



## **Columbia River Project Water Use Plan**

**Arrow Lakes Reservoir Wildlife Management Plan**

**Arrow Lakes Wildlife Physical Works**

**Implementation Year 3-4**

**Reference: CLBWORKS-30A**

***Site 15A – Cartier Bay Washout Buttressing Completion Report***

**Study Period: October 17-21, 2016**

**Watson Engineering Ltd.  
Kamloops, BC**

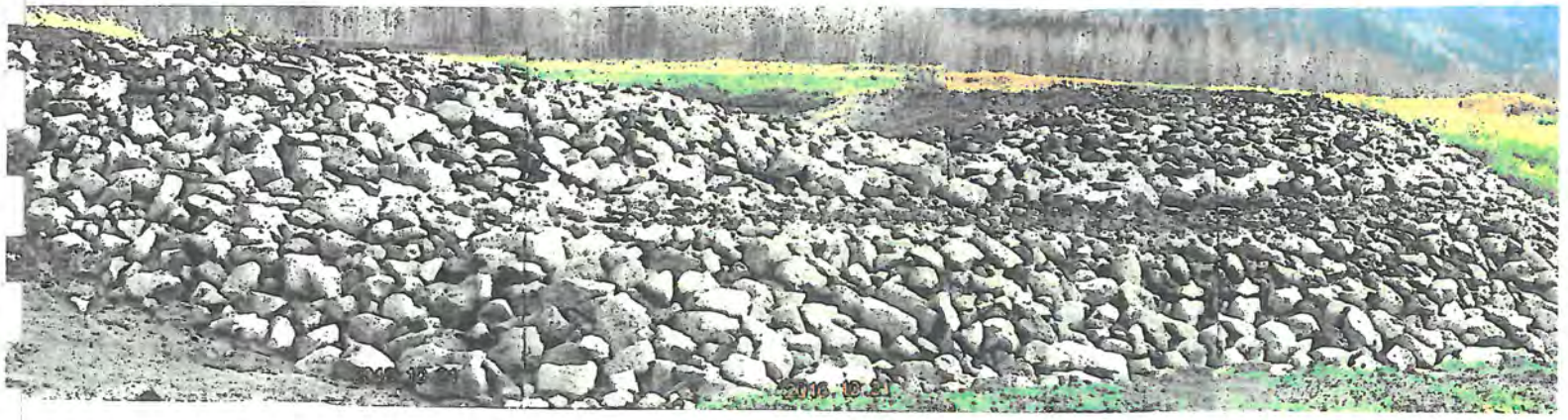
**November 2016**

OFFICE

1564/15A

**COLUMBIA RIVER PROJECT WATER USE PLAN**  
**ARROW LAKES RESERVOIR WILDLIFE PHYSICAL WORKS**  
**SITE 15A - CARTIER BAY WASHOUT BUTTRESSING**

**BRIEF COMPLETION REPORT 2016-11-16**



**Issued: 2016-11-16**

**Prepared by:**

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**COLUMBIA RIVER PROJECT WATER USE PLAN**  
**ARROW LAKES RESERVOIR WILDLIFE PHYSICAL WORKS**  
**SITE 15A - CARTIER BAY WASHOUT BUTTRESSING**

**BRIEF COMPLETION REPORT 2016-11-16**

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2016-11-30

1564/4A

BC Hydro  
6911 Southpoint Drive, 11th Floor  
Burnaby, BC V3N 4X8

Attention: S. Wenaas

**RE: COLUMBIA RIVER PROJECT WATER USE PLAN  
ARROW LAKES RESERVOIR WILDLIFE PHYSICAL WORKS  
SITE 15A - CARTIER BAY WASHOUT BUTTRESSING  
BRIEF COMPLETION REPORT 2016-11-10**

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1. GENERAL

- 1.1 A decision was made by BC Hydro/Columbia Power to implement the construction of a modified Site 15A - Cartier Bay Washout Buttressing in June 2015. The proposed works were to be designed to a much different criteria from what had been envisaged in 2012.
- 1.2 Watson Engineering Ltd., WEL, was retained by BC Hydro/Columbia Power to design the proposed works and supervise the subsequent construction works on 2016-08-10.
- 1.3 Splatsin Construction And Environmental Services LLP was retained by BC Hydro/Columbia Power to carry out the construction work on 2016-04-14.
- 1.4 WEL recommended the Site be re-surveyed so as to take into account any possible changes in the area since being previously surveyed in 2012 and because of modified project criteria and this was done on 2015-08-21. Only minor changes outside survey error were noted.
- 1.5 An initial design with Plan and Profile, Site Specific Specifications, Schedule of Quantities and proposed Contract Document were sent to BC Hydro/Columbia Power on 2015-08-26 as there was some discussion about doing the work in late 2015, which did not happen. Minor modifications were made to the Drawings and Specifications during the next ten months, principally to please the Provincial Ministry of Forests, Lands, Natural Resources and Others. The last necessary Provincial approval was received on 2016-08-10. The Federal Navigable Water Protection approval was obtained on 2016-03-10.



1.6 The rip-rap, filter blanket and granular materials were all obtained from Jake and Jay's Quarry/Pit. The rip-rap had previously been confirmed non-acid rock drainage susceptible.

1.7 Please see Appendix M, "Copy Of BC Hydro Mapping Showing Location Of Site 15A" and marked up to show Access Route.

## 2. CONSTRUCTION

2.1 A decision was made by BC Hydro/Columbia Power to construct the work in the fall of 2016 when the reservoir level was down sufficiently to do the work in the daytime. The access track across the flood plain from Airport Way Road/the Provincial Highway to the rail embankment and washout was examined by the Contractor's Project Manager, and Site Superintendent, the WEL Inspector and the undersigned on 2016-10-06. The consensus was that it would not be reasonably practical to have dump trucks try and carry rip-rap, filter blanket and granular materials to the job site without considerable improvement to the track which BC Hydro/Columbia Power did not want to do as the intent was not to improve public access to the wetlands. A decision was made to haul the rip-rap, filter blanket and granular materials by dump truck to a dump site about two thirds of the way from Airport Way Road/the Provincial Highway to the railway embankment and then transport the materials by tracked dumper to the site after temporarily installing wood mats in the poorest sections of the remaining distance to the railway embankment and washout.

2.2 A Pre-Construction Coordination Meeting was held with all the Contractors' field crew, BC Hydro/Columbia Power and WEL staff in a BC Hydro office in Revelstoke on the morning of 2016-10-17. Construction in the field commenced immediately after the meeting.

2.3 Construction of the Buttressing commenced on 2016-10-17 and continued with ten hour days until actual construction completion last thing on 2016-10-21. Clean up around the Site, the truck dump stockpile area, the access road and removal of the temporary wood mats from the access road was carried out on the morning and early afternoon of 2016-10-22.

2.4 Construction of the Buttressing was quite simple as follows:

2.4.1 The rip-rap, filter blankets and granular materials were hauled from the Jack & Jay's Quarry to the dump/stockpile site by dump truck.

2.4.2 The tracked dumper then hauled the materials to the job site and dumped them there.

2.4.3 The Buttressing was commenced by an excavator picking up the filter blanket materials and placing them on the embankment lake/river side outside the washout, trimmed them to shape and bucket packed them up to elevation 433.5 m.

2.4.4 The excavator then picked up rip-rap materials, faced the filter blanket materials, trimmed them to shape and bucket packed them up to elevation 433.5 m.

- 2.4.5 The excavator then picked up more filter blanket materials and placed them, trimmed them to shape and bucket packed them up to the embankment and washout top.
- 2.4.6 The excavator then picked up rip-rap materials and then faced the filter blanket materials, trimmed them to shape and bucket packed them up to the embankment and washout top.
- 2.4.7 The excavator then picked up the granular materials and spread it out thinly along the embankment top and packed it.
- 2.4.8 Please see Appendix N, "Photographs".

3. COSTS

3.1 Costs for Construction and Engineering are as follows:

- 3.1.1 Splatsin Construction And Environmental Services LLP = \$131,141.11.
- 3.1.2 Watson Engineering Ltd. = \$35,768.25.
- 3.1.3 BC Hydro/Columbia Power = Unknown.

4. CLOSURE

4.1 We consider the job well done.

Please call the undersigned should you have any questions on the above.

Yours truly,  
WATSON ENGINEERING LTD.

  
John C.N. Watson, P. Eng.

/jgb

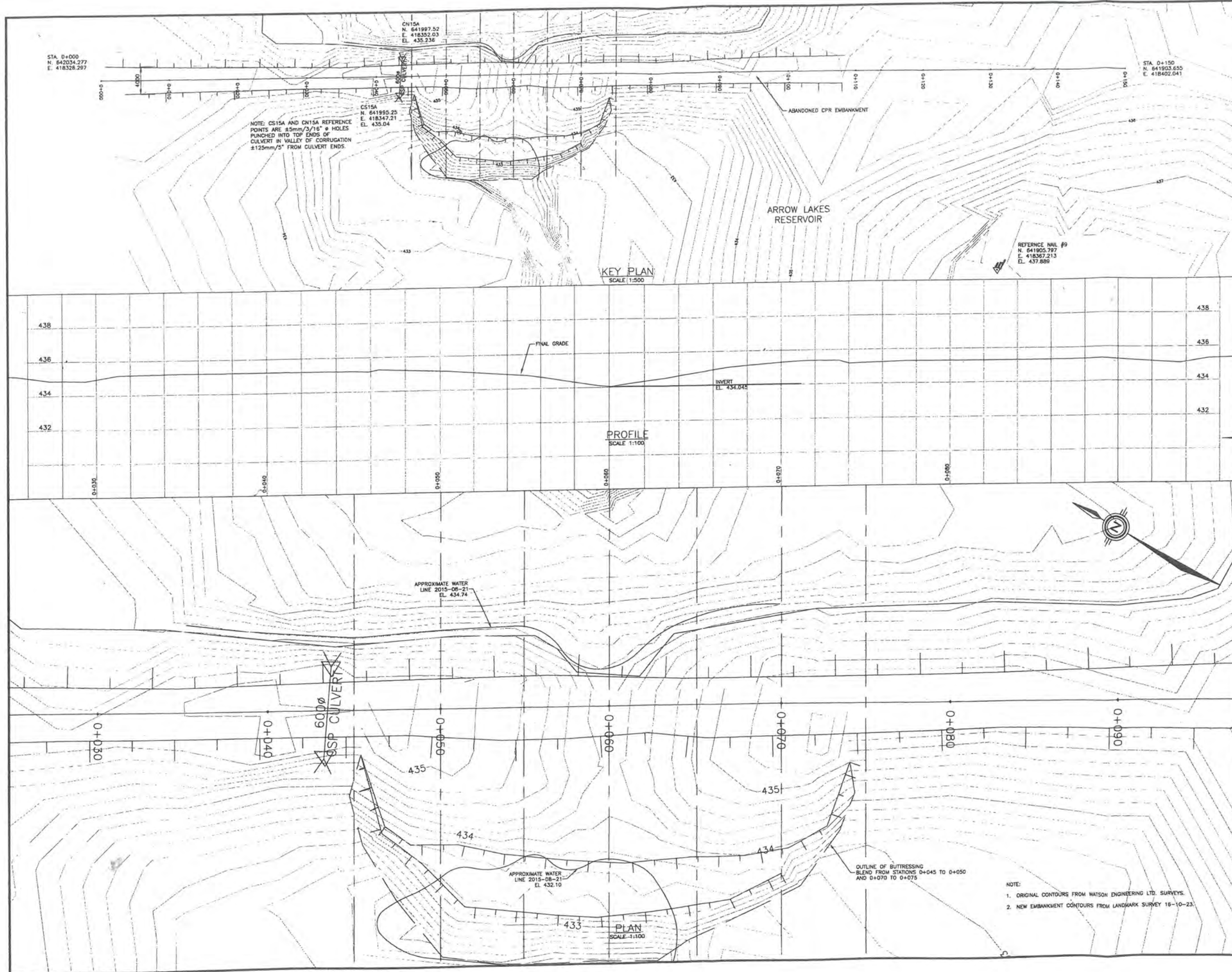
Encl.

**COLUMBIA RIVER PROJECT WATER USE PLAN**  
**ARROW LAKES RESERVOIR WILDLIFE PHYSICAL WORKS**  
**SITE 15A - CARTIER BAY WASHOUT BUTTRESSING**

**BRIEF COMPLETION REPORT 2016-11-16**

**APPENDIX L**  
**DRAWING #1564-11A - PLAN/PROFILE**  
**DRAWING #1564-12C - SECTION 0+040 TO 0+075**





REFERENCE DWGS




REDUCED  
PLOTTED 0.47 x NOTED SCALE

RECORD DRAWING		BY JW
NO.	DATE	DESCRIPTION
REVISIONS & ISSUES		
DESIGN	JCHW	DATE: 15/08/25
DRAWN	BF	DATE: 15/08/25
CHECK		
APPR BY		
CONSULT.		
DATE:		
APPR BY		
CITY		
DATE:		

SCALE:  
HOR: AS SHOWN  
VER:

Watson Engineering Ltd.  
CONSULTING ENGINEERS  
KAMLOOPS, BC

BRITISH COLUMBIA  
POWER AND HYDRO  
AUTHORITY

COLUMBIA RIVER  
PROJECT  
WATER USE PLAN  
  
ARROW LAKES  
RESERVOIR WILDLIFE  
PHYSICAL WORKS  
  
SITE 15A - CARTIER BAY  
WASHOUT BUTTRESSING  
  
PLANS/PROFILE

SHEET	OF
DWG. NO.	REV.
1564-11	A

- NOTE:
1. ORIGINAL CONTOURS FROM WATSON ENGINEERING LTD. SURVEYS.
  2. NEW EMBANKMENT CONTOURS FROM LANDMARK SURVEY 16-10-23.



15.00 10.00 5.00 C 5.00 10.00 15.00 15.00 10.00 5.00 C 5.00 10.00 15.00

CONSTRUCTION ITEM QUANTITY TABLE						
DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE	AMOUNT		
ORIGINAL CONTRACT	PROVISIONAL CONTRACT SUM	PCS	1	\$0.00	\$0.00	
	MOBILIZATION	LS	1	\$7,952.71	\$7,952.71	
	IMPROVING ACCESS TO SITE	LS	1	\$8,772.77	\$8,772.77	
	SUPPLY AND INSTALLATION OF TEMPORARY TURNAROUND AND STOCKPILE AREA	LS	1	\$12,881.15	\$12,881.15	
	REMOVAL OF TEMPORARY TURNAROUND AND STOCKPILE AREA	LS	1	\$11,921.06	\$11,921.06	
	SUPPLY AND INSTALLATION OF FILTER BLANKET AND RIP-RAP BUTTRESSING	m <sup>3</sup>	300	\$232.35	\$69,705.07	
						SUBTOTAL \$111,232.76
INCREMENTAL ITEMS	GRAVEL AND CRUSHED GRANULAR MATERIAL *			\$1,200.00		
	TRACK DUMPER MOBILIZATION			\$2,120.00		
	TRACK DUMPER LABOUR			\$2,100.00		
	TRACK DUMPER RENTAL			\$5,200.00		
	SUPPLY AND INSTALLATION OF FILTER BLANKET AND RIP-RAP BUTTRESSING	m <sup>3</sup>	9	\$232.35	\$2,091.15	
						SUBTOTAL \$12,711.15
	* SPREAD ON EMBANKMENT TOP TO RESTORE SURFACE					TOTAL VALUE \$123,943.91



REDUCED  
PLOTTED 0.47 x NOTED SCALE

NO.	DATE	DESCRIPTION	BY	APPROV.
D	13/04/24	CONSTRUCTION ITEM QUANTITY TABLE ADDED	BF	JW
C	13/04/24	RECORD DRAWING	BF	JW
B	13/04/24	COARSE FILTER BLANKET ADDED	BF	JW
A	13/04/24	GENERAL REVISIONS	BF	JW

REVISIONS & ISSUES	
DESIGN	JCNW
DATE	13/04/24
DRAWN	BF
DATE	13/04/24
CHECK	
DATE	
APPROV BY CONSULT.	
DATE	
APPROV BY CITY	
DATE	

SCALE:  
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VER:

**Watson Engineering Ltd.**  
CONSULTING ENGINEERS  
KAMLOOPS, BC

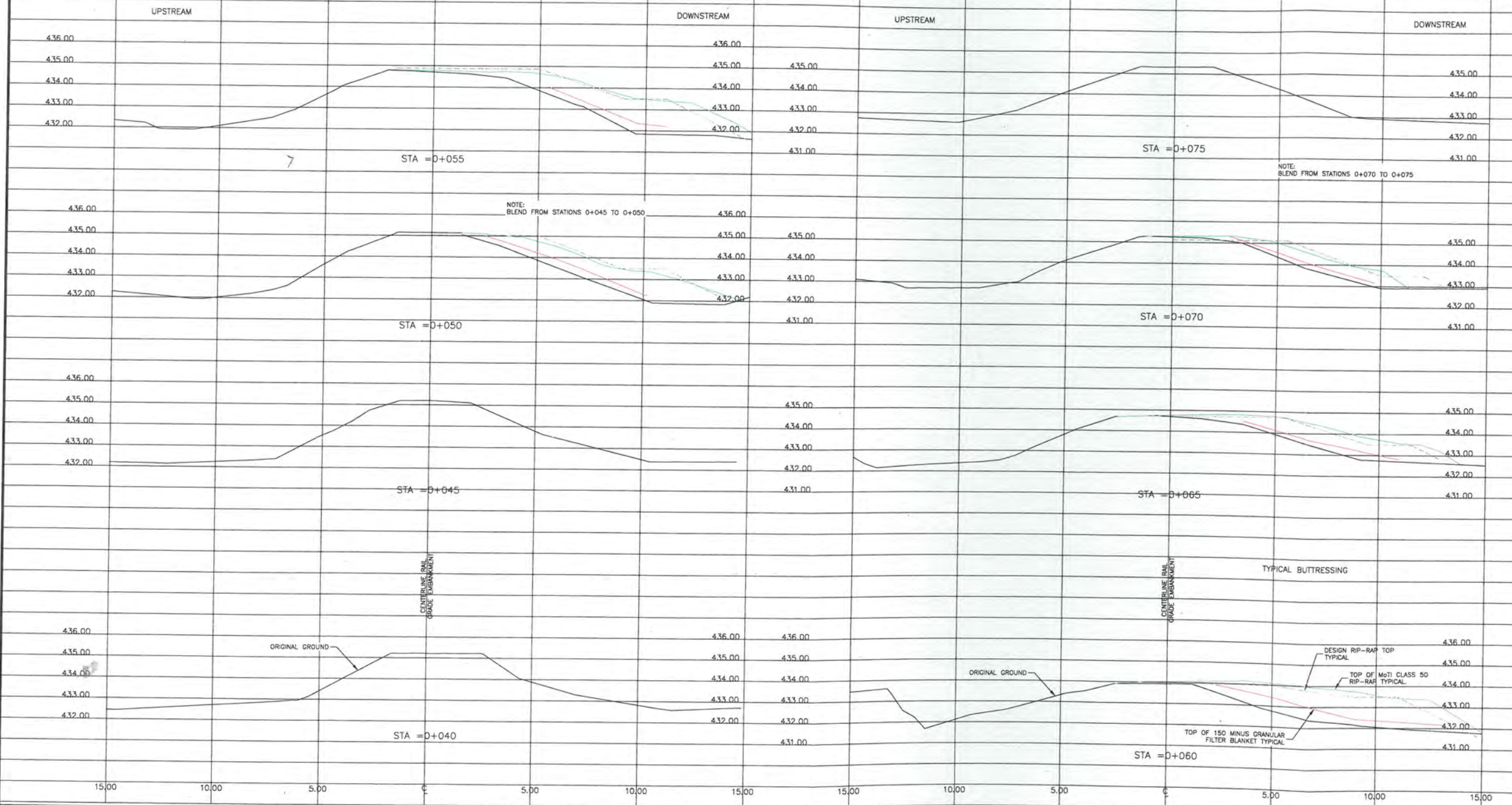
**BRITISH COLUMBIA  
HYDRO AND POWER  
AUTHORITY**

COLUMBIA RIVER  
PROJECT  
WATER USE PLAN

ARROW LAKES  
RESERVOIR WILDLIFE  
PHYSICAL WORKS

SITE 15A - CARTIER BAY  
WASHOUT BUTTRESSING  
SECTIONS  
STA. 0+040 TO 0+075

SHEET	OF
DWG. NO.	REV.
1564-12	D



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**COLUMBIA RIVER PROJECT WATER USE PLAN**  
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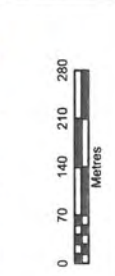
**APPENDIX M**

**COPY OF BC HYDRO MAPPING**  
**SHOWING LOCATION OF SITE 15A**





PROJECT		BC HYDRO
TITLE		CBLWORKS 30 ARROW LAKES WILDLIFE PHYSICAL WORKS PERMITTING REQUIREMENTS
PROJECT No.		11-162-0078
DESIGN No.		13-JA-11
DESIGN No.		13-JA-11
CHECK		REVIEW
SCALE		1:7,000
DATE		2013-11-11
DRAWN BY		WATSON ENGINEERING
CHECKED BY		WATSON ENGINEERING
REVIEWED BY		WATSON ENGINEERING



- ACCESS TRACK FROM AIRPORT WAY ROAD
- REFERENCE
- Base mapping and airphotos provided by BC Hydro.

- Legend**
- 10m Index Contour
  - 1m Contour
  - Waterbodies
  - Roads
  - Feature Captured by Digitized Linework
  - Feature Captured by GPS Traverse
  - Test Pits
  - Trimble GPS Points
  - Proposed Water Control Points
- Property Ownership**
- Municipal
  - Private



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**APPENDIX N**  
**PHOTOGRAPHS**

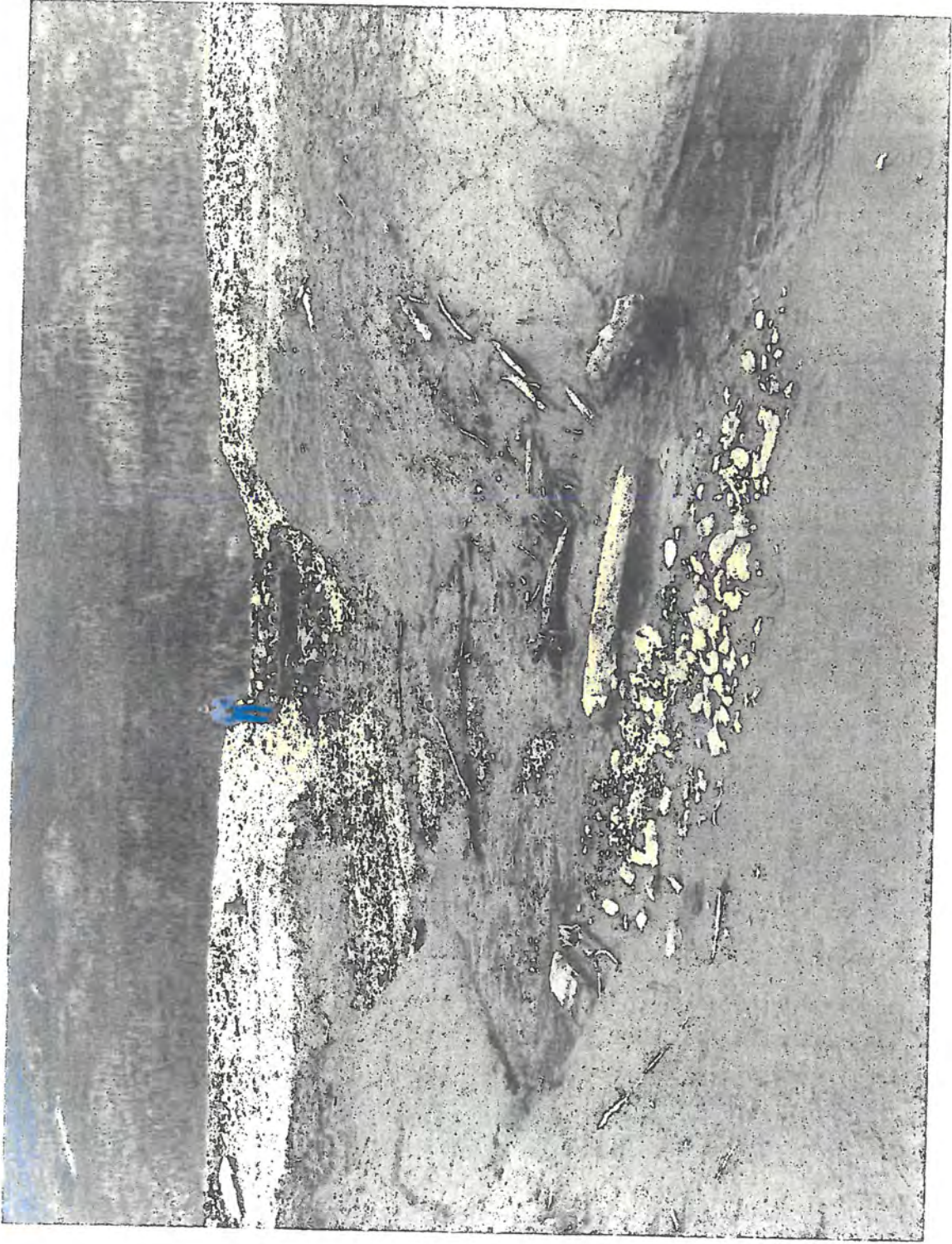
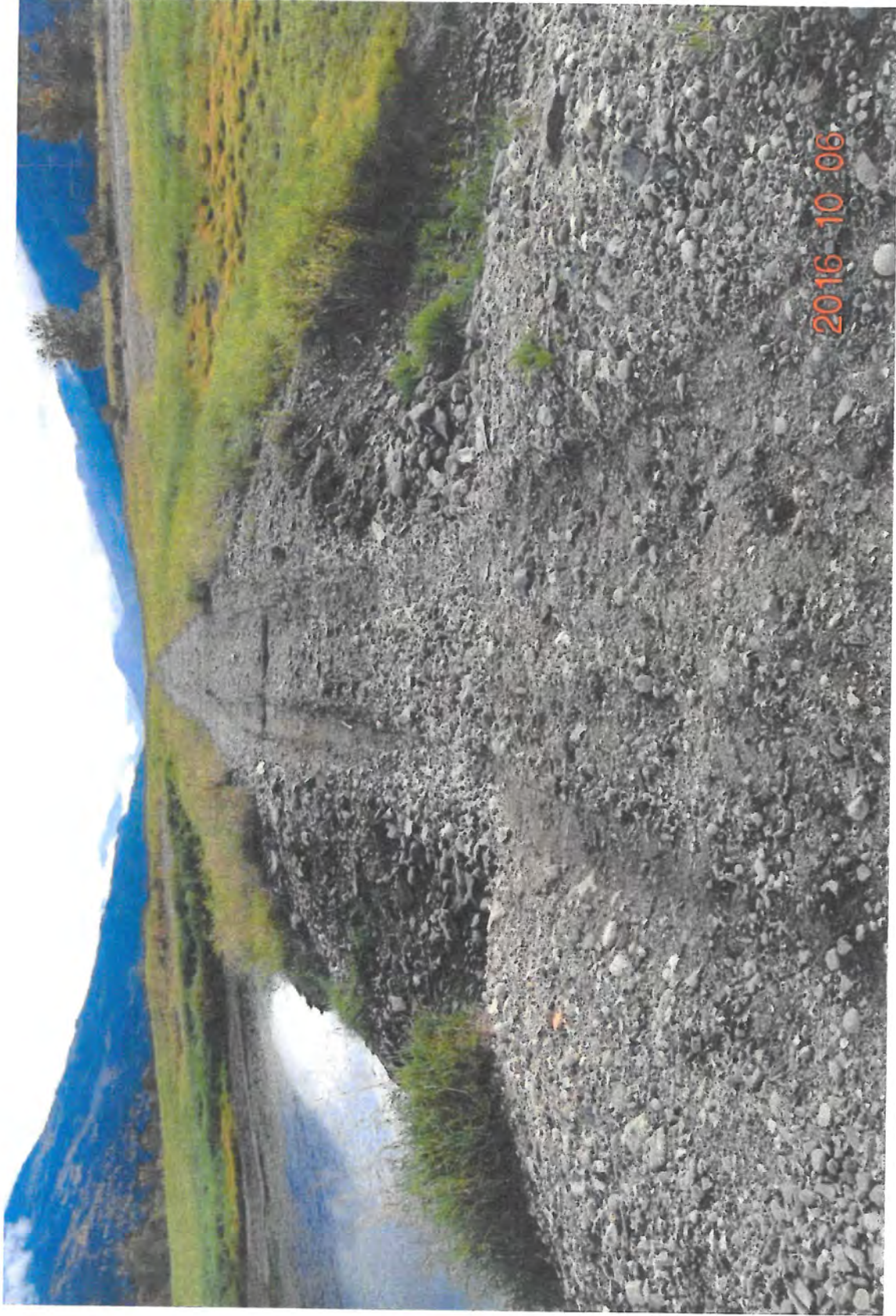


PHOTO #1 WASHOUT FROM LAKE SIDE





**PHOTO #2      WASHOUT FROM EMBANKMENT LOOKING SOUTH BEFORE BUTTRESSING**





PHOTO #3 WASHOUT FROM EMBANKMENT LOOKING NORTH BEFORE BUTTRESSING





**PHOTO #4 WOOD MATS LAID AT TRUCK DUMP  
AREA FOR RIP-RAP, FILTER BLANKET & GRAVEL**





PHOTO #5 START OF FILTER BLANKET  
STOCKPILE AT TRUCK DUMP





PHOTO #6 START OF GRAVEL STOCKPILE AT  
TRUCK DUMP





PHOTO #7 START OF RIP-RAP STOCKPILE AT TRUCK DUMP





**PHOTO #8 START OF PLACING FILTER  
BLANKET**





**PHOTO #9 START OF PLACING RIP-RAP**





PHOTO #10 TRIMMING AND PACKING UP  
TO ELEVATION 433.5 M





PHOTO #11 COMPLETED BUTTRESSING  
FROM LAKE SIDE AND SOUTH OF CHANNEL



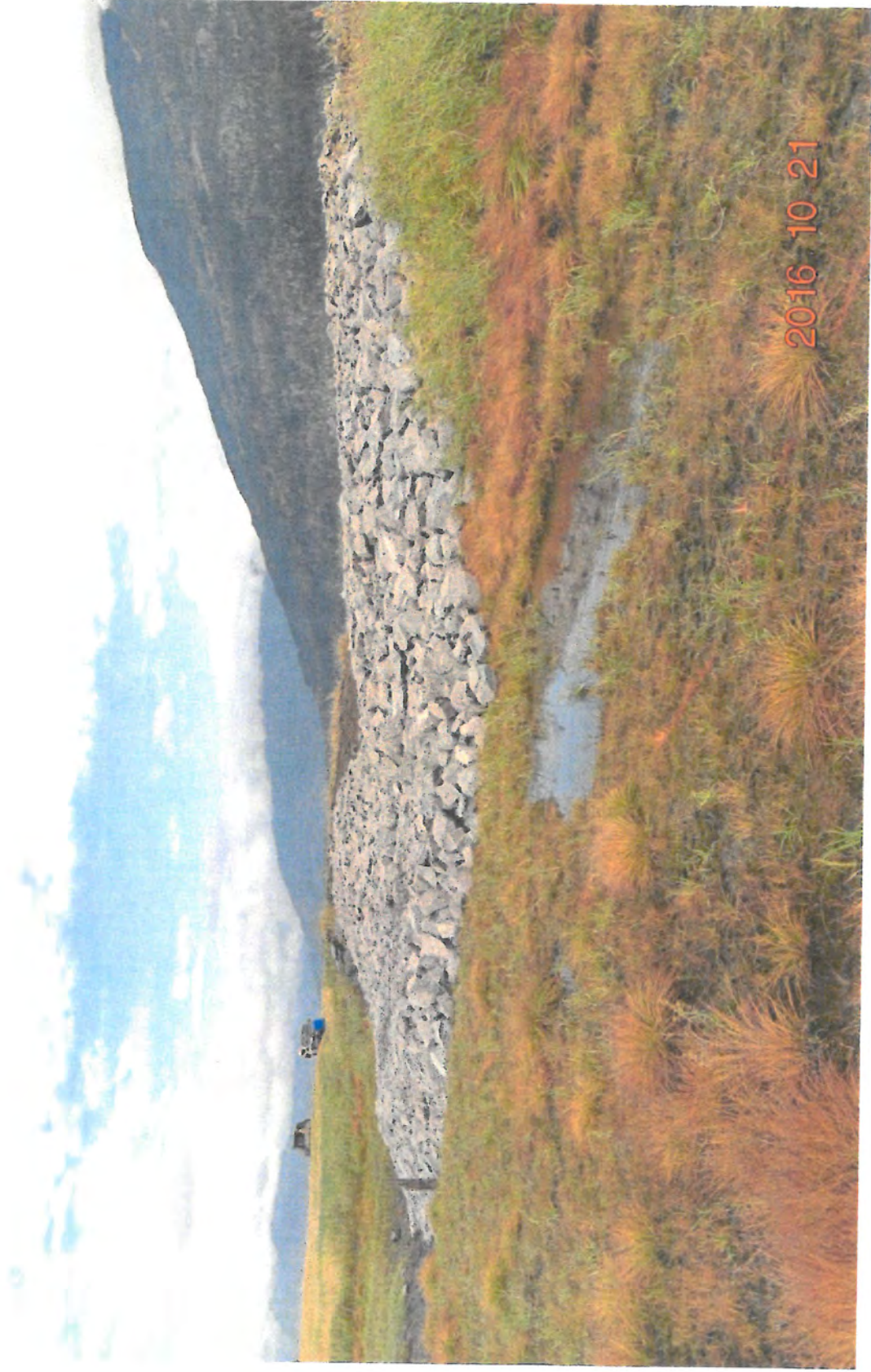
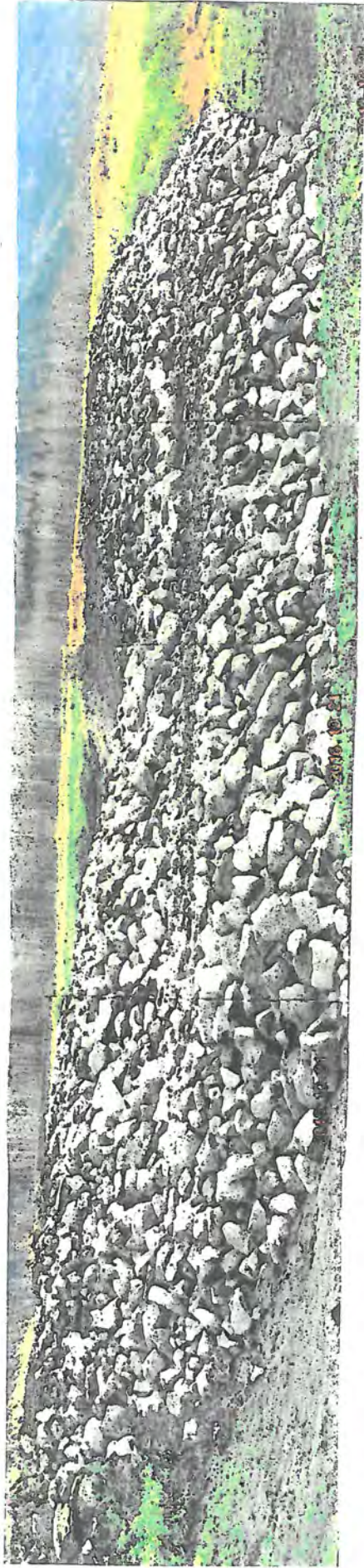


PHOTO #12 COMPLETED BUTTRESSING FROM LAKE SIDE AND NORTH OF CHANNEL LOOKING NORTH



**PHOTO #13 COMPLETED BUTTRESSING  
FROM LAKESIDE AND NORTH OF CHANNEL**





PHOTO #14 COMPLETED BUTTRESSING FROM LAKE SIDE AND NORTH OF CHANNEL LOOKING SOUTH



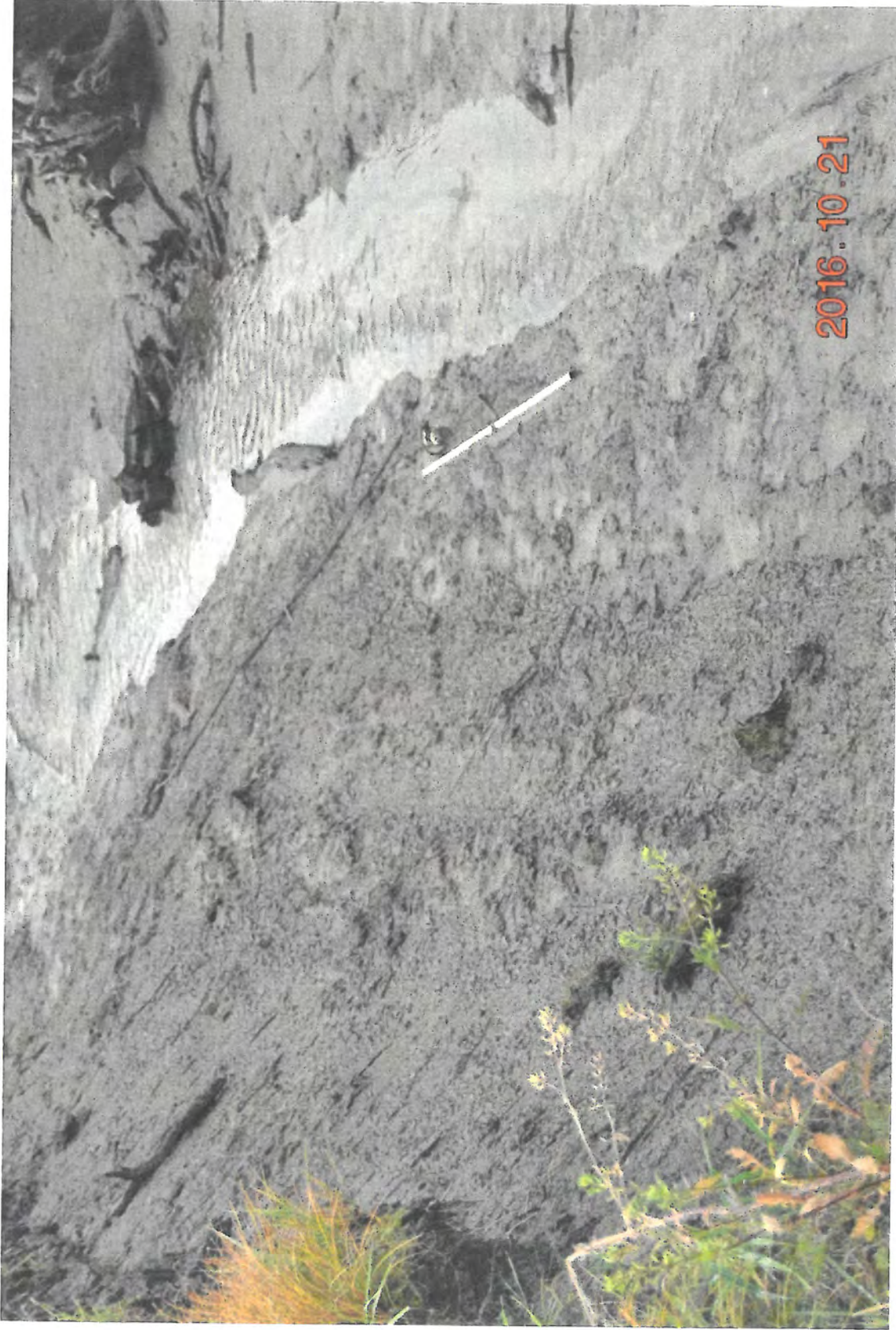


PHOTO #15 PHANTOM CABLE AND DUCT IN CHANNEL





2016.10.21

PHOTO #16 PHANTOM ANCHOR AND CABLE IN CHANNEL