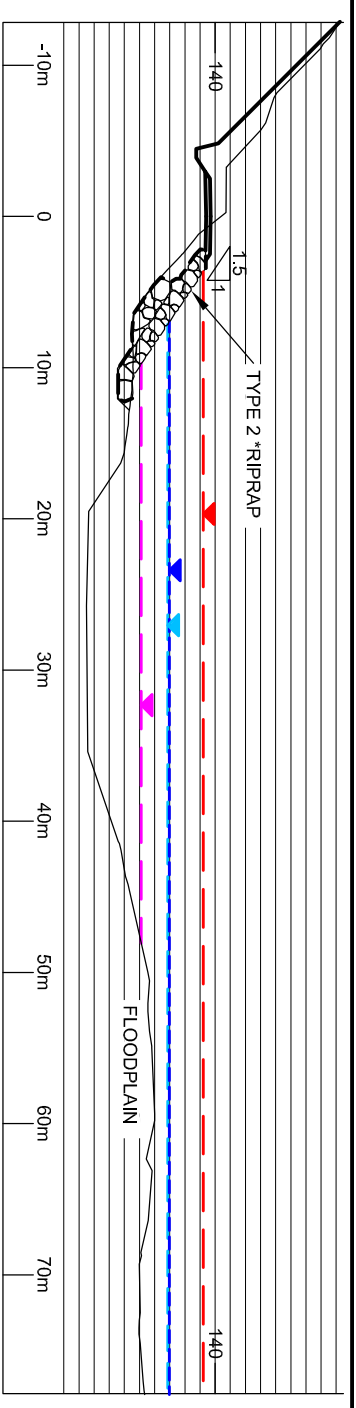
EXISTING CONDITIONS - SECTION A - 2+100m  
SCALE 1:500



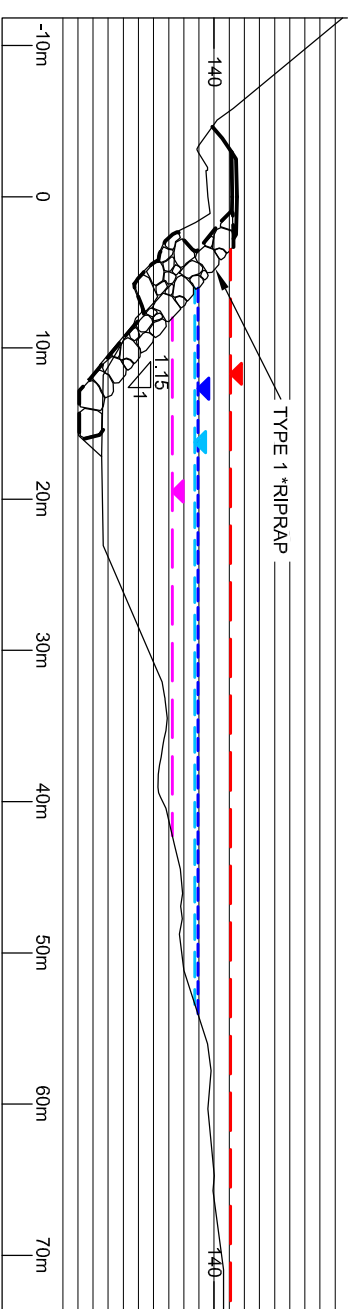
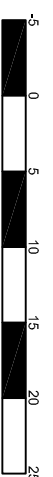
EXISTING CONDITIONS - SECTION B - 2+200m  
SCALE 1:500



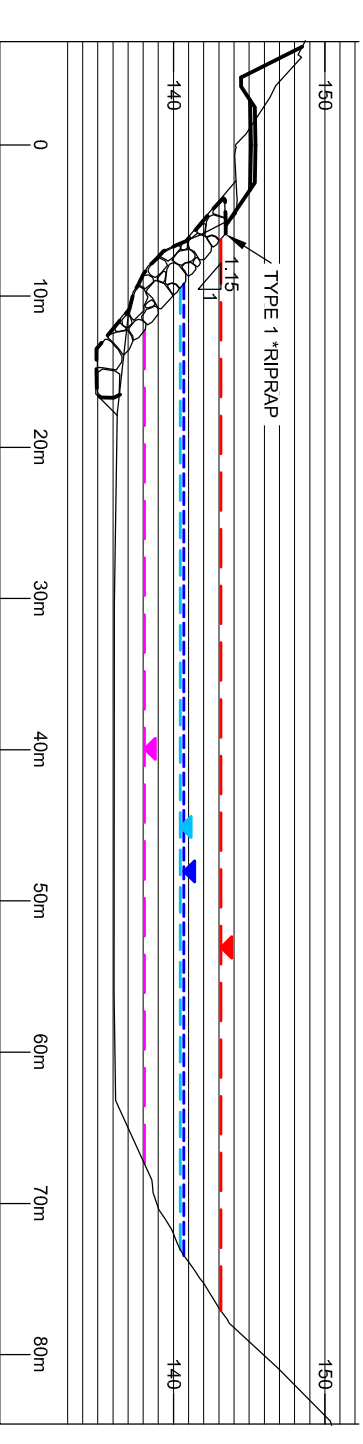
EXISTING CONDITIONS - SECTION C - 2+300m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION A - 2+100m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION B - 2+200m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION C - 2+300m  
SCALE 1:500



ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

CAUTION:  
DRAWING SCALE MAY BE DISTORTED WITH PRINTING.  
INTENDED TO BE PRINTED ON 11"x17" PAPER.

PROPOSED ROAD		FLOOD CONSTRUCTION LEVEL	
EXISTING GROUND		LIMIT OF EXCAVATION	
Q <sub>2</sub> HIGH WATER LEVEL		MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	
Q <sub>100</sub> HIGH WATER LEVEL			
Q <sub>200</sub> HIGH WATER LEVEL			

DWG No.: BITTERCREEKHYDROTECH-010

SHEET 10 OF 22

PREPARED FOR:

PREPARED BY:



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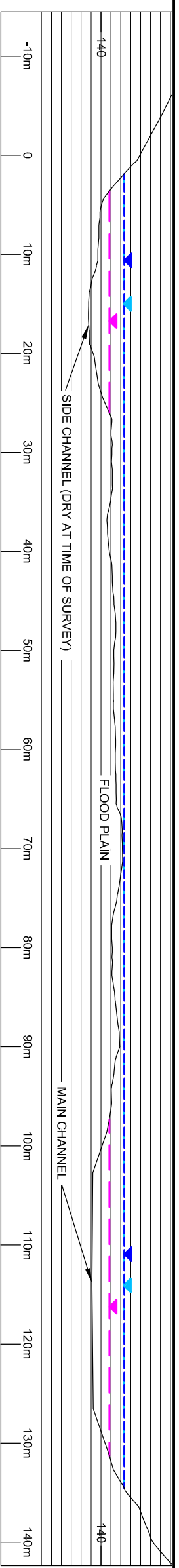
DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017  
REVIEWED BY: MATT DICKIE, EIT.  
RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
SCALE: AS NOTED  
REVISION NUMBER:  
REVISION DATE:  
ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

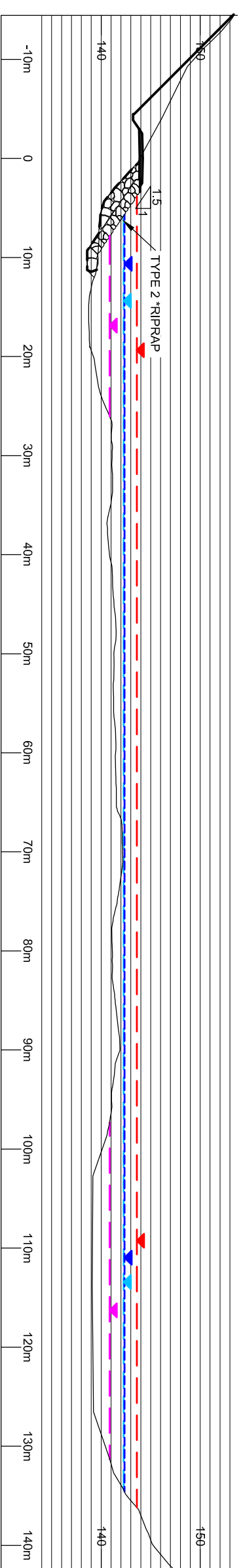
CROSS SECTIONS  
STA 2+100m TO 2+300m

SEAL OF B.C. P.ENG.

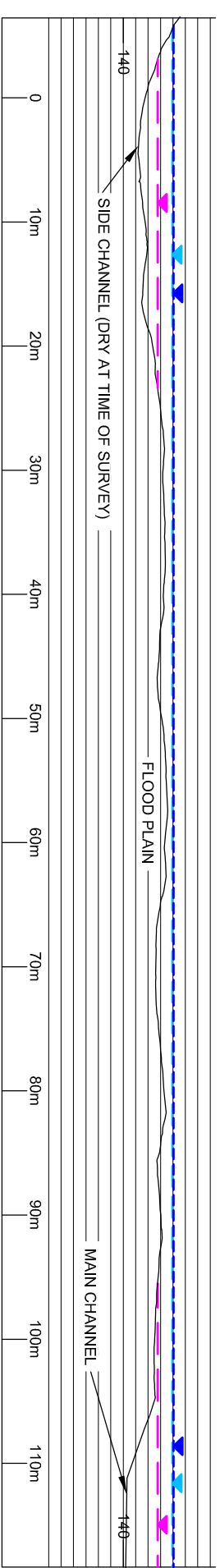
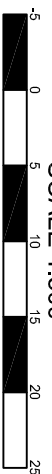
**DRAFT**  
NOT FOR CONSTRUCTION



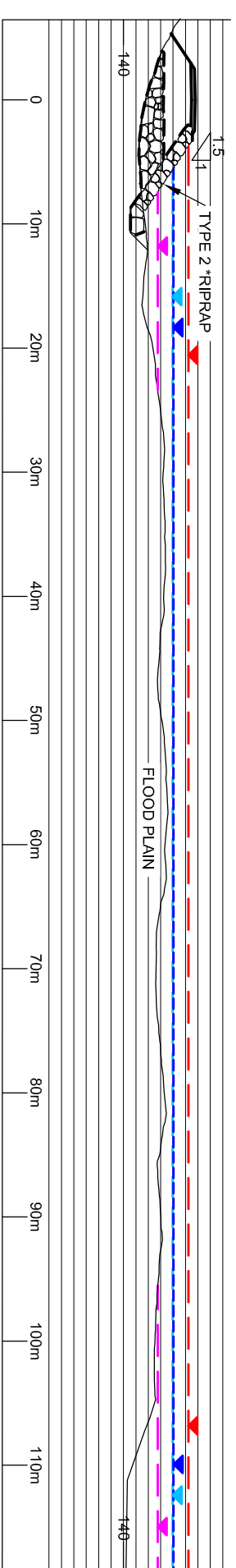
EXISTING CONDITIONS - SECTION D - 2+400m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION D - 2+400m  
SCALE 1:500



EXISTING CONDITIONS - SECTION E - 2+500m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION E - 2+500m  
SCALE 1:500



DWG No.: BITTERCREEKHYDROTECH-011

SHEET: 11 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYDROTECH.DWG

SCALE: AS NOTED

REVISION DATE:

REVISION NUMBER:

ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

CROSS SECTIONS  
STA 2+400m TO 2+500m

PROPOSED ROAD  
EXISTING GROUND  
Q<sub>2</sub> HIGH WATER LEVEL  
Q<sub>100</sub> HIGH WATER LEVEL  
Q<sub>200</sub> HIGH WATER LEVEL

FLOOD CONSTRUCTION  
LEVEL  
LIMIT OF EXCAVATION  
MIRAFI 180N GEOTEXTILE  
(OR APPROVED EQUIVALENT)

CAUTION:

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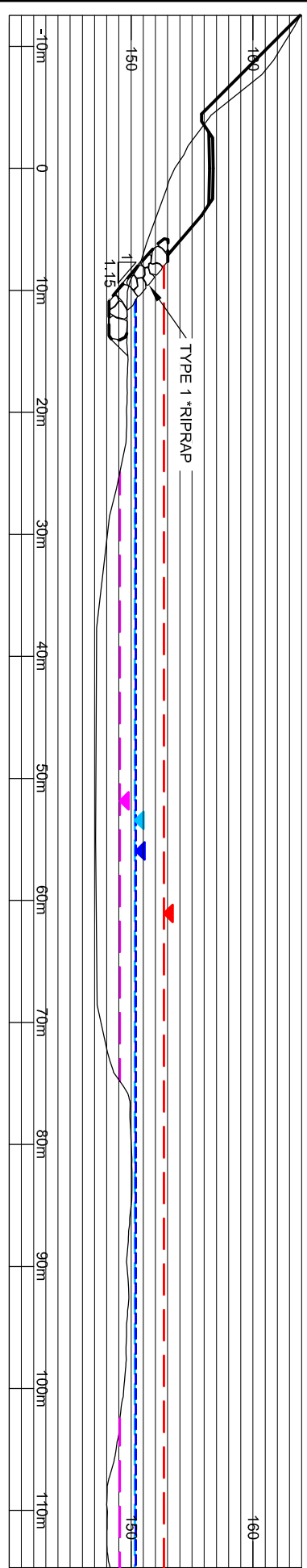
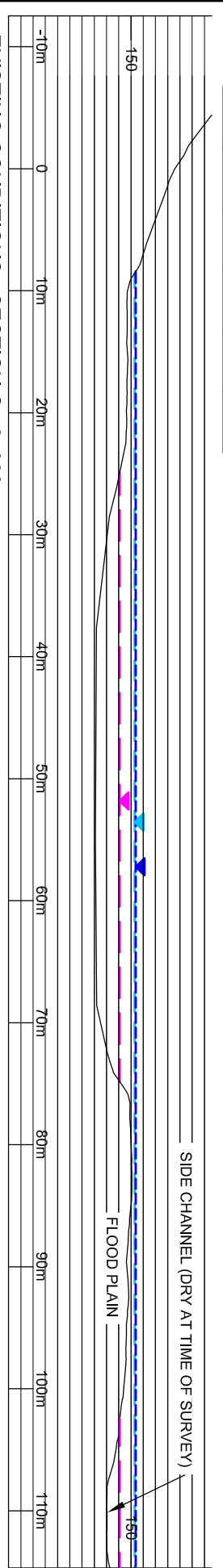
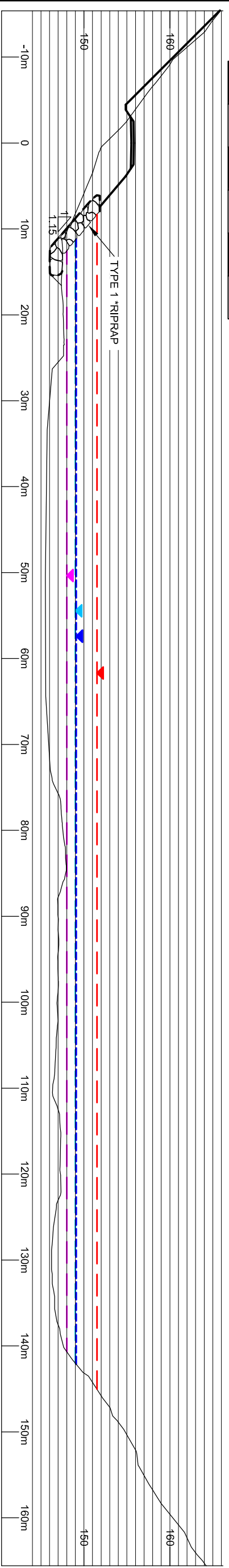
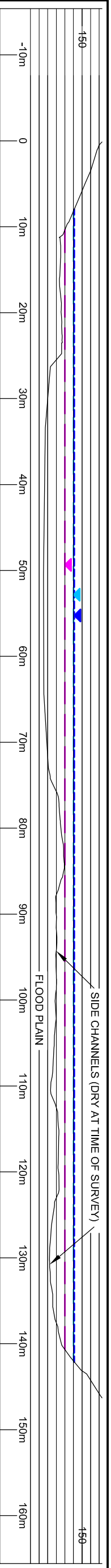
ALL SECTION STATIONS REFER TO  
PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING  
IN UPSTREAM DIRECTION

SEAL OF B.C. P.ENG.

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ALL SECTION STATIONS REFER TO  
PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING  
IN UPSTREAM DIRECTION

PROPOSED ROAD	—	FLOOD CONSTRUCTION LEVEL	—
EXISTING GROUND	—	LIMIT OF EXCAVATION	—
Q <sub>2</sub> HIGH WATER LEVEL	—	MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	—
Q <sub>100</sub> HIGH WATER LEVEL	—		
Q <sub>200</sub> HIGH WATER LEVEL	—		

DWG No: BITTERCREEKHYDROTECH-012 SHEET 12 OF 22

PREPARED FOR: PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT;  
RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYDROTECH.DWG

SCALE: AS NOTED  
REVISION NUMBER:

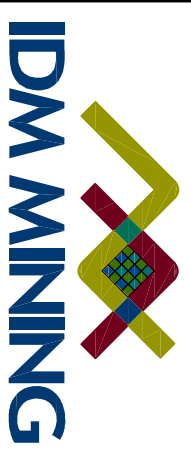
REVISION DATE:  
ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

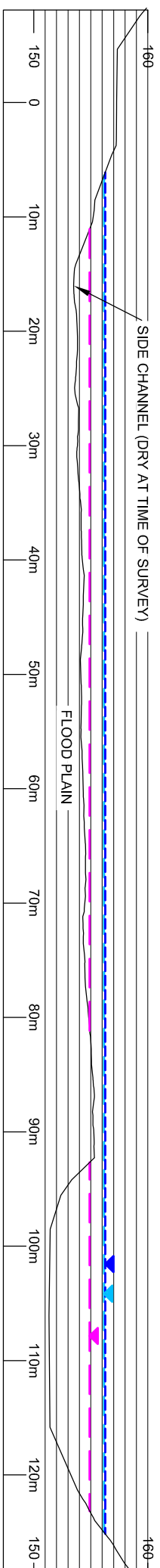
CROSS SECTIONS  
STA 2+800m TO 2+900m

SEAL OF B.C. P.ENG.

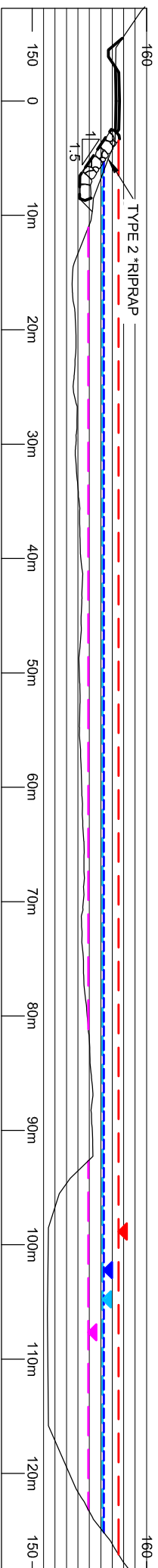
**DRAFT**  
NOT FOR CONSTRUCTION



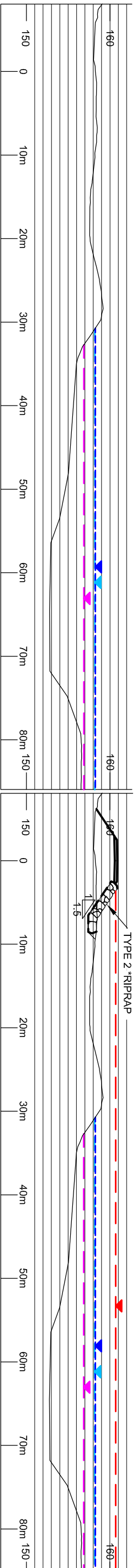
**ONSITE**  
ENGINEERING LTD.  
NORTH VANCOUVER  
2 - 252 1ST ST E  
NORTH VANCOUVER, BC, V7L 1B3  
PH.: 778-628-4968 FAX: 866-235-6943



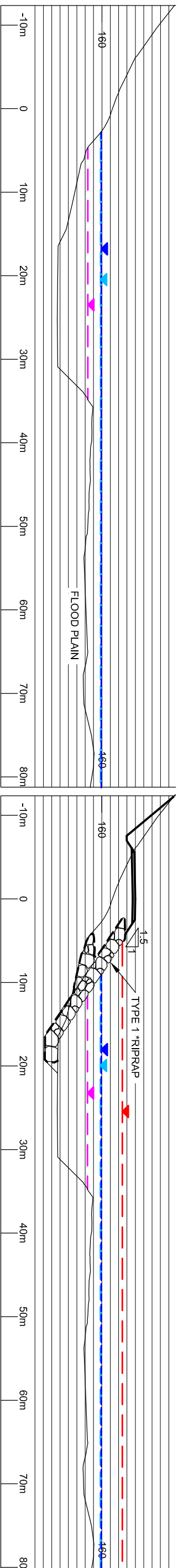
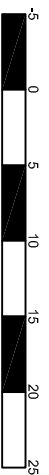
EXISTING CONDITIONS - SECTION H - 3+200m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION H - 3+200m  
SCALE 1:500



EXISTING CONDITIONS - SECTION I - 3+300m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION I - 3+300m  
SCALE 1:500



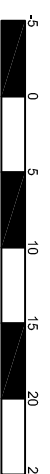
EXISTING CONDITIONS - SECTION J - 3+400m  
SCALE 1:500



ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

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PROPOSED CONDITIONS - SECTION J - 3+400m  
SCALE 1:500



PROPOSED ROAD		FLOOD CONSTRUCTION LEVEL	
EXISTING GROUND		LIMIT OF EXCAVATION	
Q <sub>2</sub> HIGH WATER LEVEL		MIRAFI (80N GEOTEXTILE (OR APPROVED EQUIVALENT))	
Q <sub>100</sub> HIGH WATER LEVEL			
Q <sub>200</sub> HIGH WATER LEVEL			

DWG No.: BITTERCREEKHYDROTECH-013

SHEET 13 OF 22

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

SEAL OF B.C. P.ENG.

PREPARED FOR:

PREPARED BY:

REVIEWED BY: MATT DICKIE, EIT.

CROSS SECTIONS  
STA 3+200m TO 3+400m

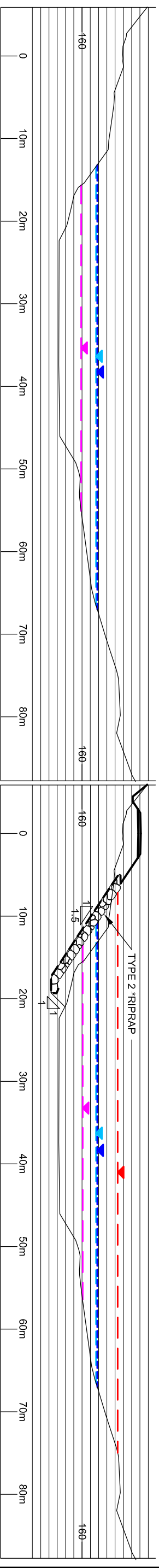
NOT FOR CONSTRUCTION

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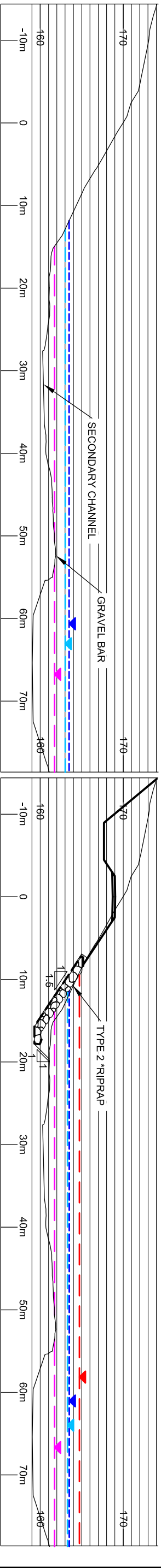
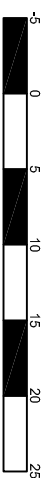
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**DRAFT**



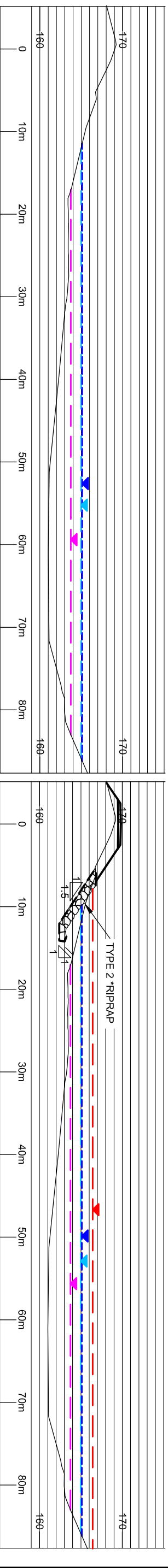
EXISTING CONDITIONS - SECTION K - 3+500m

SCALE 1:500



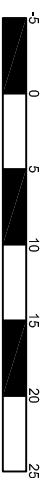
EXISTING CONDITIONS - SECTION L - 3+600m

SCALE 1:500



EXISTING CONDITIONS - SECTION M - 3+700m

SCALE 1:500



ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

CAUTION:  
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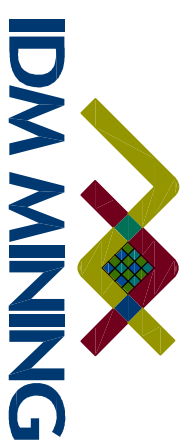
PROPOSED ROAD	—	FLOOD CONSTRUCTION LEVEL	—
EXISTING GROUND	—	LIMIT OF EXCAVATION	—
Q <sub>2</sub> HIGH WATER LEVEL	—	MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	—
Q <sub>100</sub> HIGH WATER LEVEL	—		
Q <sub>200</sub> HIGH WATER LEVEL	—		

DWG No.: BITTERCREEKHYDROTECH-014

SHEET 14 OF 22

PREPARED FOR:

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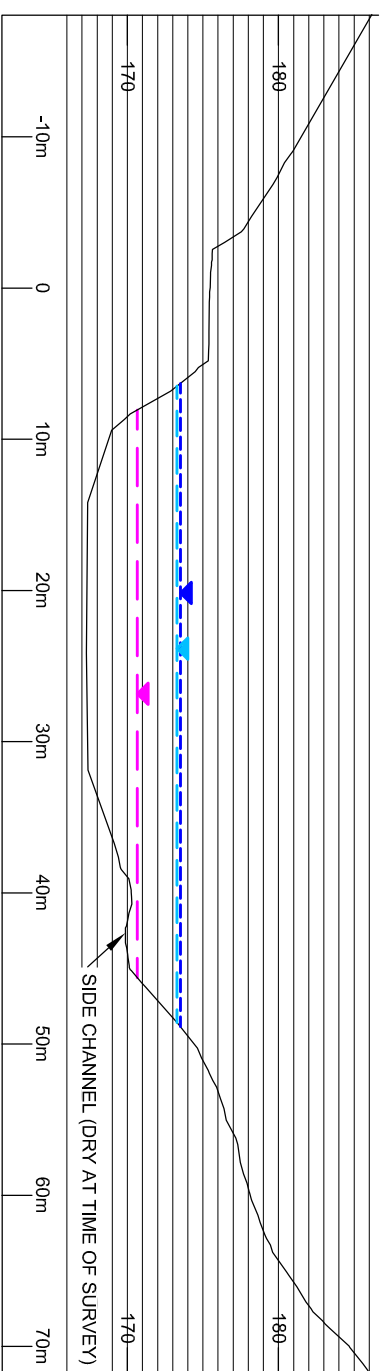
NORTH VANCOUVER  
2 - 252 1ST ST E  
NORTH VANCOUVER, BC, V7L 1B3  
PH.: 778-628-4968 FAX: 866-235-6943

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017  
REVIEWED BY: MATT DICKIE, EIT.  
RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
SCALE: AS NOTED  
REVISION NUMBER:  
REVISION DATE:  
ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
CROSS SECTIONS  
STA 3+500m TO 3+700m

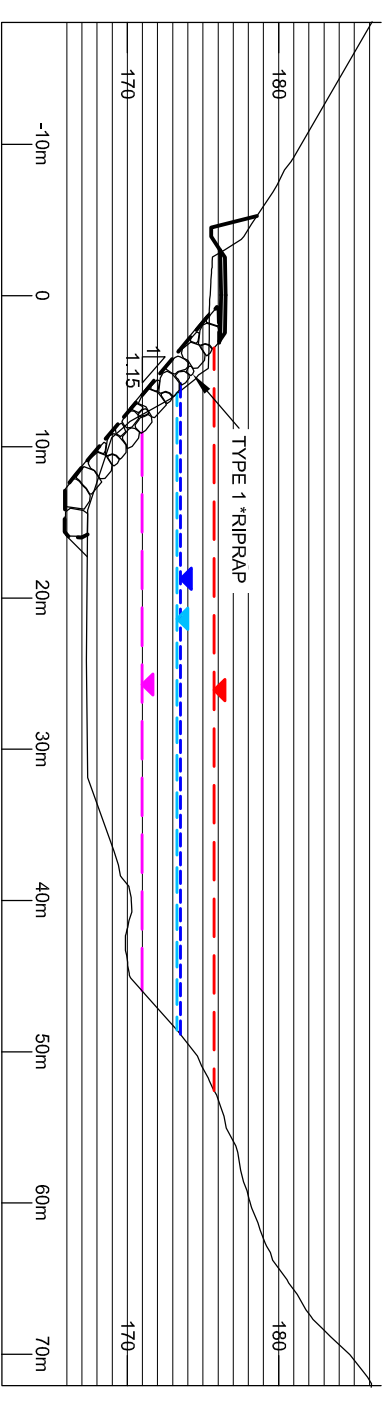
SEAL OF B.C. P.ENG.

**DRAFT**  
NOT FOR CONSTRUCTION



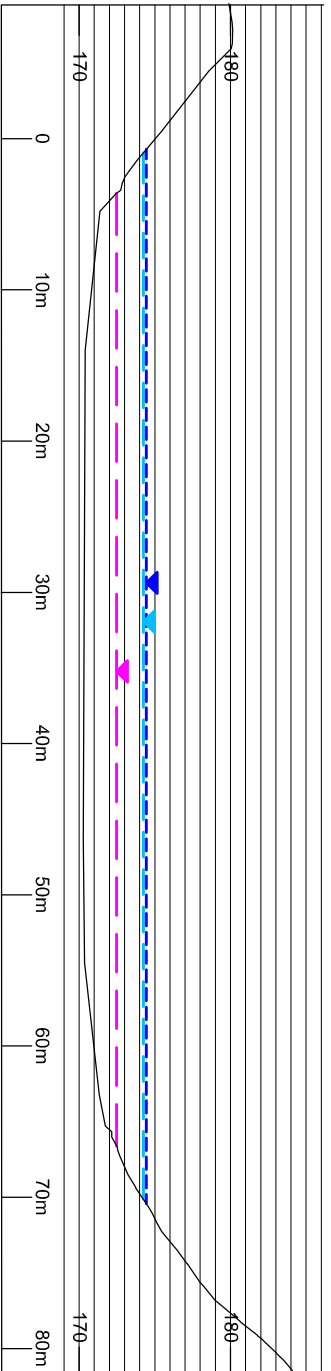
EXISTING CONDITIONS - SECTION N - 4+000m

SCALE 1:500



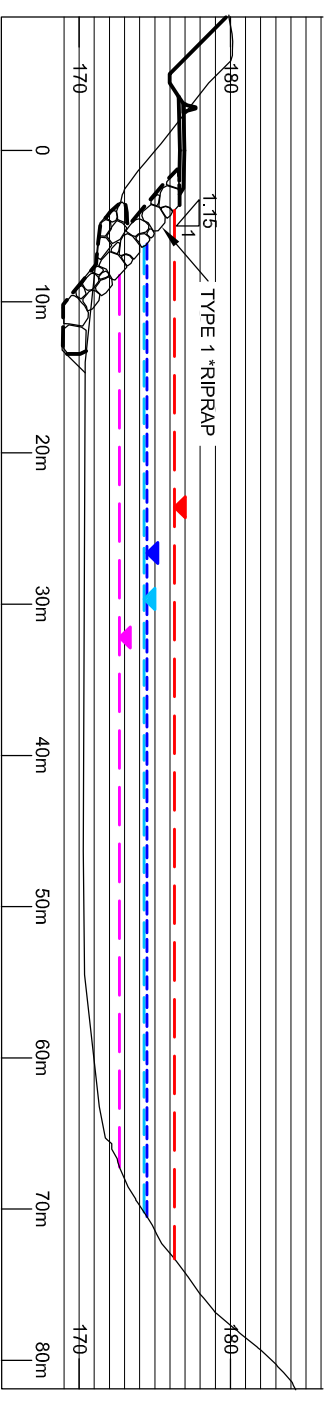
PROPOSED CONDITIONS - SECTION N - 4+000m

SCALE 1:500



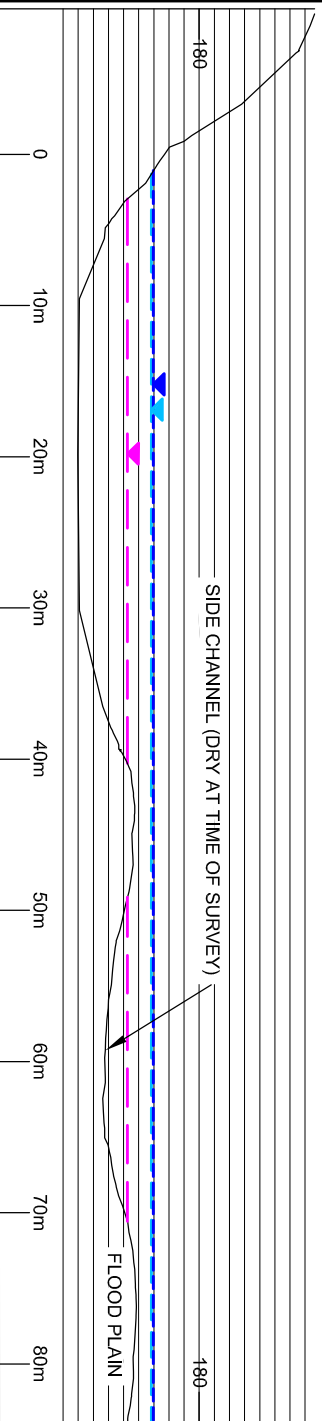
EXISTING CONDITIONS - SECTION O - 4+100m

SCALE 1:500



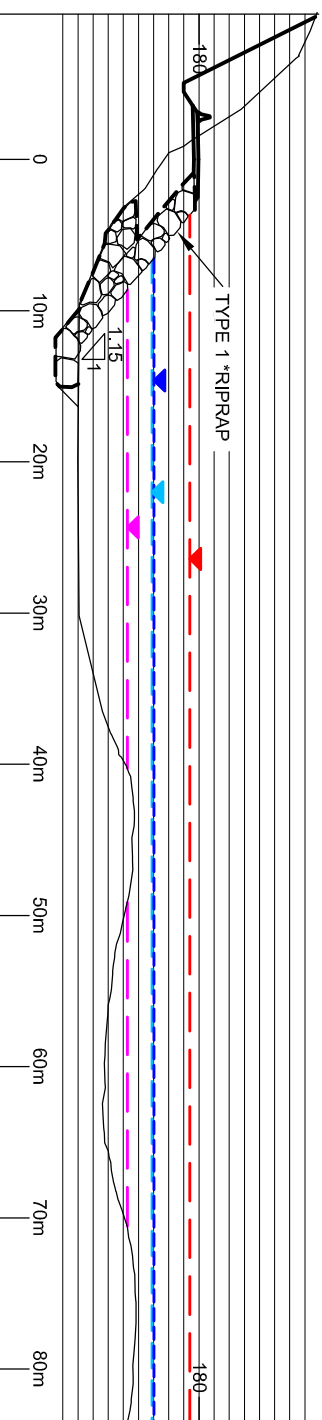
PROPOSED CONDITIONS - SECTION O - 4+100m

SCALE 1:500



EXISTING CONDITIONS - SECTION P - 4+200m

SCALE 1:500



PROPOSED CONDITIONS - SECTION P - 4+200m

SCALE 1:500



ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

CAUTION:  
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INTENDED TO BE PRINTED ON 11"x17" PAPER.

PROPOSED ROAD		FLOOD CONSTRUCTION LEVEL	
EXISTING GROUND		LIMIT OF EXCAVATION	
Q <sub>2</sub> HIGH WATER LEVEL		MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	
Q <sub>100</sub> HIGH WATER LEVEL			
Q <sub>200</sub> HIGH WATER LEVEL			

DWG No.: BITTERCREEKHYDROTECH-015

SHEET 15 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYDROTECH.DWG

SCALE: AS NOTED

REVISION NUMBER:

ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

SEAL OF B.C. P.ENG.

**DRAFT**

NOT FOR CONSTRUCTION

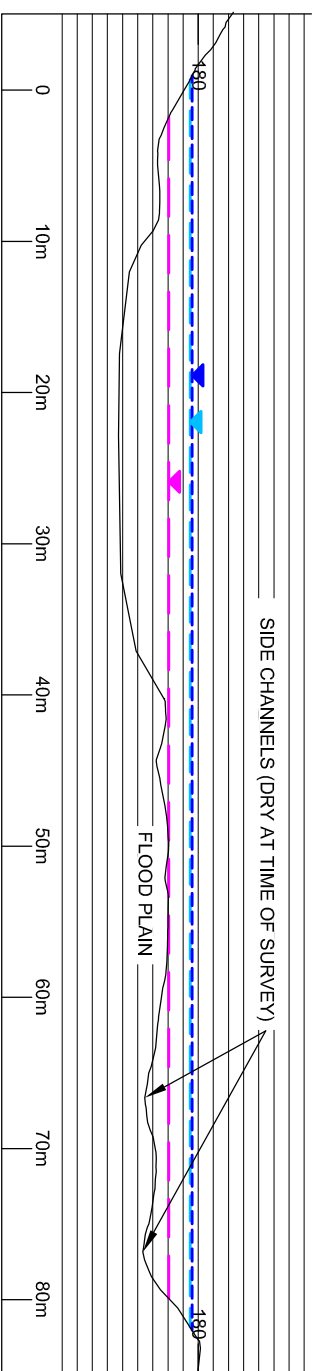
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

CROSS SECTIONS  
STA 4+000m TO 4+200m

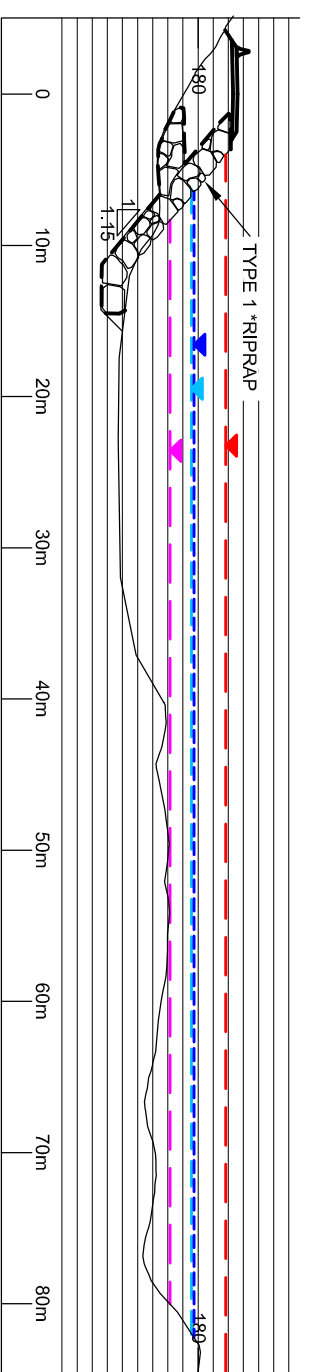
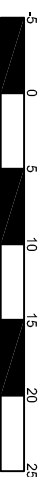


NORTH VANCOUVER  
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2 - 252 1ST ST E  
NORTH VANCOUVER, BC, V7L 1B3  
PH.: 778-628-4968 FAX: 866-235-6943

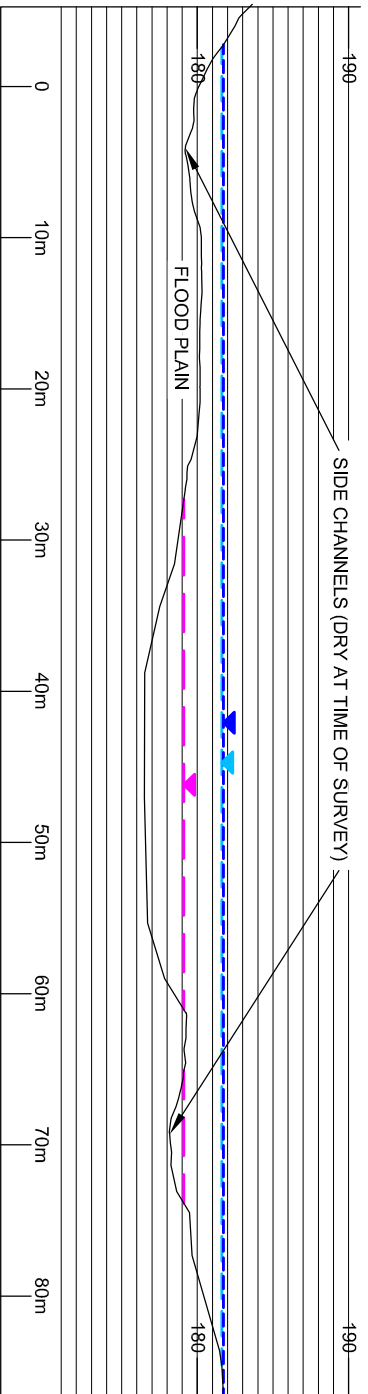




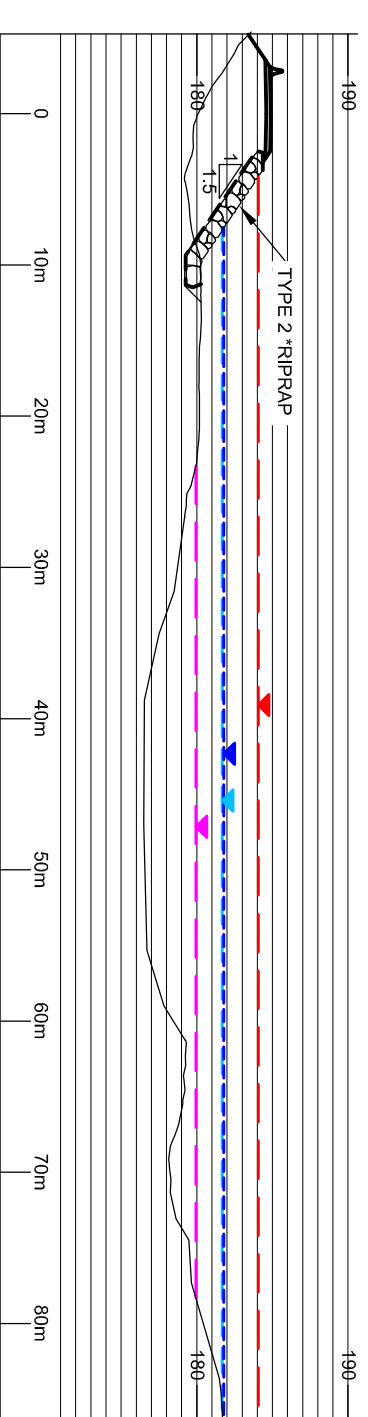
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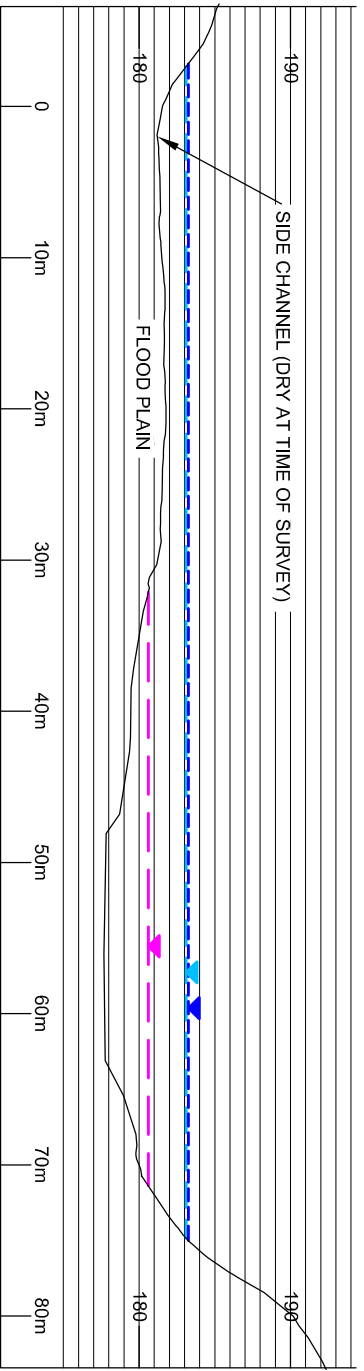
PROPOSED CONDITIONS - SECTION Q - 4+300m  
SCALE 1:500



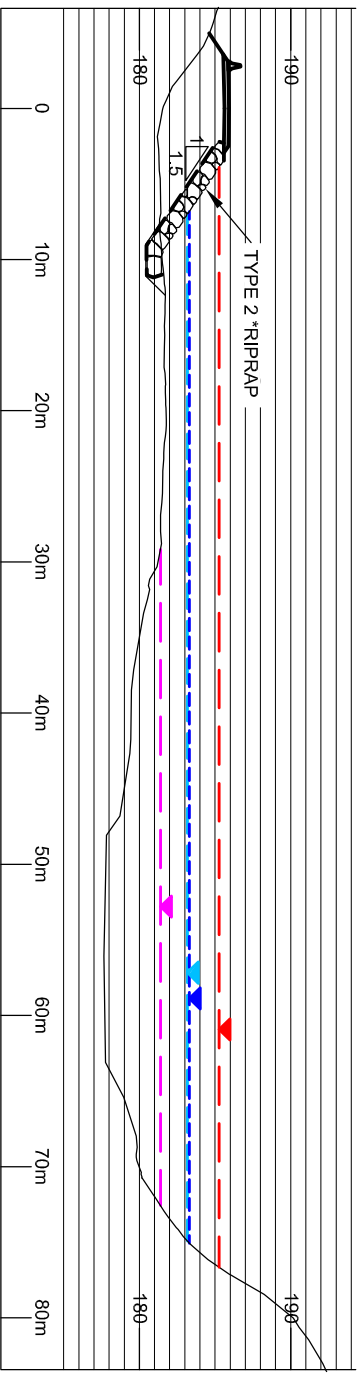
EXISTING CONDITIONS - SECTION R - 4+400m  
SCALE 1:500



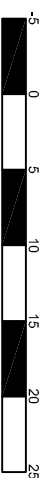
PROPOSED CONDITIONS - SECTION R - 4+400m  
SCALE 1:500



EXISTING CONDITIONS - SECTION S - 4+500m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION S - 4+500m  
SCALE 1:500



ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING IN UPSTREAM DIRECTION

CAUTION: DRAWING SCALE MAY BE DISTORTED WITH PRINTING. INTENDED TO BE PRINTED ON 11"x17" PAPER.

PROPOSED ROAD	—	FLOOD CONSTRUCTION LEVEL	—
EXISTING GROUND	—	LIMIT OF EXCAVATION	—
Q <sub>2</sub> HIGH WATER LEVEL	—	MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	—
Q <sub>100</sub> HIGH WATER LEVEL	—		
Q <sub>200</sub> HIGH WATER LEVEL	—		

DWG No.: BITTERCREEKHYDROTECH-016

SHEET 16 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYDROTECH.DWG

SCALE: AS NOTED

REVISION NUMBER:

ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

SEAL OF B.C. P.ENG.

**DRAFT**

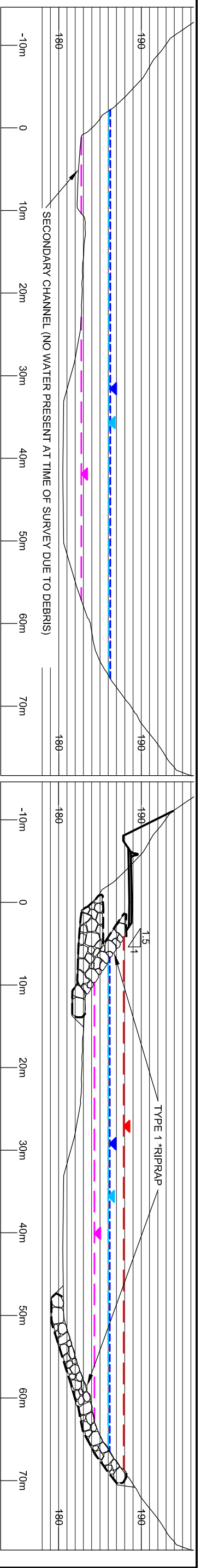
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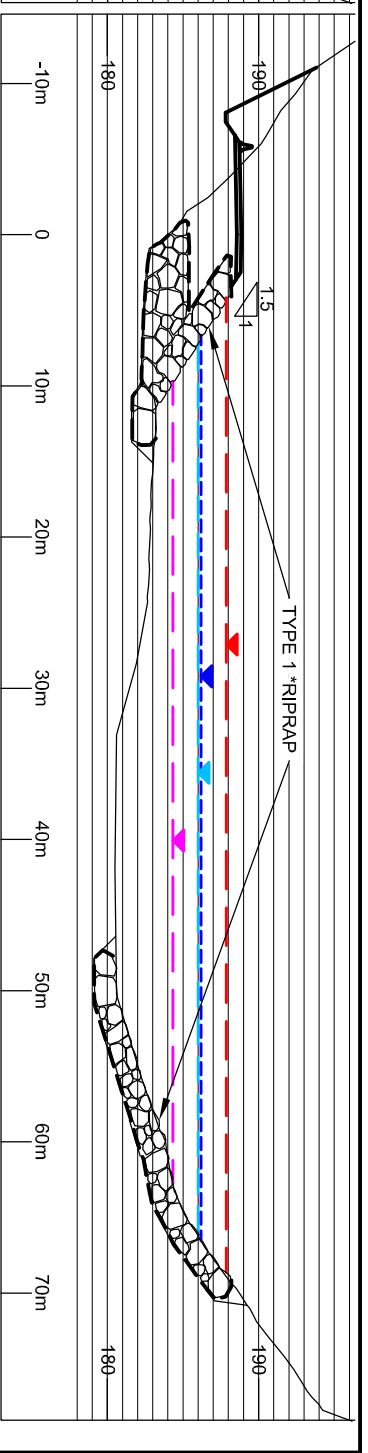
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

CROSS SECTIONS  
STA 4+300m TO 4+500m



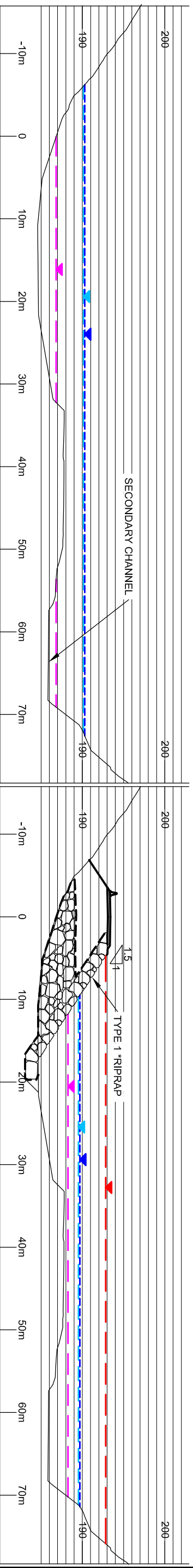
EXISTING CONDITIONS - SECTION T - 4+600m

SCALE 1:500



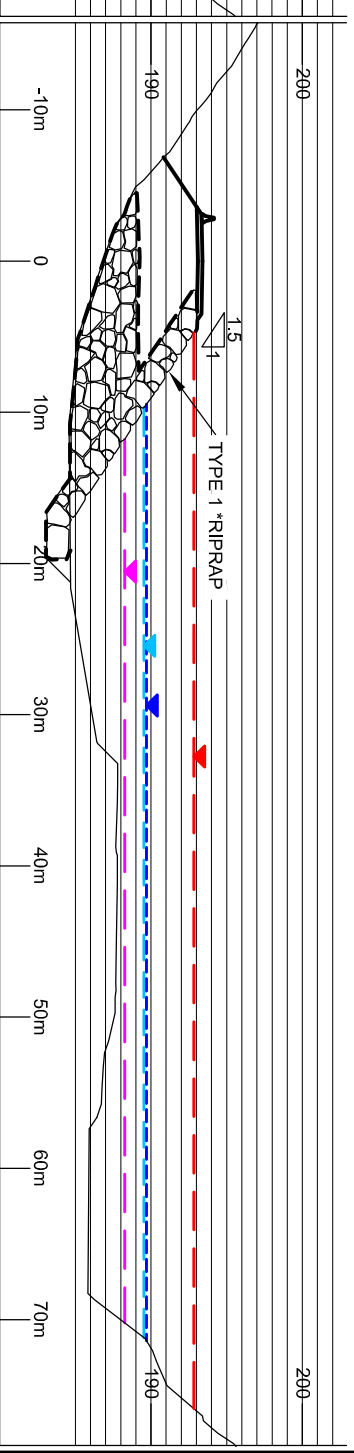
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SCALE 1:500



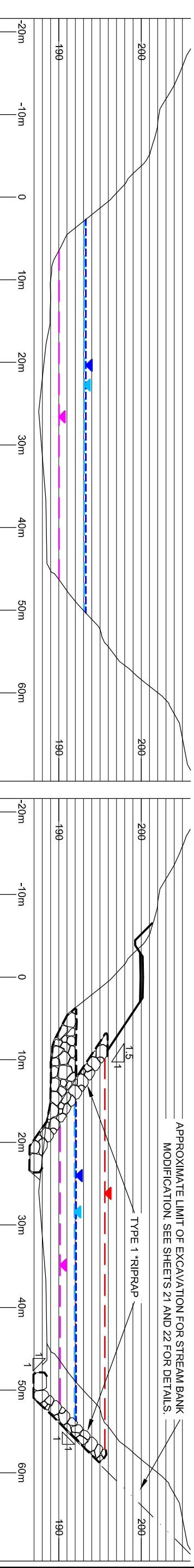
EXISTING CONDITIONS - SECTION U - 4+700m

SCALE 1:500



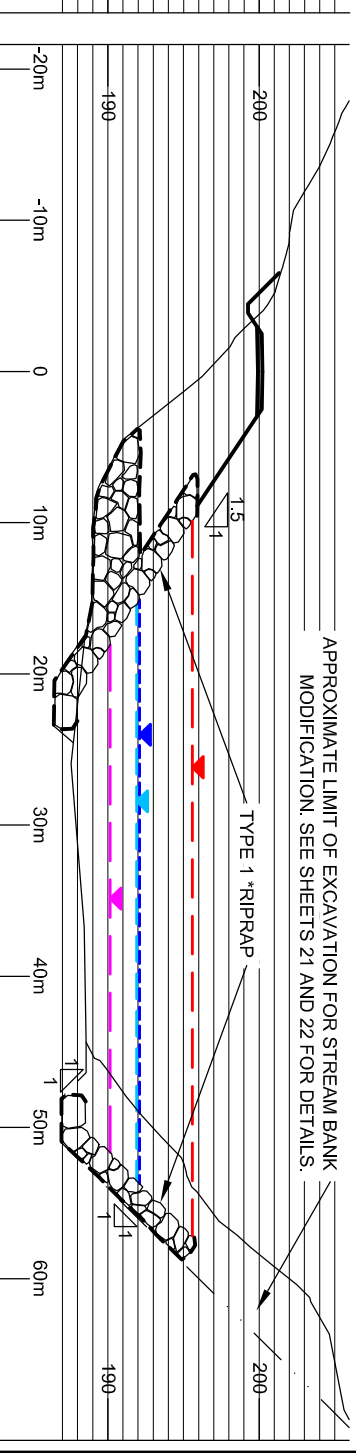
PROPOSED CONDITIONS - SECTION U - 4+700m

SCALE 1:500



EXISTING CONDITIONS - SECTION V - 4+800m

SCALE 1:500



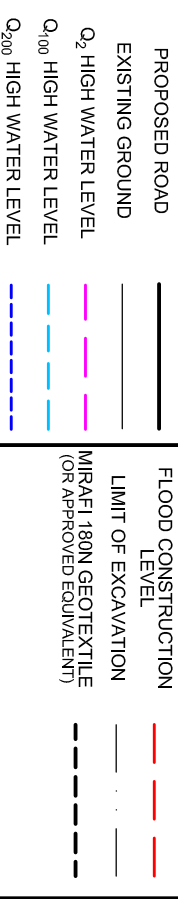
PROPOSED CONDITIONS - SECTION V - 4+800m

SCALE 1:500



ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

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DWG No.: BITTERCREEKHYDROTECH-017

SHEET 17 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH

FILE NAME: BITTERCREEKHYDROTECH.DWG

SCALE: AS NOTED

REVISION DATE:

REVISION NUMBER:

ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

SEAL OF B.C. P.ENG.

**DRAFT**

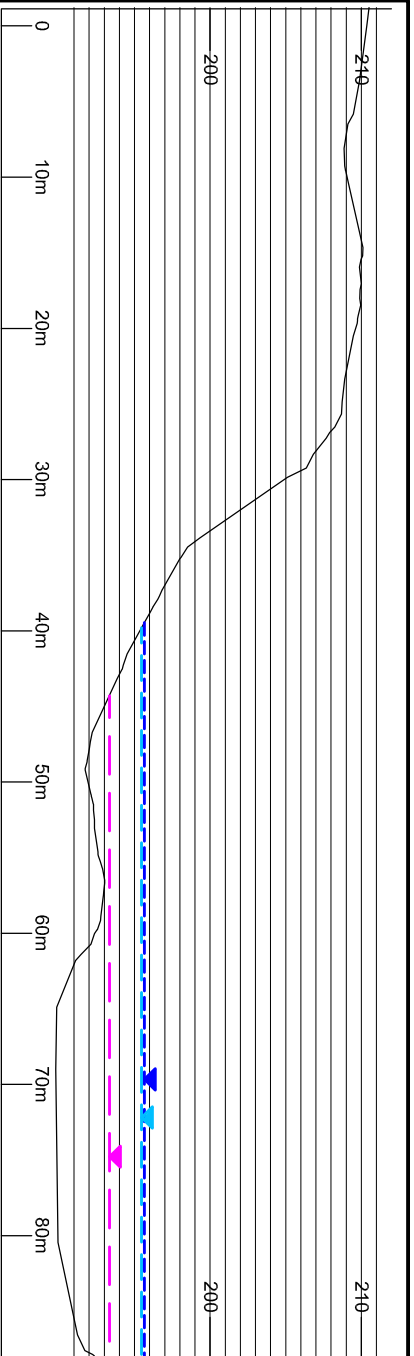
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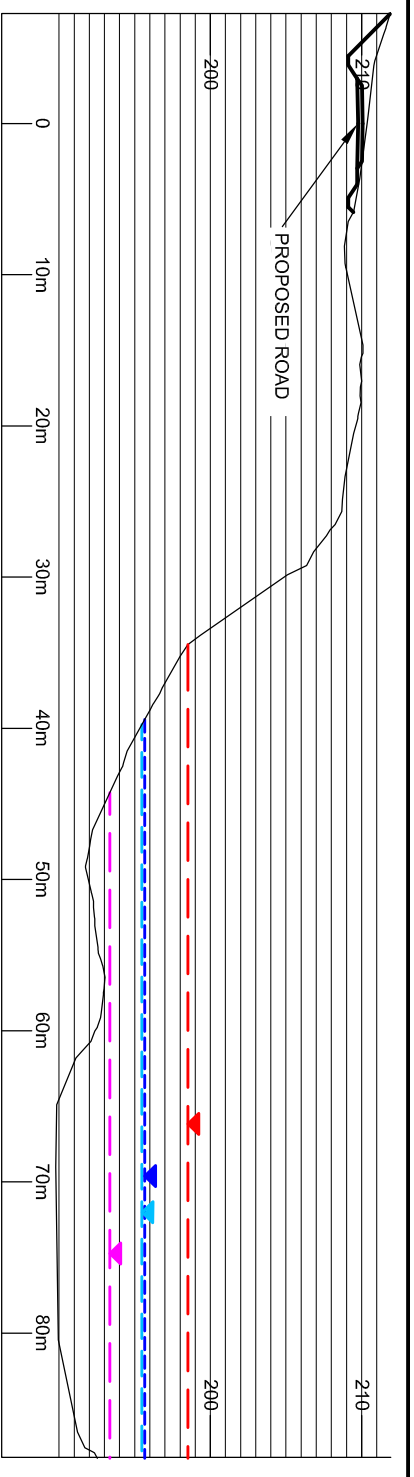
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK

CROSS SECTIONS  
STA 4+600m TO 4+800m



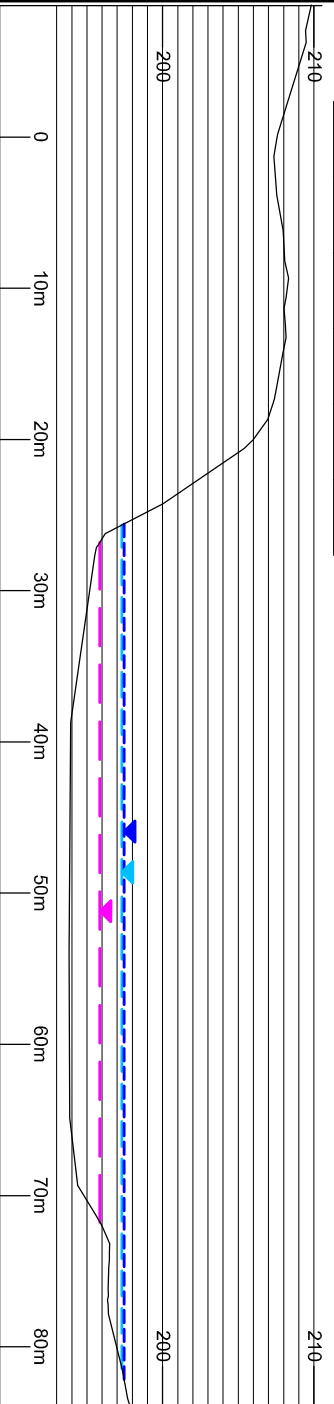
EXISTING CONDITIONS - SECTION W - 4+900m

SCALE 1:500



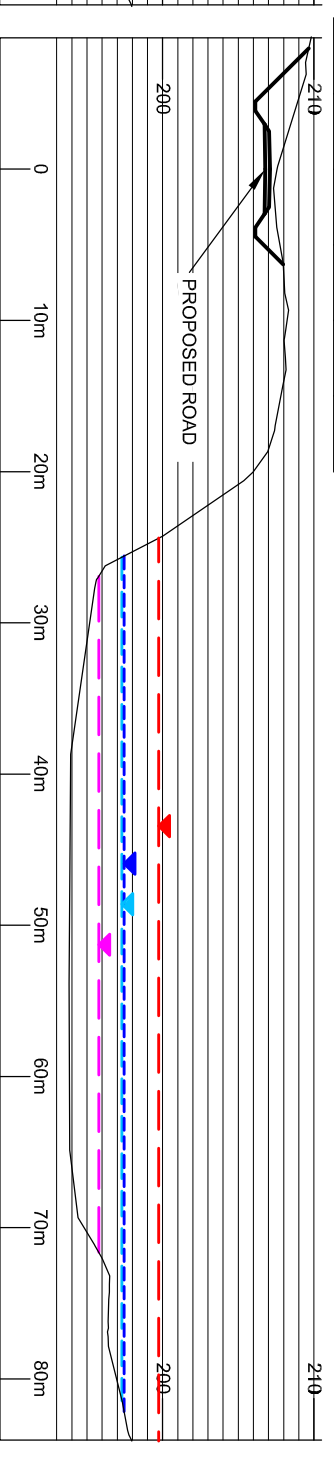
PROPOSED CONDITIONS - SECTION W - 4+900m

SCALE 1:500



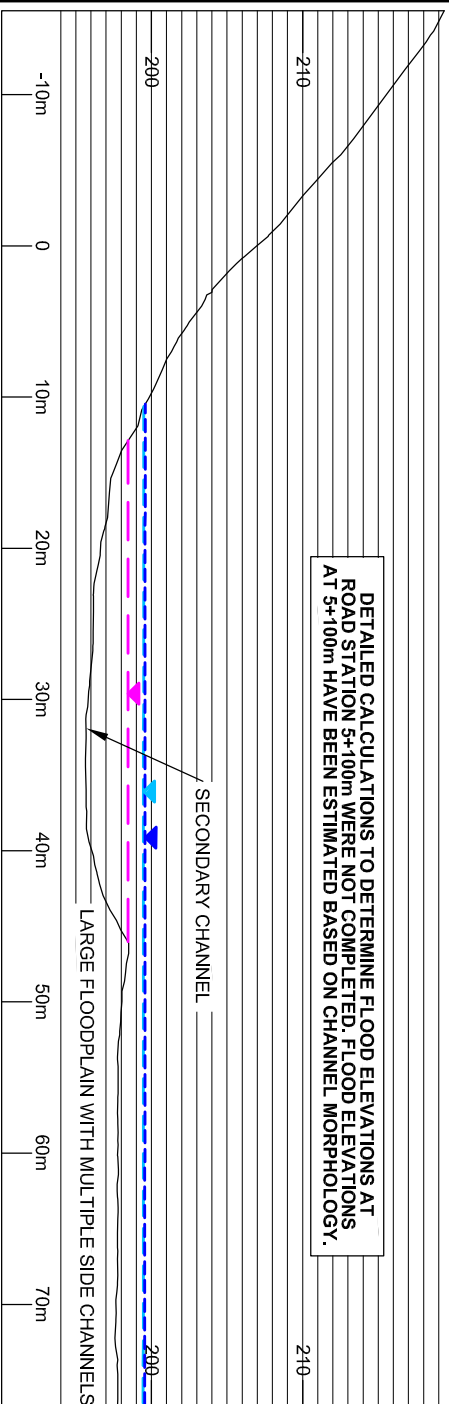
EXISTING CONDITIONS - SECTION X - 5+000m

SCALE 1:500



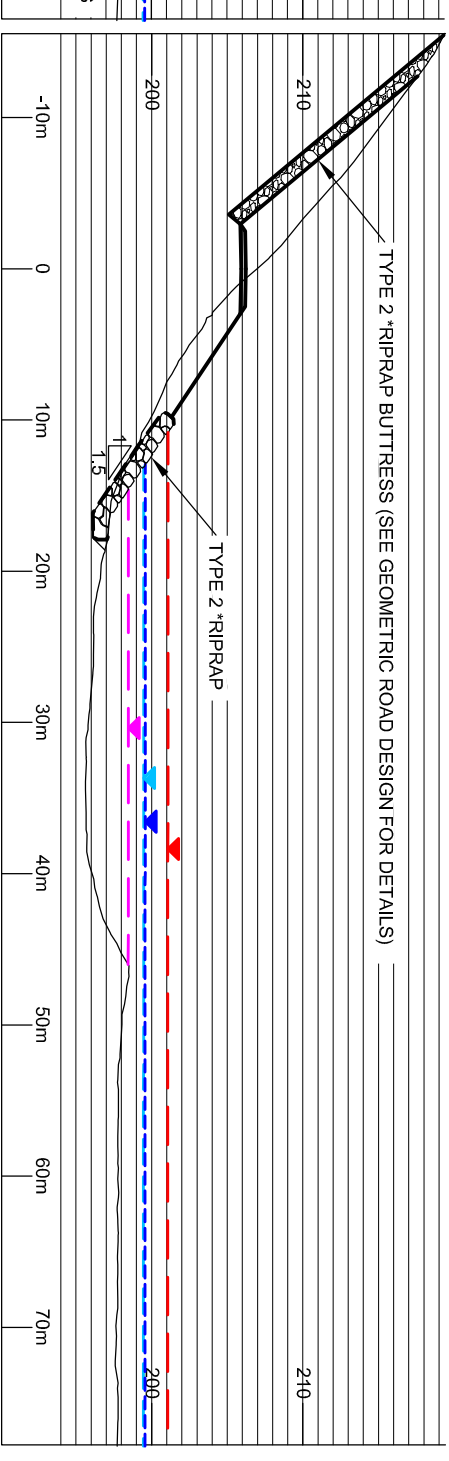
PROPOSED CONDITIONS - SECTION X - 5+000m

SCALE 1:500



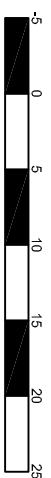
EXISTING CONDITIONS - SECTION Y - 5+100m

SCALE 1:500



PROPOSED CONDITIONS - SECTION Y - 5+100m

SCALE 1:500



DETAILED CALCULATIONS TO DETERMINE FLOOD ELEVATIONS AT ROAD STATION 5+100m WERE NOT COMPLETED. FLOOD ELEVATIONS AT 5+100m HAVE BEEN ESTIMATED BASED ON CHANNEL MORPHOLOGY.

ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

CAUTION:  
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PROPOSED ROAD	—	FLOOD CONSTRUCTION LEVEL	—
EXISTING GROUND	—	LIMIT OF EXCAVATION	—
Q <sub>2</sub> HIGH WATER LEVEL	—	MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	—
Q <sub>100</sub> HIGH WATER LEVEL	—		
Q <sub>200</sub> HIGH WATER LEVEL	—		

DWG No.: BITTERCREEKHYDROTECH-018

SHEET: 18 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.

RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYDROTECH.DWG

SCALE: AS NOTED

REVISION NUMBER:

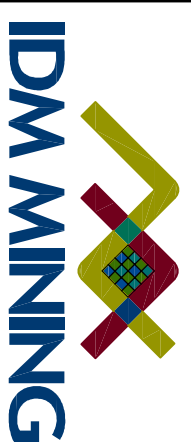
REVISION DATE:

ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

SEAL OF B.C. P.ENG.

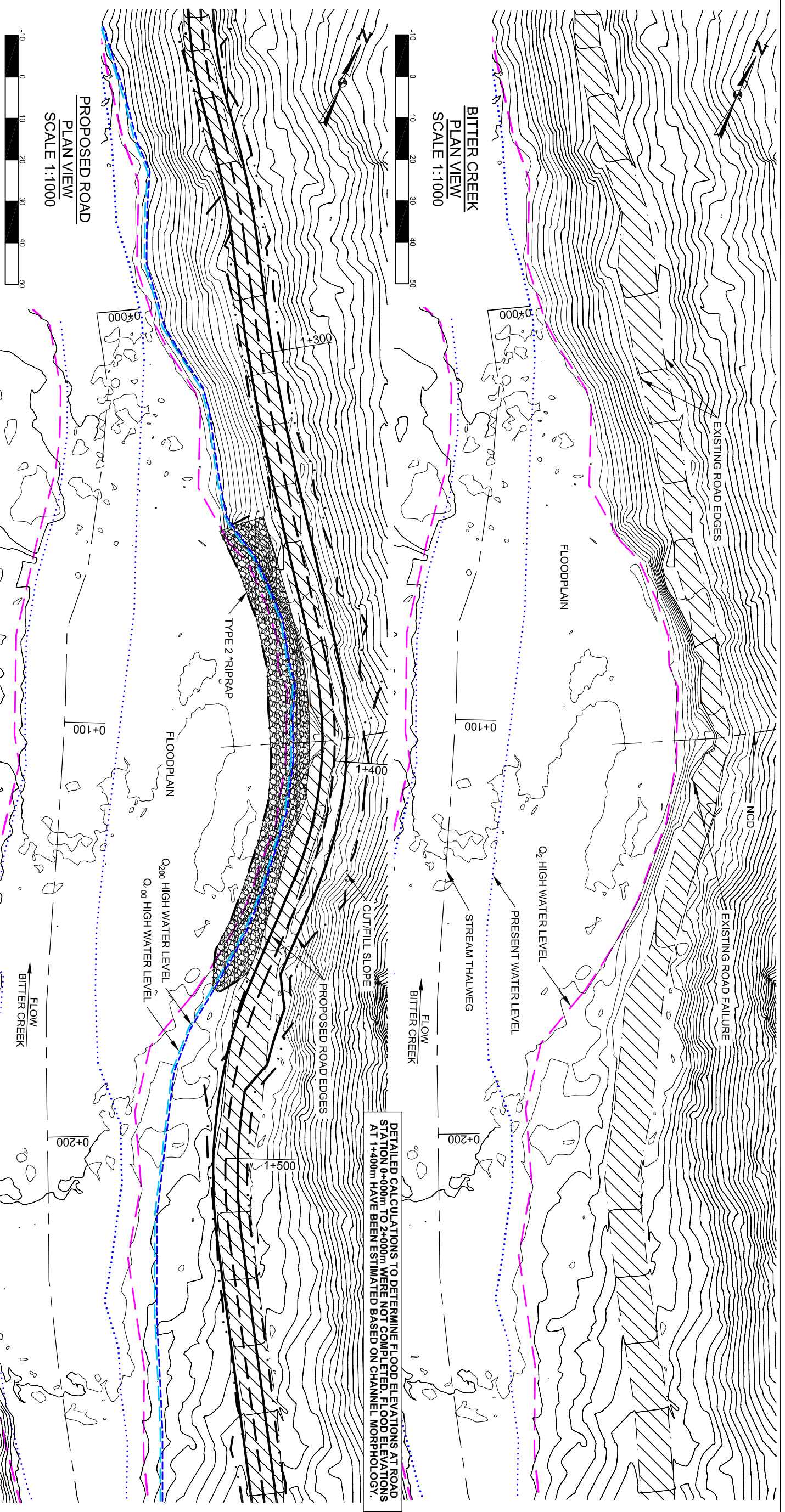
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RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
CROSS SECTIONS  
STA 4+900m TO 5+100m



PROPOSED ROAD EDGE	—————	Q <sub>2</sub> HIGH WATER LEVEL	—————
PROPOSED ROAD CENTRELINE	—————	Q <sub>100</sub> HIGH WATER LEVEL	—————
CUT/FILL SLOPE	—————	Q <sub>200</sub> HIGH WATER LEVEL	—————
EXISTING ROAD EDGE	—————	STREAM THALWEG	—————
PRESENT WATER LEVEL	.....	GRAVEL BAR	.....
SIDE CHANNEL BANK	.....		

DWG No: BITTERCREEKHYDROTECH-019

SHEET 19 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.  
RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH

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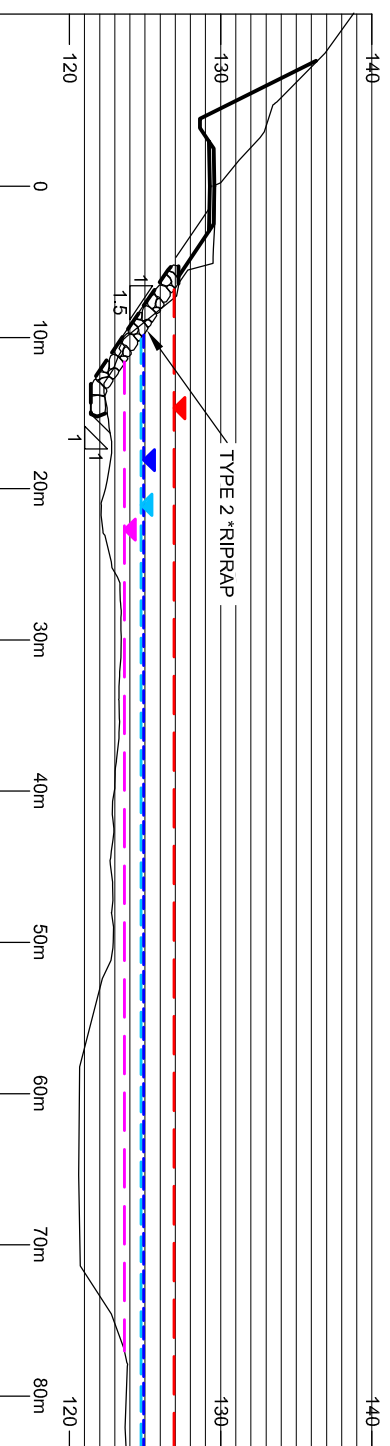
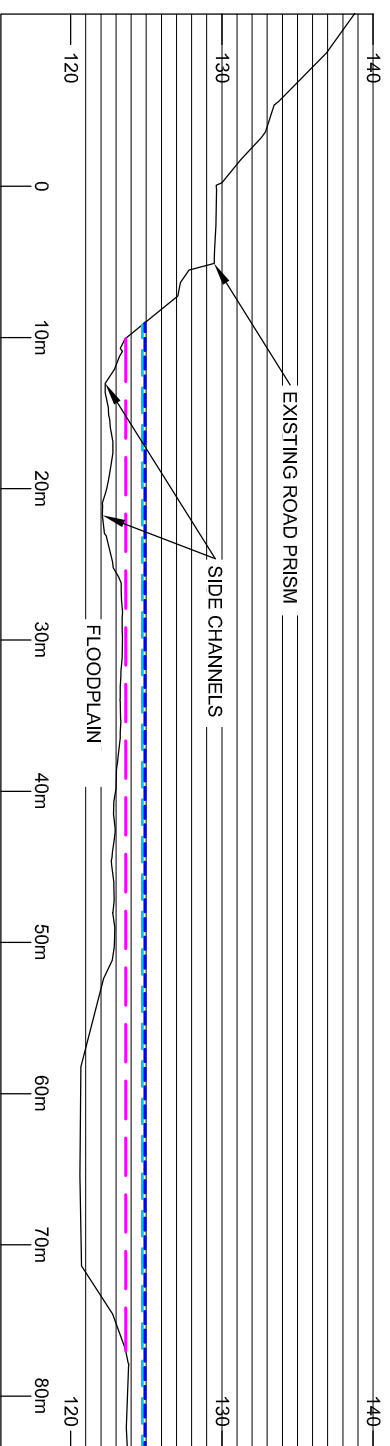
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FILE NAME: BITTERCREEKHYDROTECH.DWG  
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RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
PLAN VIEW OF EXISTING ROAD  
FAILURE AT 1+400m  
STREAM STA 0+000m TO 0+290m



DETAILED CALCULATIONS TO DETERMINE FLOOD ELEVATIONS AT ROAD STATION 1+400m WERE NOT COMPLETED. FLOOD ELEVATIONS AT 1+400m HAVE BEEN ESTIMATED BASED ON CHANNEL MORPHOLOGY.

ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING IN UPSTREAM DIRECTION

PROPOSED ROAD		FLOOD CONSTRUCTION LEVEL	
EXISTING GROUND		LIMIT OF EXCAVATION	
Q <sub>2</sub> HIGH WATER LEVEL		MIRAFI 180N GEOTEXTILE (OR APPROVED EQUIVALENT)	
Q <sub>100</sub> HIGH WATER LEVEL			
Q <sub>200</sub> HIGH WATER LEVEL			

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DWG No.: BITTERCREEKHYDROTECH-020

SHEET 20 OF 22

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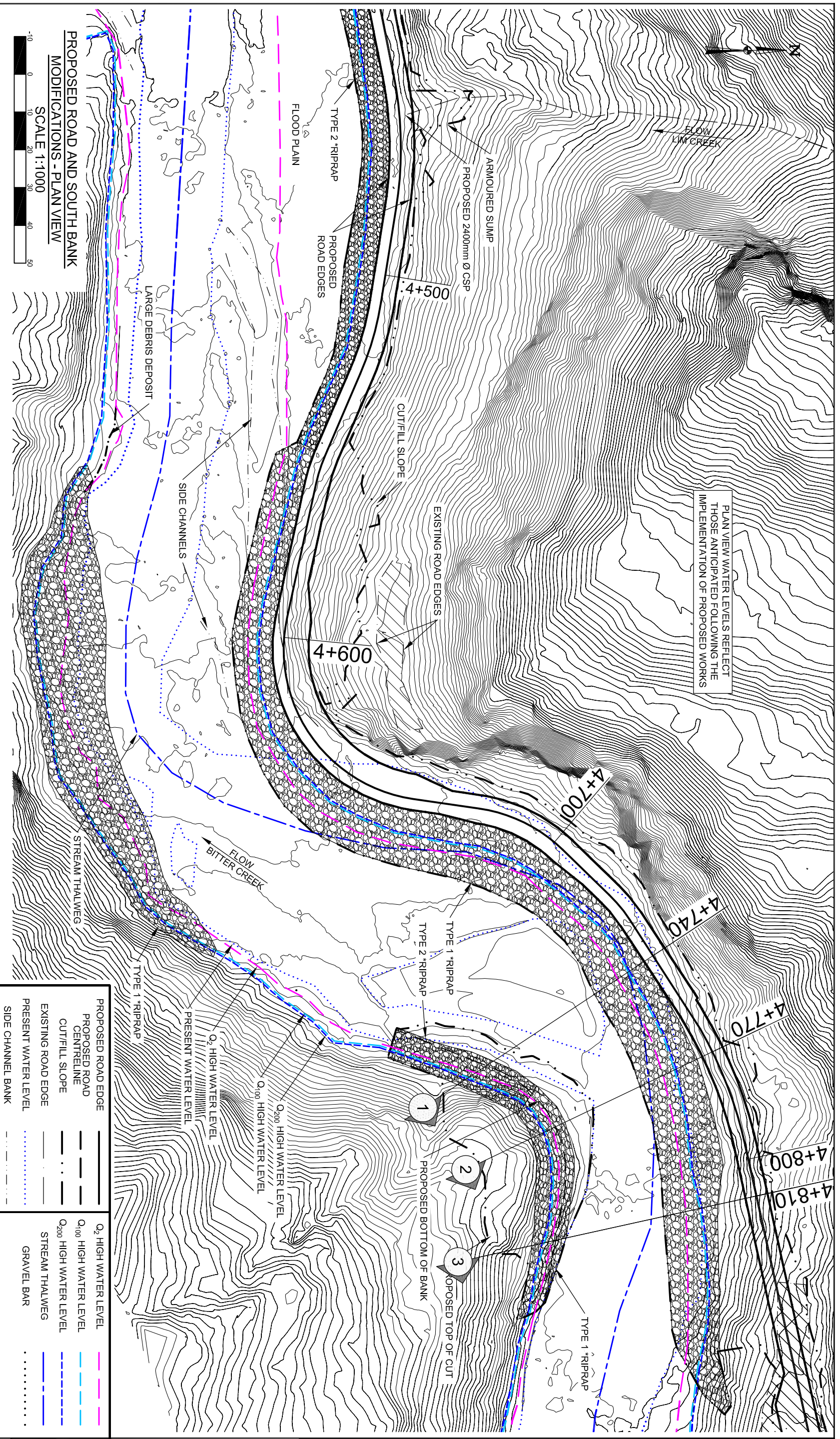
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DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017  
REVIEWED BY: MATT DICKIE, EIT.  
RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH.  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
SCALE: AS NOTED  
REVISION NUMBER:  
REVISION DATE:  
ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
CROSS SECTIONS  
STA 4+900m TO 5+100m

SEAL OF B.C. P.ENG.

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PROPOSED ROAD AND SOUTH BANK  
MODIFICATIONS - PLAN VIEW  
SCALE 1:1000

DWG No.: BITTERCREEKHYDROTECH-021  
SHEET 21 OF 22

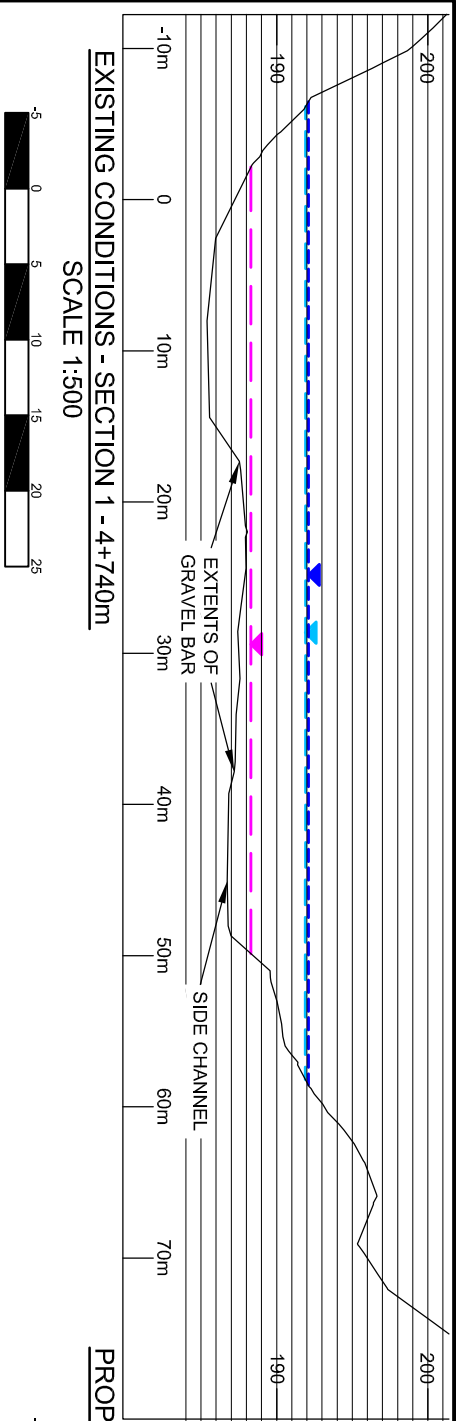
DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017  
REVIEWED BY: MATT DICKIE, ET.  
RW (BOB) ASKIN, P.GEO., P.ENG.  
DRAWN BY: ANDREW BRABANDT, C.TECH  
FILE NAME: BITTERCREEKHYDROTECH.DWG  
SCALE: AS NOTED  
REVISION NUMBER:  
REVISION DATE:  
ALL MEASUREMENTS IN m UNLESS OTHERWISE NOTED.

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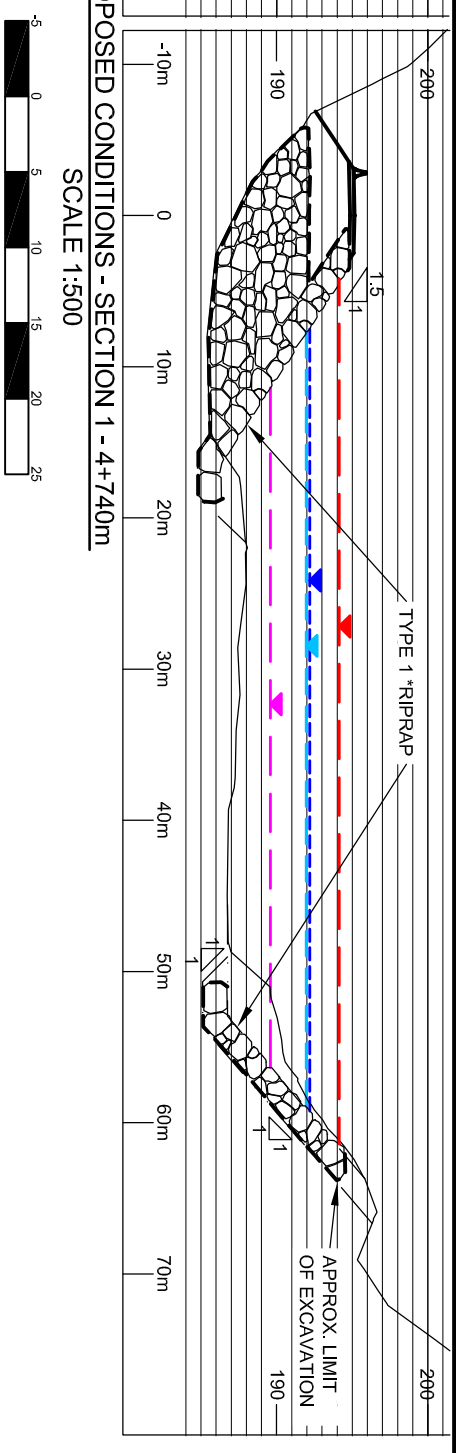
RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
SOUTH BANK  
MODIFICATION PLAN VIEW

SEAL OF B.C. P.ENG.  
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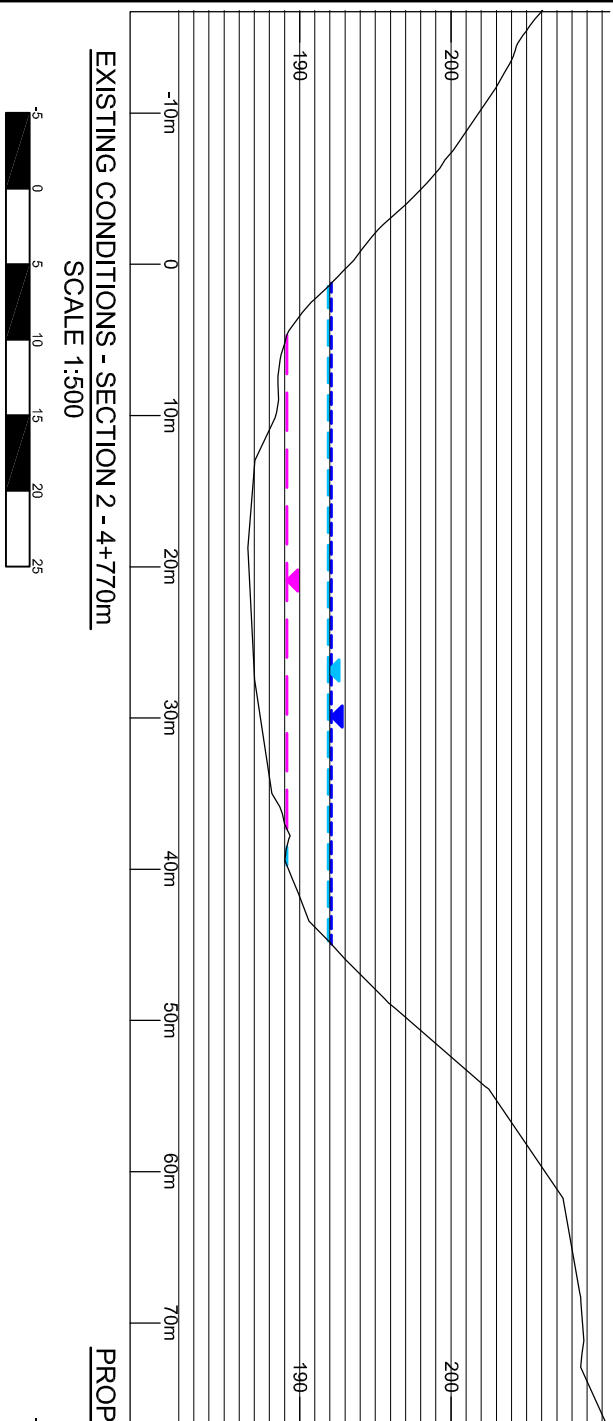
PROPOSED ROAD EDGE	—	Q <sub>2</sub> HIGH WATER LEVEL
PROPOSED ROAD CENTRELINE	—	Q <sub>100</sub> HIGH WATER LEVEL
CUT/FILL SLOPE	—	Q <sub>200</sub> HIGH WATER LEVEL
EXISTING ROAD EDGE	—	STREAM THALWEG
PRESENT WATER LEVEL	—	GRAVEL BAR
SIDE CHANNEL BANK	—	



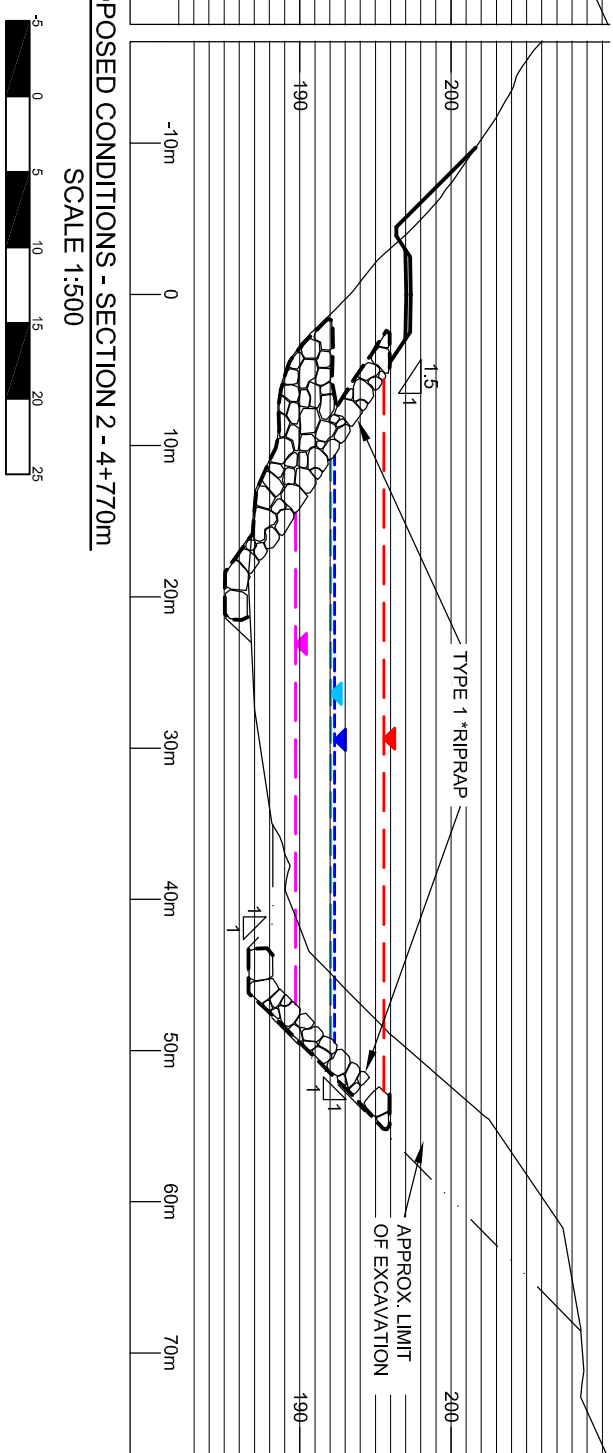
EXISTING CONDITIONS - SECTION 1 - 4+740m  
SCALE 1:500



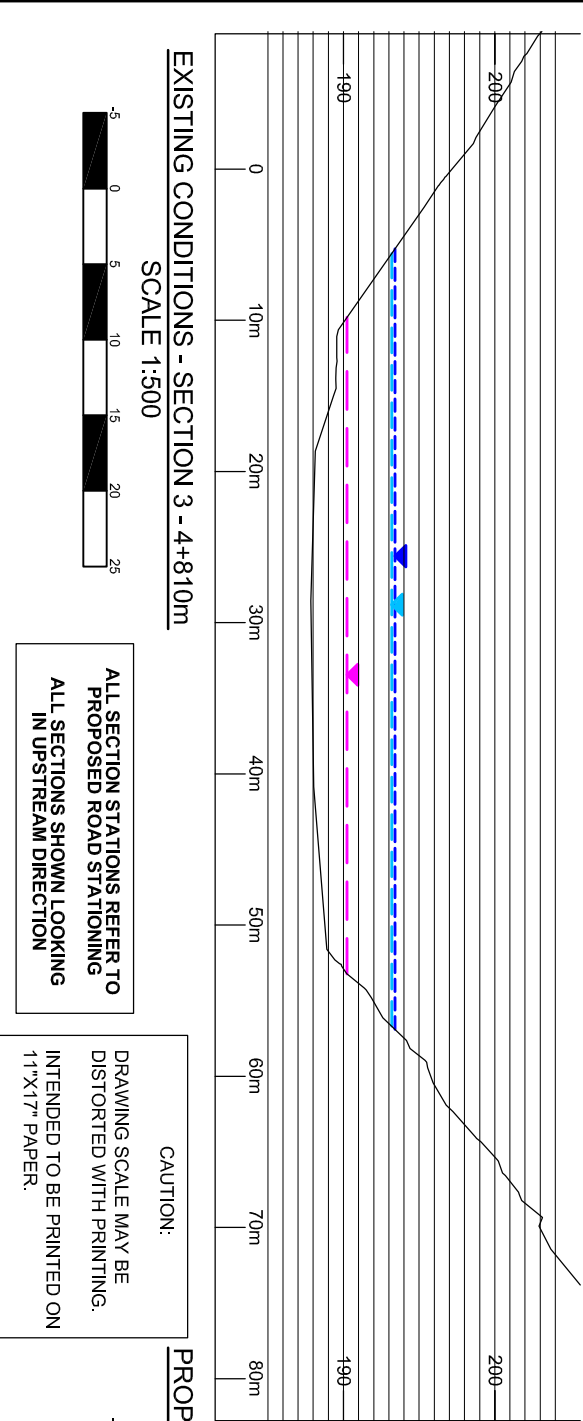
PROPOSED CONDITIONS - SECTION 1 - 4+740m  
SCALE 1:500



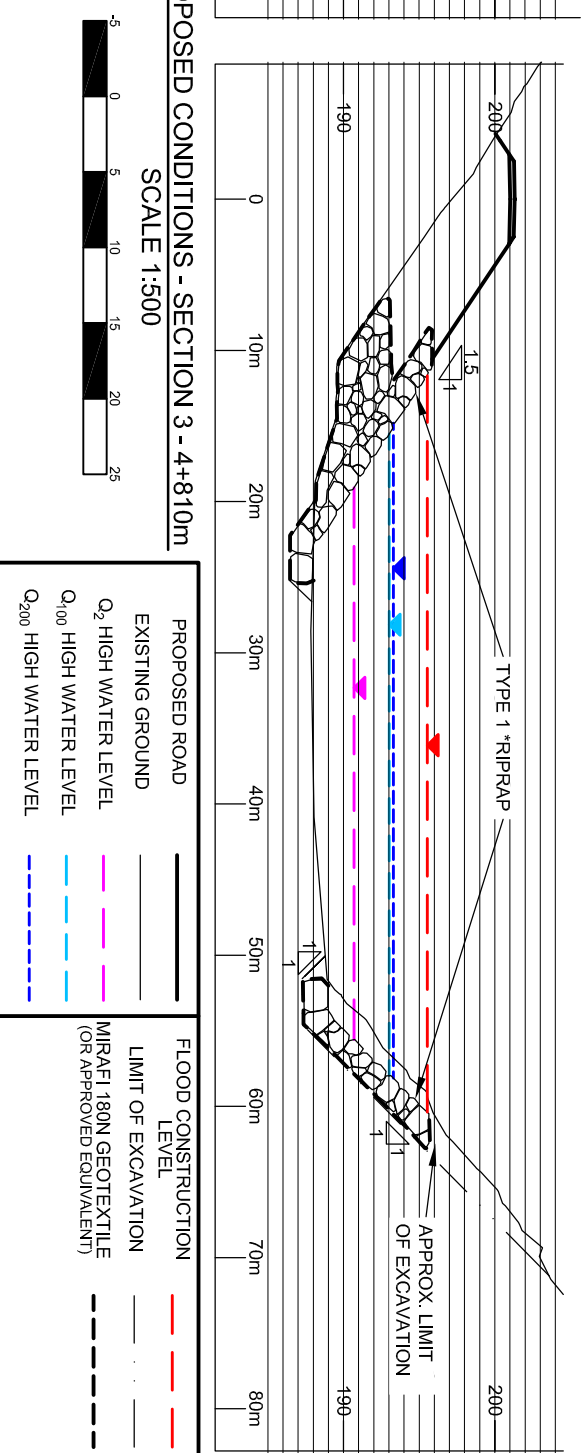
EXISTING CONDITIONS - SECTION 2 - 4+770m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION 2 - 4+770m  
SCALE 1:500



EXISTING CONDITIONS - SECTION 3 - 4+810m  
SCALE 1:500



PROPOSED CONDITIONS - SECTION 3 - 4+810m  
SCALE 1:500

ALL SECTION STATIONS REFER TO PROPOSED ROAD STATIONING  
ALL SECTIONS SHOWN LOOKING IN UPSTREAM DIRECTION

CAUTION:  
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PROPOSED ROAD	—	FLOOD CONSTRUCTION LEVEL	—
EXISTING GROUND	—	LIMIT OF EXCAVATION	—
Q <sub>2</sub> HIGH WATER LEVEL	—	MIRAFI (180N GEOTEXTILE (OR APPROVED EQUIVALENT))	---
Q <sub>100</sub> HIGH WATER LEVEL	—		
Q <sub>200</sub> HIGH WATER LEVEL	—		

DWG No.: BITTERCREEKHYDROTECH-022  
SHEET 22 OF 22

PREPARED FOR:

PREPARED BY:

DESIGN BY: MICHAEL FOSTER, P.ENG.  
DESIGN DATE: OCTOBER 31, 2017

REVIEWED BY: MATT DICKIE, EIT.  
RW (BOB) ASKIN, P.GEO., P.ENG.

DRAWN BY: ANDREW BRABANDT, C.TECH.

FILE NAME: BITTERCREEKHYDROTECH.DWG

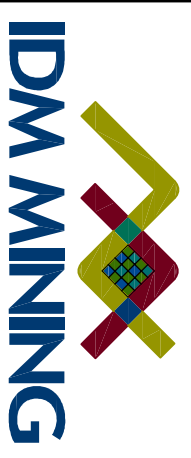
SCALE: AS NOTED

REVISION NUMBER:

REVISION DATE:  
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RED MOUNTAIN ACCESS ROAD  
HYDROTECHNICAL DRAWINGS  
BITTER CREEK  
STREAM MODIFICATION  
CROSS SECTIONS