

RAMP

**Regional Aquatics
Monitoring Program**



2011 TECHNICAL REPORT

APPENDICES



REGIONAL AQUATICS MONITORING PROGRAM

2011 Technical Report – Appendices

FINAL

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LIST OF APPENDICES

- Appendix A Estimating Area of Land Change for the RAMP Focus Study Area
- Appendix B Quality Assurance and Quality Control Procedures for 2011
- Appendix C Climate and Hydrology Component
- Appendix D Water Quality Component
- Appendix E Benthic Invertebrate Communities and Sediment Quality Component
- Appendix F Fish Populations Component
- Appendix G Acid-Sensitive Lakes Component

TABLE OF CONTENTS

LIST OF TABLES	iv
LIST OF FIGURES.....	vii
A ESTIMATING AREA OF LAND CHANGE FOR THE RAMP FOCUS STUDY AREA.....	A-1
A.1 INTRODUCTION.....	A-1
A.2 METHODOLOGY.....	A-1
A.2.1 Satellite Imagery Acquisition.....	A-1
A.2.2 Ortho-Rectification of Image Data	A-1
A.2.3 Atmospheric Correction	A-3
A.2.4 Classification of Land Change.....	A-3
A.3 RESULTS.....	A-3
B QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES FOR 2011.....	B-1
B.1 QUALITY ASSURANCE PROCEDURES.....	B-1
B.1.1 Field Staff Training	B-1
B.1.2 Field Operations	B-2
B.1.3 Laboratory Analyses	B-3
B.1.4 Data Management	B-3
B.1.5 Sample Management	B-4
B.1.6 RAMP Quality Assurance Plan	B-4
B.2 QUALITY CONTROL PROCEDURES.....	B-5
B.2.1 Climate and Hydrology Component.....	B-5
B.2.2 Water Quality Component	B-6
B.2.3 Benthic Invertebrate Communities Component.....	B-33
B.2.4 Sediment Quality Component.....	B-34
B.2.5 Fish Populations Component	B-44
B.2.6 Acid-Sensitive Lakes Component.....	B-46
C CLIMATE AND HYDROLOGY COMPONENT	C-1
C.1 2011 CLIMATE AND HYDROLOGY STATIONS.....	C-1
C.2 CLIMATE DATA COLLECTED IN THE 2011 WATER YEAR	C-3
C.2.1 RAMP Climate Data.....	C-3
C.2.2 Climate Data from Government Agencies	C-16
C.3 HYDROMETRIC DATA COLLECTED IN THE 2011 WY	C-19
C.3.1 RAMP Hydrometric Data	C-19
C.3.2 Hydrometric Data from Focal Projects.....	C-24
C.3.3 Hydrometric Data from Government Agencies	C-24
C.3.4 2011 WY Hydrographs in Historical Context.....	C-26
C.3.5 Stage-Discharge Rating Curves	C-48
C.4 NATURALIZED FLOW CALCULATION.....	C-68
C.4.1 Introduction.....	C-68
C.4.2 Rationale	C-68
C.4.3 Water Balance Procedure.....	C-70
C.4.4 Previously Published Estimates	C-70

C.5	UPDATED STATION DESCRIPTION SHEETS	C-71
C.6	INVENTORY OF CLIMATE AND HYDROLOGIC DATA IN THE RAMP DATABASE	C-119
C.7	STATION VISIT RECORDS AND MANUAL MEASUREMENTS.....	C-126
C.8	2011 WATER YEAR NATURALIZED FLOW CALCULATION RESULTS	C-406
D	WATER QUALITY COMPONENT	D-1
D.1	ANALYTICAL CHEMISTRY METHODS	D-1
D.2	CALCULATED DETECTION LIMITS FOR WATERBORNE PAHS.....	D-5
E	BENTHIC INVERTEBRATE COMMUNITIES AND SEDIMENT QUALITY COMPONENT	E-1
E.1	BENTHIC INVERTEBRATE COMMUNITIES	E-1
E.1.1	Benthic Invertebrate Sample Processing Procedures	E-1
E.1.2	Calculating <i>Baseline</i> Ranges.....	E-3
E.2	SEDIMENT QUALITY COMPONENT	E-6
E.2.1	Analytical Methods	E-6
E.2.2	Predicted PAH Toxicity.....	E-7
F	FISH POPULATIONS COMPONENT	F-1
F.1	COMMON AND SCIENTIFIC NAMES FOR FISH SPECIES CAPTURED IN THE 2011 FISH POPULATIONS COMPONENT	F-1
F.2	EXTERNAL HEALTH ASSESSMENT INDEX CODES FOR FISH EXAMINATION.....	F-2
G	ACID-SENSITIVE LAKES COMPONENT	G-1
G.1	RUNOFF CALCULATIONS FOR EACH RAMP LAKE	G-1
G.2	TEST OF THE ASSUMPTION THAT CURRENT BASE CATIONS ARE SIMILAR TO HISTORIC BASE CATIONS IN THE RAMP LAKES	G-4
G.3	ORIGIN OF THE USE OF $ANC_{LIM} = 75 \mu\text{EQ/L}$ IN THE CRITICAL LOAD CALCULATIONS	G-6
G.4	COMPARISON OF RAMP LAKE CHEMISTRY IN 2011 TO REGIONAL LAKES	G-7
G.5	CHARACTERIZATION OF ION CHEMISTRY IN THE RAMP LAKES.....	G-11
G.6	ANALYSIS OF METALS IN THE RAMP LAKES.....	G-13

LIST OF TABLES

Table A.3-1	Area of watersheds with land change as of 2011, summarized by land change type.	A-4
Table A.3-2	Percent of total area of watershed with land change as of 2011, summarized by type of land change.	A-5
Table B.2-1	Results of analysis of field blanks prepared during RAMP water quality surveys in winter, spring, summer and fall, 2011.	B-10
Table B.2-2	Results of analysis of trip blanks prepared during RAMP water quality surveys in winter, spring, summer and fall, 2011.	B-14
Table B.2-3	Relative percent difference between duplicate water quality samples collected from the Athabasca River (ATR-DD-E), winter 2011.	B-18
Table B.2-4	Relative percent difference between duplicate water quality samples collected from the Athabasca River (ATR-DC-E), summer 2011.	B-21
Table B.2-5	Relative percent difference between duplicate water quality samples collected from the MacKay River (MAR-2), fall 2011.	B-25
Table B.2-6	Relative percent difference between duplicate water quality samples collected from the Beaver River (BER-2), fall 2011.	B-29
Table B.2-7	Results of quality control checks on sorting efficiency of RAMP benthic invertebrate samples, 2011.	B-34
Table B.2-8	Relative percent difference between duplicate and split sediment quality samples, lower Muskeg River (MUR-D3), September 2011.	B-37
Table B.2-9	Relative percent difference between duplicate and split sediment quality samples, lower Ells River (ELR-D1), September 2011.	B-39
Table B.2-10	Concentration of metals in the rinsate blank taken from sediment sampling equipment, September 2011.	B-41
Table B.2-11	Concentration of PAHs in the rinsate blank taken from sediment sampling equipment, September 2011.	B-43
Table B.2-12	Relative percent difference between duplicate mercury fish tissue samples collected from the Athabasca River, fall 2011.	B-45
Table B.2-13	Relative percent difference between duplicate water quality samples collected for conventional variables from three RAMP lakes sampled in 2011.	B-48

Table B.2-14	Percent bias between measured and theoretical values for laboratory reference standards.....	B-49
Table C.1-1	RAMP climate, hydrometric and snowcourse stations monitored in 2011.....	C-1
Table C.2-1	Data collected at the RAMP Aurora Climate Station (C1), 2011.....	C-3
Table C.2-2	Summary of monthly climate data collected at the RAMP Aurora Climate Station (C1) during the 2011 WY.....	C-4
Table C.2-3	Data collected at the RAMP Horizon Climate Station (C2), 2011.....	C-5
Table C.2-4	Summary of monthly climate data collected at the RAMP Horizon Climate Station (C2) during the 2011 WY.....	C-6
Table C.2-5	Data collected at the RAMP Steepbank Climate Station (C3), 2011.....	C-7
Table C.2-6	Summary of monthly climate data collected at the RAMP Steepbank Climate Station (C3) during the 2011 WY.....	C-8
Table C.2-7	Data collected at the RAMP Pierre Climate Station (C4), 2011.....	C-9
Table C.2-8	Summary of monthly climate data collected at the RAMP Pierre Climate Station (C4) during the 2011 WY.....	C-10
Table C.2-9	Climate data collected at other RAMP stations, 2011.....	C-11
Table C.2-10	Summary of climate data collected at RAMP stations at McClelland Lake (L1) and Kearn Lake (L2) during the 2011 WY.....	C-12
Table C.2-11	Summary of total rainfall and atmospheric pressure data collected at other RAMP stations during the 2011 WY.....	C-13
Table C.2-12	Summary of the RAMP snow course surveys organized by land cover type, winter 2011.....	C-17
Table C.2-13	Summary of the RAMP snow course surveys organized by region, winter 2011.....	C-18
Table C.3-1	Summary of RAMP hydrometric monitoring during the 2011 WY.....	C-21
Table C.3-2	Suspended sediment data collected at RAMP hydrometric stations during the 2011 WY.....	C-23
Table C.3-3	Hydrometric information for 2011 WY received from oil sands operators and incorporated into the water balance analyses.....	C-25
Table C.4-1	Area of each watershed that was cleared or hydrologically closed-circuited, 2011.....	C-69
Table C.6-1	Inventory of climate and hydrologic data collected by RAMP.....	C-120

Table D.1-1	Analytical methods, method detection limits, and Variable Method Values (VMV codes) for water quality variables measured by analytical laboratories for RAMP in 2011.....	D-1
Table D.2-1	Original reporting limits versus blank-corrected detection limits for individual PAH species/homologues, RAMP 2011 data.	D-6
Table E.1-1	Level of taxonomic identification.	E-3
Table E.2-1	Analytical methods, method detection limits, and Variable Method Values (VMV codes) for sediment quality variables measured by analytical laboratories for RAMP in 2011.....	E-9
Table F.1-1	Common and scientific names for fish species captured during Fish Populations component activities, 2011.....	F-1
Table F.2-1	External and internal health assessment codes for fish examinations.....	F-2
Table F.2-2	Codes for the location of external fish abnormalities.	F-5
Table G.1-1	Water Yields to the RAMP lakes, 2002 to 2011 ¹	G-2
Table G.1-2	Runoff to the RAMP lakes, 2002 to 2011.....	G-3
Table G.2-1	Comparison of the calculated BC_o to the current BC_T in the RAMP lakes.	G-5
Table G.4-1	Comparison between RAMP lakes in 2011 and 450 regional lakes in the NSMWG database.....	G-8
Table G.5-1	Key chemical characteristics of RAMP lakes having greater than 40% of anion charge attributable to sulphate and chloride.....	G-11
Table G.5-2	Key chemical characteristics of RAMP lakes having greater than 40% of cation charge attributable to sodium and potassium.	G-12
Table G.6-1	Statistical summary of total trace metals in the RAMP lakes, 2011 to 2011.....	G-14
Table G.6-2	Statistical summary of dissolved trace metals in the RAMP lakes, 2003 to 2011.	G-15
Table G.6-3	Mean concentrations of total and dissolved trace metals in the RAMP lakes in each subregion, 2001 to 2011.....	G-16
Table G.6-4	Number of lakes in each region having mean individual trace metal concentrations greater than the 95 th percentile.....	G-23
Table G.6-5	List of exceedances of CCME surface water quality guidelines for metals in 2011.	G-23

LIST OF FIGURES

Figure A.2-1	Illustration of the SPOT-5 and Landsat-5 scenes acquired, 2011.....	A-2
Figure A.3-1	RAMP land change classes derived from SPOT-5 (June and July 2011) satellite imagery, north of Fort McMurray.....	A-7
Figure A.3-2	RAMP land change classes overlaid on a mosaic of SPOT-5 satellite images (June and July 2011), north of Fort McMurray.	A-9
Figure A.3-3	RAMP land change classes derived from SPOT-5 (June and August 2011) and Landsat-5 (May 2011) satellite imagery, south of Fort McMurray.	A-11
Figure A.3-4	RAMP land change classes overlaid on mosaics of SPOT-5 (June and August 2011) and Landsat-5 (May 2011) satellite images, south of Fort McMurray.	A-13
Figure C.2-1	Annual Precipitation at Fort McMurray and RAMP climate stations, 2011 WY.....	C-14
Figure C.2-2	Rainfall at Fort McMurray and RAMP climate stations, 2011 WY.....	C-15
Figure C.3-1	2011 WY water level hydrograph and historical context for Station L1, McClelland Lake.	C-26
Figure C.3-2	2011 WY water level hydrograph and historical context for Station L2, Kearl Lake.	C-27
Figure C.3-3	2011 WY water level hydrograph and historical context for Station L3, Isadore’s lake.	C-27
Figure C.3-4	2011 WY discharge hydrograph and historical context for Station S2, Jackpine Creek at Canterra Road.....	C-28
Figure C.3-5	2011 WY discharge hydrograph and historical context for Station S3, Iyininim Creek above Kearl Lake.	C-28
Figure C.3-6	2011 WY discharge hydrograph and historical context for Station S5, Muskeg River above Stanley Creek.....	C-29
Figure C.3-7	2011 WY discharge hydrograph and historical context for Station S5A, Muskeg River above Muskeg Creek.....	C-29
Figure C.3-8	2011 WY discharge hydrograph and historical context for Station S6, Mills Creek at Highway 63.....	C-30
Figure C.3-9	2011 WY discharge hydrograph and historical context for Station S7, Muskeg River near Fort McKay (07DA008).	C-30
Figure C.3-10	2011 WY discharge hydrograph and historical context for Station S9, Kearl Lake Outlet.	C-31

Figure C.3-11	2011 WY discharge hydrograph and historical context for Station S10, Wapasu Creek at Canterra Road.	C-31
Figure C.3-12	2011 WY discharge hydrograph and historical context for Station S11, Poplar Creek at Highway 63 (07DA007).	C-32
Figure C.3-13	2011 WY discharge hydrograph and historical context for Station S12, Fort Creek at Highway 63.	C-32
Figure C.3-14	2011 WY discharge hydrograph and historical context for Station S14A, Ells River at the CNRL Bridge.	C-33
Figure C.3-15	2011 WY discharge hydrograph and historical context for Station S15A, Tar River near the mouth.	C-33
Figure C.3-16	2011 WY discharge hydrograph and historical context for Station S16A, Calumet River Upland Tributary.	C-34
Figure C.3-17	2011 WY discharge hydrograph and historical context for Station S19, Tar River Lowland Tributary near the mouth.	C-34
Figure C.3-18	2011 WY discharge hydrograph and historical context for Station S20, Muskeg River Upland.	C-35
Figure C.3-19	2011 WY discharge hydrograph and historical context for Station S22, Muskeg Creek near the mouth.	C-35
Figure C.3-20	2011 WY discharge hydrograph and historical context for Station S24, Athabasca River below Eymundson Creek.	C-36
Figure C.3-21	2011 WY discharge hydrograph for Station S25, Susan Lake Outlet.	C-36
Figure C.3-22	2011 WY discharge hydrograph and historical context for Station S26, MacKay River near Fort McKay (07DB001).	C-37
Figure C.3-23	2011 WY discharge hydrograph and historical context for Station S27, Firebag River near the mouth (07DC001).	C-37
Figure C.3-24	2011 WY discharge hydrograph and historical context for Station S29, Christina River near Chard (07CE002).	C-38
Figure C.3-25	2011 WY discharge hydrograph and historical context for Station S31, Hangingstone Creek at North Star Road.	C-38
Figure C.3-26	2011 WY discharge hydrograph and historical context for Station S32, Surmont Creek at Highway 881.	C-39
Figure C.3-27	2011 WY discharge hydrograph and historical context for Station S33, Muskeg River at the Aurora/Albian Boundary.	C-39
Figure C.3-28	2011 WY discharge hydrograph and historical context for Station S34, Tar River above CNRL Lake.	C-40

Figure C.3-29	2011 WY discharge hydrograph for Station S36, McClelland Lake Outlet above Firebag River.	C-40
Figure C.3-30	2011 WY discharge hydrograph and historical context for Station S37, East Jackpine Creek near the 1300 m contour.	C-41
Figure C.3-31	2011 WY discharge hydrograph and historical context for Station S38, Steepbank River near Fort McMurray (07DA006).....	C-41
Figure C.3-32	2011 WY discharge hydrograph and historical context for Station S39, Beaver River above Syncrude (07DA018).	C-42
Figure C.3-33	2011 WY discharge hydrograph and historical context for Station S40, Mackay River at Petro-Canada Bridge.....	C-42
Figure C.3-34	2011 WY discharge hydrograph and historical context for Station S42, Clearwater River above Christina River (07CD005).....	C-43
Figure C.3-35	2011 WY discharge hydrograph and historical context for Station S43, Firebag River above Suncor Firebag.	C-43
Figure C.3-36	2011 WY discharge hydrograph and historical context for Station S44, Pierre River near Fort McKay (07DA013).	C-44
Figure C.3-37	2011 WY discharge hydrograph for Station S45, Ells River above Joslyn Creek Diversion.	C-44
Figure C.3-38	2011 WY discharge hydrograph and historical context for Station S46, Athabasca River near Embarras Airport.	C-45
Figure C.3-39	2011 WY discharge hydrograph for Station S47, Christina River near the mouth.....	C-45
Figure C.3-40	2011 WY discharge hydrograph for Station S48, Big Creek.	C-46
Figure C.3-41	2011 WY discharge hydrograph for Station S49, Eymundson Creek near the mouth.	C-46
Figure C.3-42	2011 WY discharge hydrograph for Station S50, Red Clay Creek.	C-47
Figure C.3-43	Stage-discharge rating curve for RAMP Station S2, Jackpine Creek at Canterra Road.....	C-48
Figure C.3-44	Stage-discharge rating curve for RAMP Station S3, Iyininim Creek above Kearl Lake.	C-49
Figure C.3-45	Stage-discharge rating curve for RAMP Station S5, Muskeg River above Stanley Creek.	C-49
Figure C.3-46	Stage-discharge rating curve for RAMP Station S5A, Muskeg River above Muskeg Creek.	C-50

Figure C.3-47	Stage-discharge rating curve for RAMP Station S6, Mills Creek at Highway 63.	C-50
Figure C.3-48	Stage-discharge rating curve for WSC Station 07DA008, RAMP Station S7, Muskeg River near Fort McKay.	C-51
Figure C.3-49	Stage-discharge rating curve for RAMP Station S9, Kearn Lake Outlet.	C-51
Figure C.3-50	Stage-discharge rating curve for RAMP Station S10, Wapasu Creek at Canterra Road.	C-52
Figure C.3-51	Stage-discharge rating curve for WSC Station 07DA007, RAMP Station S11, Poplar Creek at Highway 63.	C-52
Figure C.3-52	Stage-discharge rating curve for RAMP Station S12, Fort Creek at Highway 63.	C-53
Figure C.3-53	Stage-discharge rating curve for RAMP Station S14A, Ells River at the CNRL Bridge.	C-53
Figure C.3-54	Stage-discharge rating curve for RAMP Station S15A, Tar River near the mouth.	C-54
Figure C.3-55	Stage-discharge rating curve for RAMP Station S16A, Calumet River near the mouth.	C-54
Figure C.3-56	Stage-discharge rating curve for RAMP Station S19, Tar River Lowland Tributary near the mouth.	C-55
Figure C.3-57	Stage-discharge rating curve for RAMP Station S20, Muskeg River Upland.	C-55
Figure C.3-58	Stage-discharge rating curve for RAMP Station S22, Muskeg Creek near the mouth.	C-56
Figure C.3-59	Stage-discharge rating curve for RAMP Station S24, Athabasca River below Eymundson Creek.	C-56
Figure C.3-60	Stage-discharge rating curve for RAMP Station S25, Susan Lake Outlet.	C-57
Figure C.3-61	Stage-discharge rating curve for WSC Station 07DB001, RAMP Station S26, MacKay River near Fort McKay.	C-57
Figure C.3-62	Stage-discharge rating curve for WSC Station 07DC001, RAMP Station S27, Firebag River near the mouth.	C-58
Figure C.3-63	Stage-discharge rating curve for WSC Station 07CE002, RAMP Station S29, Christina River near Chard.	C-58
Figure C.3-64	Stage-discharge rating curve for RAMP Station S31, Hangingstone Creek at North Star Road.	C-59

Figure C.3-65	Stage-discharge rating curve for RAMP Station S32, Surmont Creek at Highway 881.	C-59
Figure C.3-66	Stage-discharge rating curve for RAMP Station S33, Muskeg River at the Aurora/Shell Boundary.	C-60
Figure C.3-67	Stage-discharge rating curve for RAMP Station S34, Tar River above CNRL Lake.	C-60
Figure C.3-68	Stage-discharge rating curve for RAMP Station S36, McClelland Lake Outlet above Firebag River.	C-61
Figure C.3-69	Stage-discharge rating curve for RAMP Station S37, East Jackpine Creek near the 1,300 m contour.	C-61
Figure C.3-70	Stage-discharge rating curve for WSC Station 07DA006, RAMP Station S38, Steepbank River.	C-62
Figure C.3-71	Stage-discharge rating curve for WSC Station 07DA018, RAMP Station S39, Beaver River above Syncrude.	C-62
Figure C.3-72	Stage-discharge rating curve for RAMP Station S40, MacKay River at the Petro-Canada Bridge.	C-63
Figure C.3-73	Stage-discharge rating curve for RAMP Station S42, Clearwater River above the Christina River.	C-63
Figure C.3-74	Stage-discharge rating curve for RAMP Station S43, Firebag River above Suncor Firebag.	C-64
Figure C.3-75	Stage-discharge rating curve for WSC Station 07DA013, RAMP Station S44, Pierre River near Fort McKay.	C-64
Figure C.3-76	Stage-discharge rating curve for RAMP Station S45, Ells River above the Jocelyn Creek Diversion.	C-65
Figure C.3-77	Stage-discharge rating curve for RAMP Station S46, Athabasca River near Embarras Airport.	C-65
Figure C.3-78	Stage-discharge rating curve for RAMP Station S47, Christina River near the mouth.	C-66
Figure C.3-79	Stage-discharge rating curve for RAMP Station S48, Big Creek near the mouth.	C-66
Figure C.3-80	Stage-discharge rating curve for RAMP Station S49, Eymundson Creek near the mouth.	C-67
Figure C.3-81	Stage-discharge rating curve for RAMP Station S50, Red Clay Creek.	C-67

Figure E.1-1	Benthic invertebrate sorting and sub-sampling protocol, applicable for samples with large detrital material and large numbers of small organisms.....	E-2
Figure E.1-2	Example biplot showing time trend of benthic invertebrate CA Axis scores in relation to the baseline range of variation, in this case, for samples from the Athabasca River delta.	E-5
Figure E.1-3	Example time trend chart for benthic invertebrate community abundance in relation to the <i>baseline</i> range of variation, in this case, for a depositional reach.....	E-6
Figure G.3-1	Lake pH vs. alkalinity for 180 regional lakes.	G-6
Figure G.4-1	Box-plots of selected chemical variables for the RAMP lakes in 2011 versus 432 regional lakes reported by the NSMWG (WRS 2004).....	G-9
Figure G.5-1	Piper plots showing the proportion of major cations and anions in the RAMP lakes, 2011.	G-12
Figure G.6-1	Concentrations of dissolved aluminum in the RAMP lakes.....	G-17
Figure G.6-2	Concentrations of dissolved iron in the RAMP lakes.	G-19
Figure G.6-3	Concentrations of dissolved cobalt in the RAMP lakes.....	G-21

Appendix A

**Estimating Area of Land Change
for the RAMP Focus Study Area**

A ESTIMATING AREA OF LAND CHANGE FOR THE RAMP FOCUS STUDY AREA

A.1 INTRODUCTION

This appendix documents the methodology used to quantify the location, extent, and type of land change in the RAMP Focus Study Area (FSA) as of 2011 related to:

- focal projects (i.e., those projects owned by 2011 RAMP industry members, which were under construction or operational in 2011 in the RAMP FSA); and
- oil sands projects within the RAMP FSA that were under active development in 2011 by companies that were not members of RAMP in 2011.

This land change information was used to designate RAMP sampling stations and locations as *baseline* and *test* and to provide information to the hydrologic analysis of potential effects of focal project activities.

A.2 METHODOLOGY

A.2.1 Satellite Imagery Acquisition

A total of seven SPOT-5 10-meter resolution scenes were obtained by RAMP (Figure A.2-1); these images were acquired on June 29, June 30, July 4, July 5, July 25, August 8, and August 14, 2011. Two Landsat-5 30 m resolution scenes were also obtained by RAMP; these images (one north and one south of Fort McMurray) were acquired on May 15, 2011 (Figure A.2-1).

A.2.2 Ortho-Rectification of Image Data

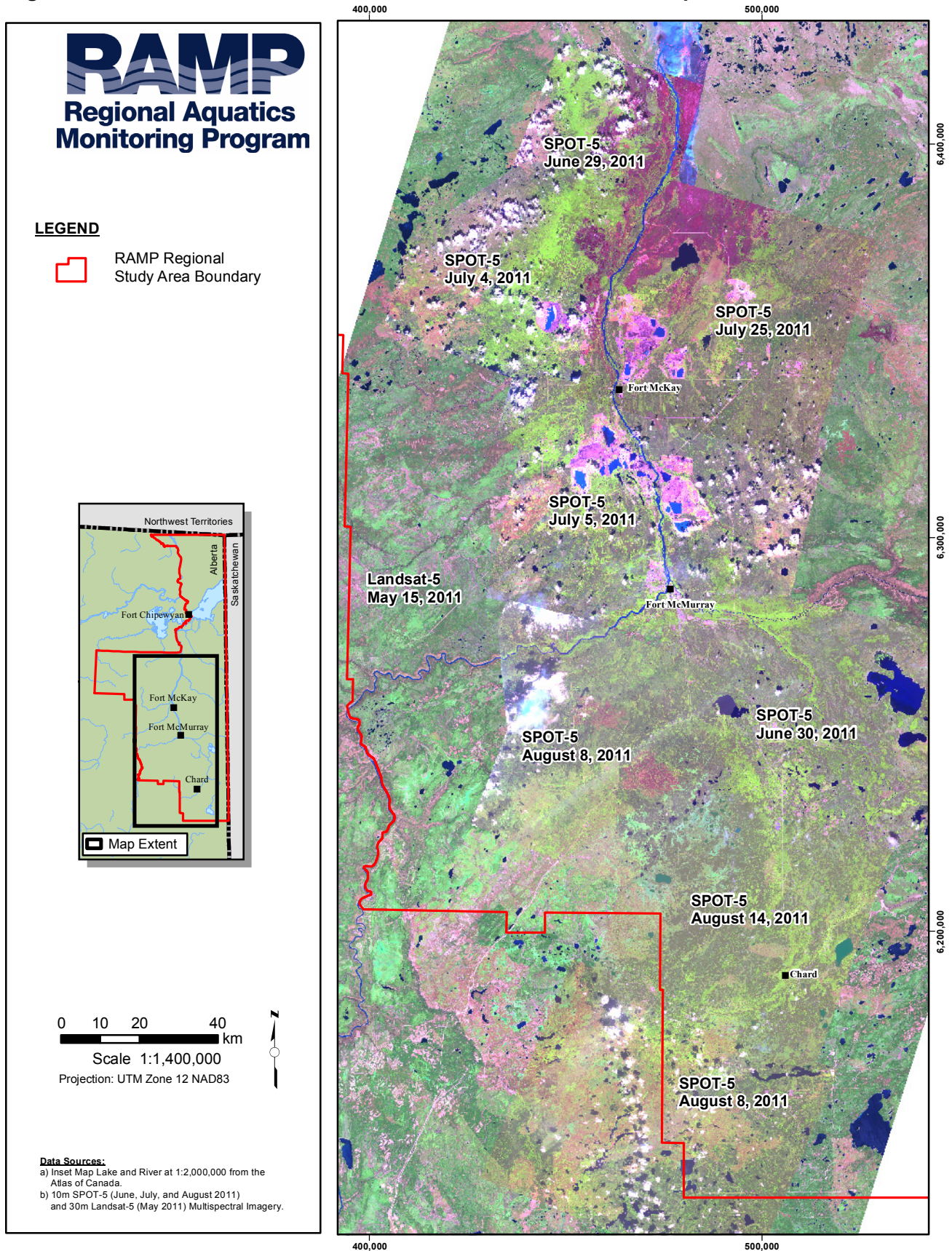
To ensure that the assessments made from the earth observation (EO) imagery were spatially correct, the imagery was first geometrically corrected. The procedure was undertaken using PCI Geomatica® image processing software and entailed the alignment of the image data to a known map projection, essentially georeferencing all pixel values in the data to a known location on the Earth's surface.

The procedure for ortho-rectifying the image data to a map projection involved the application of previously-collected control points, topographic maps, existing ortho-rectified satellite imagery¹ and a digital elevation model (DEM)² to identify common ground control points (GCPs, known reference locations that can be identified on the satellite image). A total of 20 to 30 GCPs for each satellite image were identified to provide enough input values for the image processing software to solve the ortho-rectification algorithm. Once the collection of GCPs was complete, the ortho-rectification model was executed, creating a copy of the image, with the new positions, aligned to the reference maps and the elevation data.

¹ Geobase Landsat 7 ETM+ ortho-rectified images from 1999, 2000 and 2001.

² Geobase 1:50,000 scale Digital Elevation Model.

Figure A.2-1 Illustration of the SPOT-5 and Landsat-5 scenes acquired, 2011.



A.2.3 Atmospheric Correction

Atmospheric correction³ was applied to the SPOT-5 and Landsat-5 images using an automated routine within the PCI Geomatica image processing software as well as a spatially-adaptive atmospheric correction model for flat terrain.

A.2.4 Classification of Land Change

The 2011 areas of land change were digitized beginning with the results of the 2010 classification (RAMP 2011, Appendix A). New land change areas were added and changed areas were modified based on 2010 SPOT-5 and Landsat-5 images, and the digitized polygons were coded to one of two land change classes: closed-circuited; or not closed-circuited. Draft land change maps were then distributed to the RAMP Technical Program Committee in fall 2011 for review and comment, and a final set of land change maps was then prepared.

A GIS overlay analysis was performed to estimate the area of each land change class in each of the RAMP FSA watersheds. The results of the overlay analysis were exported to MS Excel[®] for data summary.

A.3 RESULTS

Table A.3-1 and Table A.3-2 provide tabular summaries of the land change in each of the main watersheds by each land change type, for focal projects and non-RAMP oil sands projects within the RAMP FSA. These land change areas are also shown in Figure A.3-1 and Figure A.3-2 for the area north of Fort McMurray and in Figure A.3-3 and Figure A.3-4 for the area south of Fort McMurray.

Land change as of 2011 within the RAMP FSA is estimated at approximately 93,500 ha for focal projects and 700 ha for oil sands projects operated by oil sands companies that were not members of RAMP in 2011, for a total of slightly more than 94,300 ha. This represents approximately 2.7% of the area of the RAMP FSA. The percentage of the area of watersheds with land change as of 2011 varies from less than 1% for many watersheds (MacKay, Ells, Christina, Hangingstone, Horse, and Firebag rivers), to 1% to 5% for the Calumet, Poplar and Steepbank watersheds, to 5% to 10% for the Upper Beaver watershed, to more than 10% for the Muskeg River, Fort Creek, Mills Creek, Tar River, Shipyard Lake, and McLean Creek watersheds, as well as the smaller Athabasca River tributaries from Fort McMurray to the confluence of the Firebag River.

³ Optical satellite imagery captures solar radiation reflected from the earth's surface. As visible light is susceptible to interference created by the presence of water vapor in the atmosphere, it is necessary to correct the imagery to remove these effects.

Table A.3-1 Area of watersheds with land change as of 2011, summarized by land change type.

Watershed	Total Watershed Area (ha)	Watershed Area with Land Change (ha)						Watershed Total (ha and %)	
		Focal Projects		Other Oil Sands Projects		Total			
		Not-Closed Circuited (ha)	Closed-Circuited (ha)	Not-Closed Circuited (ha)	Closed-Circuited (ha)	Not-Closed Circuited (ha)	Closed-Circuited (ha)		
Muskeg	146,000	6,898	11,874			6,898	11,874	18,772	12.86
Steepbank	135,491	4,006	488			4,006	488	4,494	3.32
MacKay	557,000	1,275	538			1,275	538	1,813	0.33
Tar	33,261	1,333	7,642			1,333	7,642	8,975	26.98
Calumet	17,354	9	189			9	189	198	1.14
Firebag	568,174	4,282	257			4,282	257	4,539	0.80
Ells	245,000	1,654	164			1,654	164	1,818	0.74
Christina	1,303,805	4,854	680	504		5,358	680	6,038	0.46
Hangingstone	106,641	9	47			9	47	56	0.05
Mills Creek	890	58	235			58	235	293	32.93
Shipyard Lake	4,047	15	3,739			15	3,739	3,754	92.76
Fort Creek	3,193	1,966	33			1,966	33	1,999	62.61
Horse	215,741	115	38	163	66	278	104	382	0.18
McLean	4,712	84	1,103			84	1,103	1,187	25.20
Original Poplar ¹	13,856	182	310			182	310	492	3.55
Upper Beaver ¹	28,711	861	1,928			861	1,928	2,789	9.71
Minor Athabasca River Tributaries ²	160,730	7,311	29,346			7,311	29,346	36,657	22.81
Total	3,544,606	34,912	58,611	667	66	35,579	58,677	94,257	2.66
Slave ³	863,473	323				323	0	323	0.04

¹ Original Poplar refers to the Poplar Creek watershed prior to the Beaver Creek diversion, while "Upper Beaver" refers to that part of the Beaver Creek drainage that now drains into Poplar Creek as a result of the Beaver Creek diversion. Drainage boundaries were estimated from maps provided in Syncrude Canada Ltd. (1977).

² Refers to Athabasca River tributaries from upstream of Fort McMurray to the mouth of the Firebag River excluding the watersheds explicitly listed in this table.

³ The Slave watershed was added in 2011 given some of the Canadian Natural Kirby project is located within this watershed. The Slave watershed is not part of the RAMP FSA.

Table A.3-2 Percent of total area of watershed with land change as of 2011, summarized by type of land change.

Watershed	Total Watershed Area (ha)	Watershed Area with Land Change (%)						Watershed Total (%)
		Focal Projects		Other Oil Sands Projects in RAMP FSA		Total		
		Not-Closed Circuited (%)	Closed-Circuited (%)	Not-Closed Circuited (%)	Closed-Circuited (%)	Not-Closed Circuited (%)	Closed-Circuited (%)	
Muskeg	146,000	4.72	8.13	-	-	4.72	8.13	12.86
Steepbank	135,491	2.96	0.36	-	-	2.96	0.36	3.32
MacKay	557,000	0.23	0.10	-	-	0.23	0.10	0.33
Tar	33,261	4.01	22.98	-	-	4.01	22.98	26.98
Calumet	17,354	0.05	1.09	-	-	0.05	1.09	1.14
Firebag	568,174	0.75	0.05	-	-	0.75	0.05	0.80
Ells	245,000	0.68	0.07	-	-	0.68	0.07	0.74
Christina	1,303,805	0.37	0.05	0.04	-	0.41	0.05	0.46
Hangingstone	106,641	0.01	0.04	-	-	0.01	0.04	0.05
Mills Creek	890	6.52	26.41	-	-	6.52	26.41	32.93
Shipyards Lake	4,047	0.37	92.39	-	-	0.37	92.39	92.76
Fort Creek	3,193	61.57	1.03	-	-	61.57	1.03	62.61
Horse	215,741	0.05	0.02	0.08	0.03	0.13	0.05	0.18
McLean	4,712	1.78	23.42	-	-	1.78	23.42	25.20
Original Poplar ¹	13,856	1.31	2.24	-	-	1.31	2.24	3.55
Upper Beaver ¹	28,711	3.00	6.72	-	-	3.00	6.72	9.71
Minor Athabasca River Tributaries ²	533,276	4.55	18.26	-	-	4.55	18.26	22.81
Total	3,917,152	0.98	1.65	0.02	0.00	1.00	1.66	2.66
Slave ³	863,473	0.04	-	-	-	0.04	-	0.04

¹ Original Poplar refers to the Poplar Creek watershed prior to the Beaver Creek diversion, while "Upper Beaver" refers to that part of the Beaver Creek drainage that now drains into Poplar Creek as a result of the Beaver Creek diversion. Drainage boundaries were estimated from maps provided in Syncrude Canada Ltd. (1977).

² Refers to Athabasca River tributaries from upstream of Fort McMurray to the mouth of the Firebag River excluding the watersheds explicitly listed in this table.

³ The Slave watershed was added in 2011 given some of the Canadian Natural Kirby project is located within this watershed. The Slave watershed is not part of the RAMP FSA.

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Figure A.3-1 RAMP land change classes derived from SPOT-5 (June and July 2011) satellite imagery, north of Fort McMurray.

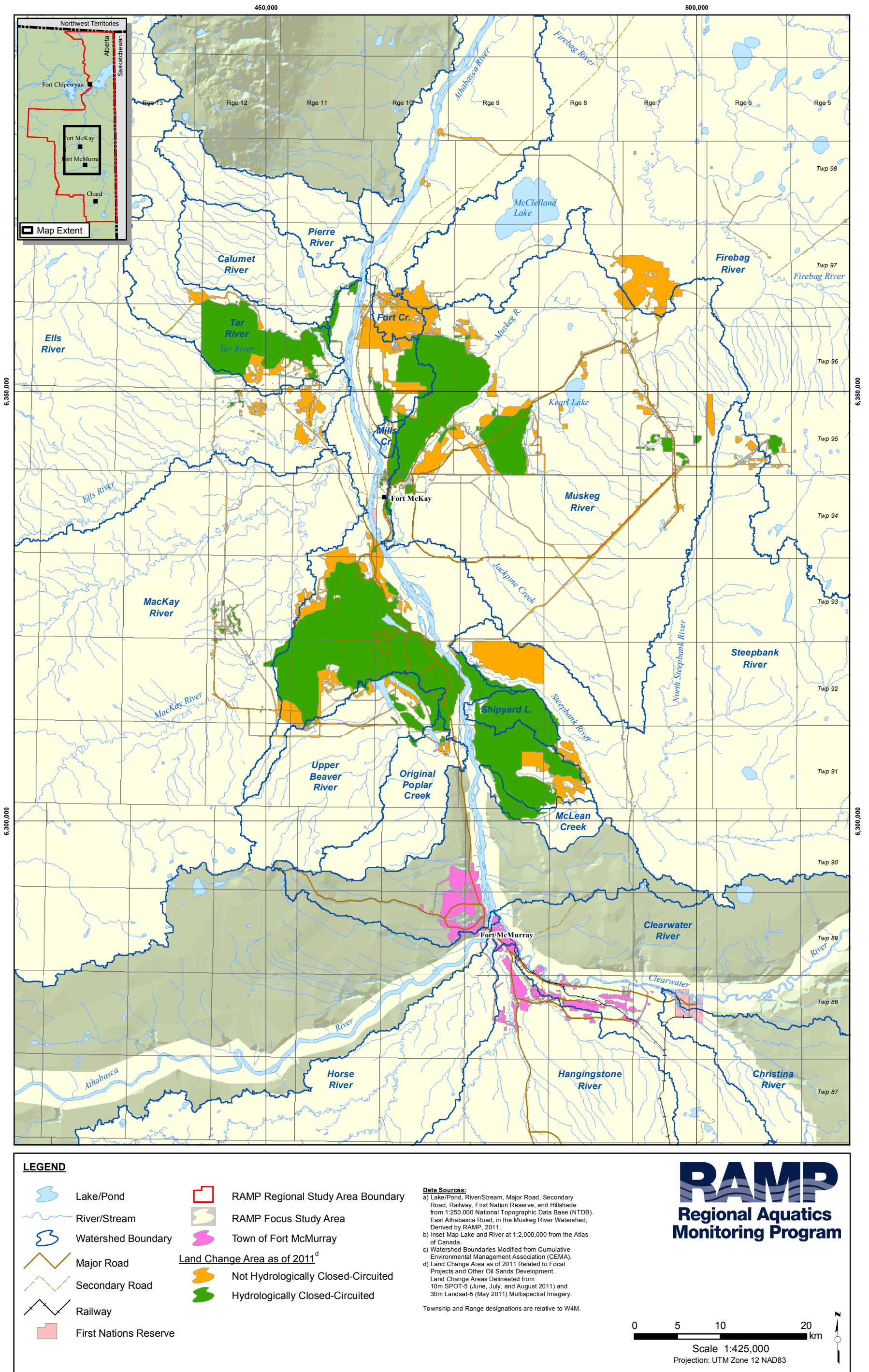


Figure A.3-2 RAMP land change classes overlaid on a satellite imagery mosaic of SPOT-5 (June and July 2011), north of Fort McMurray.

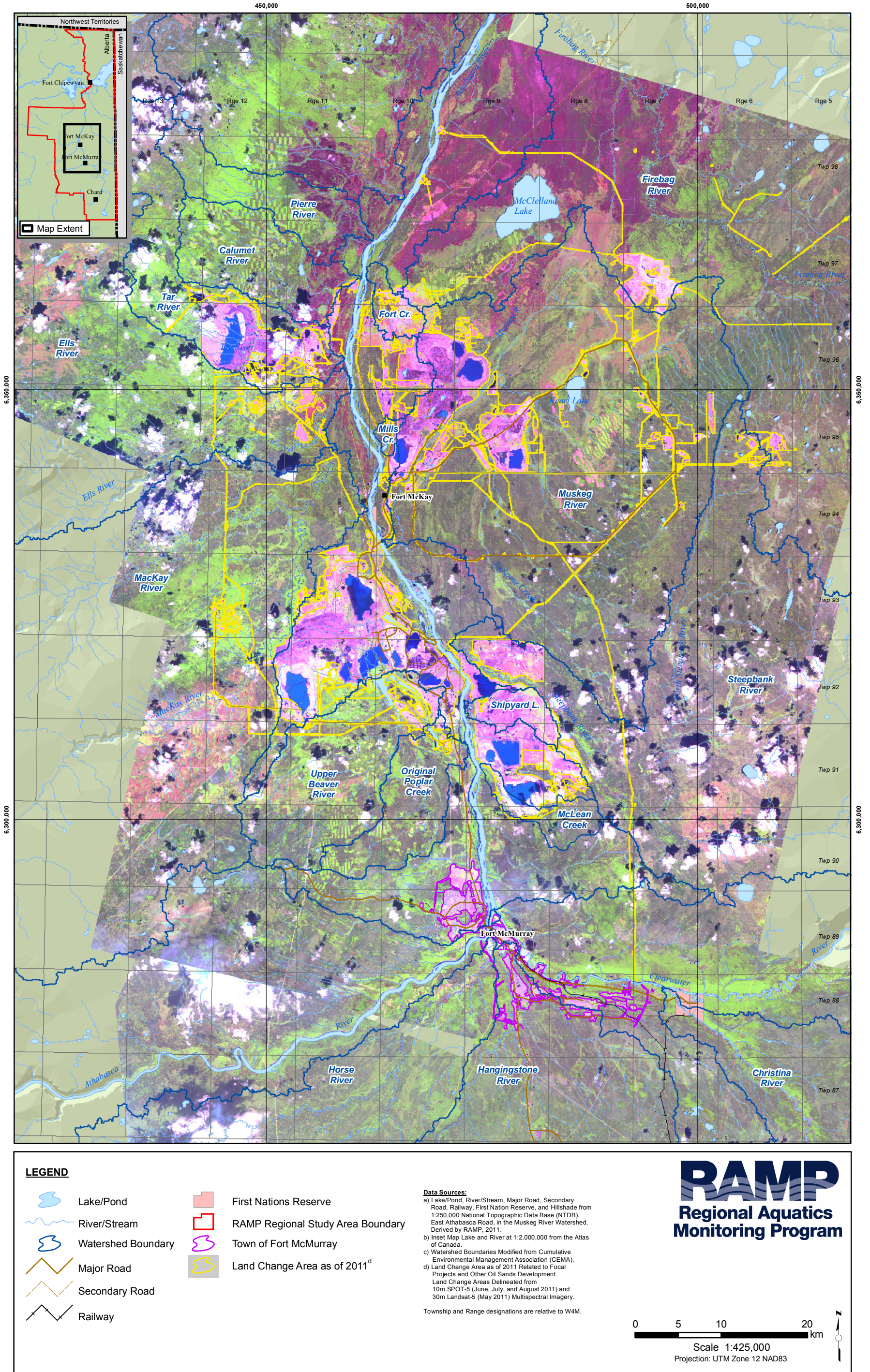
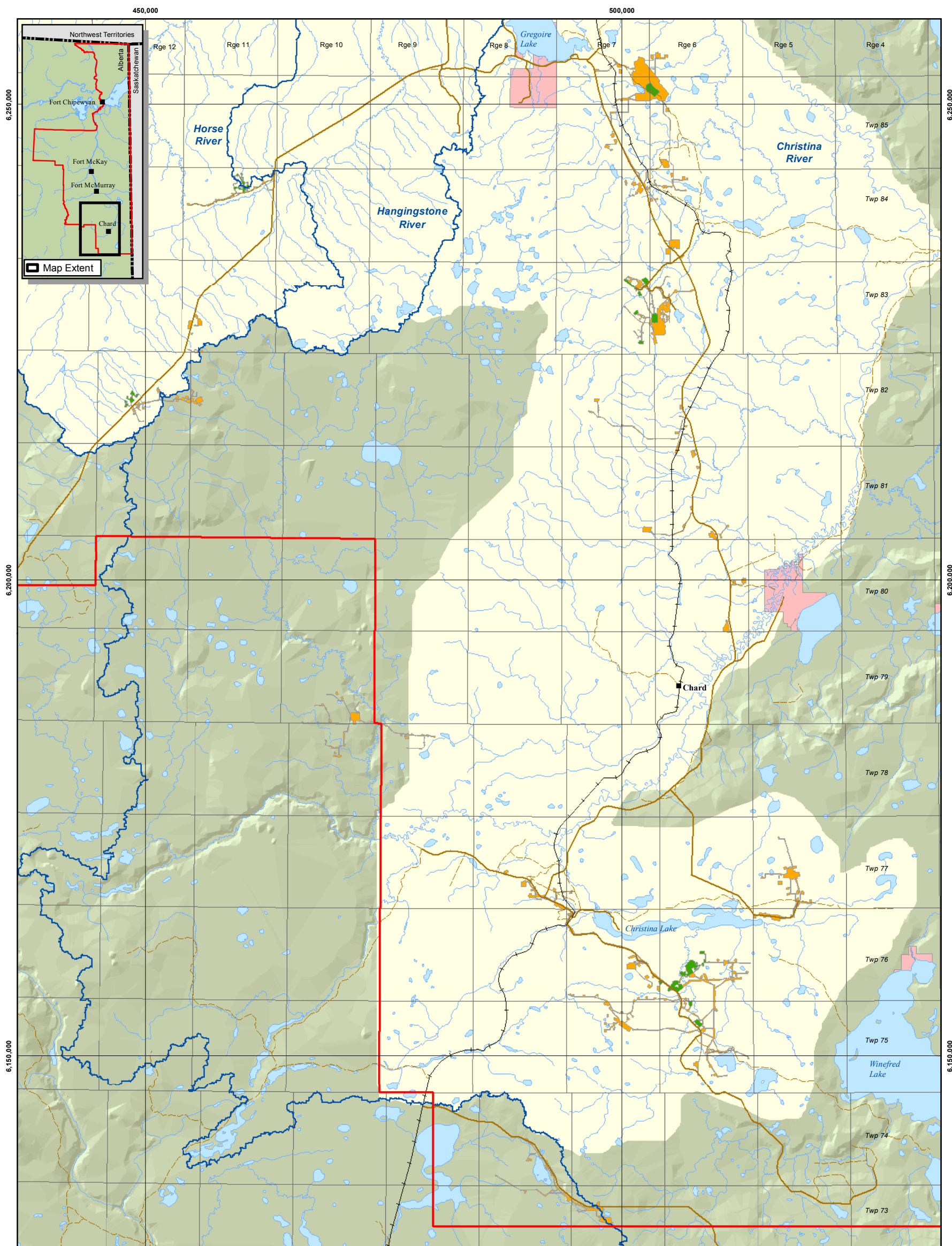
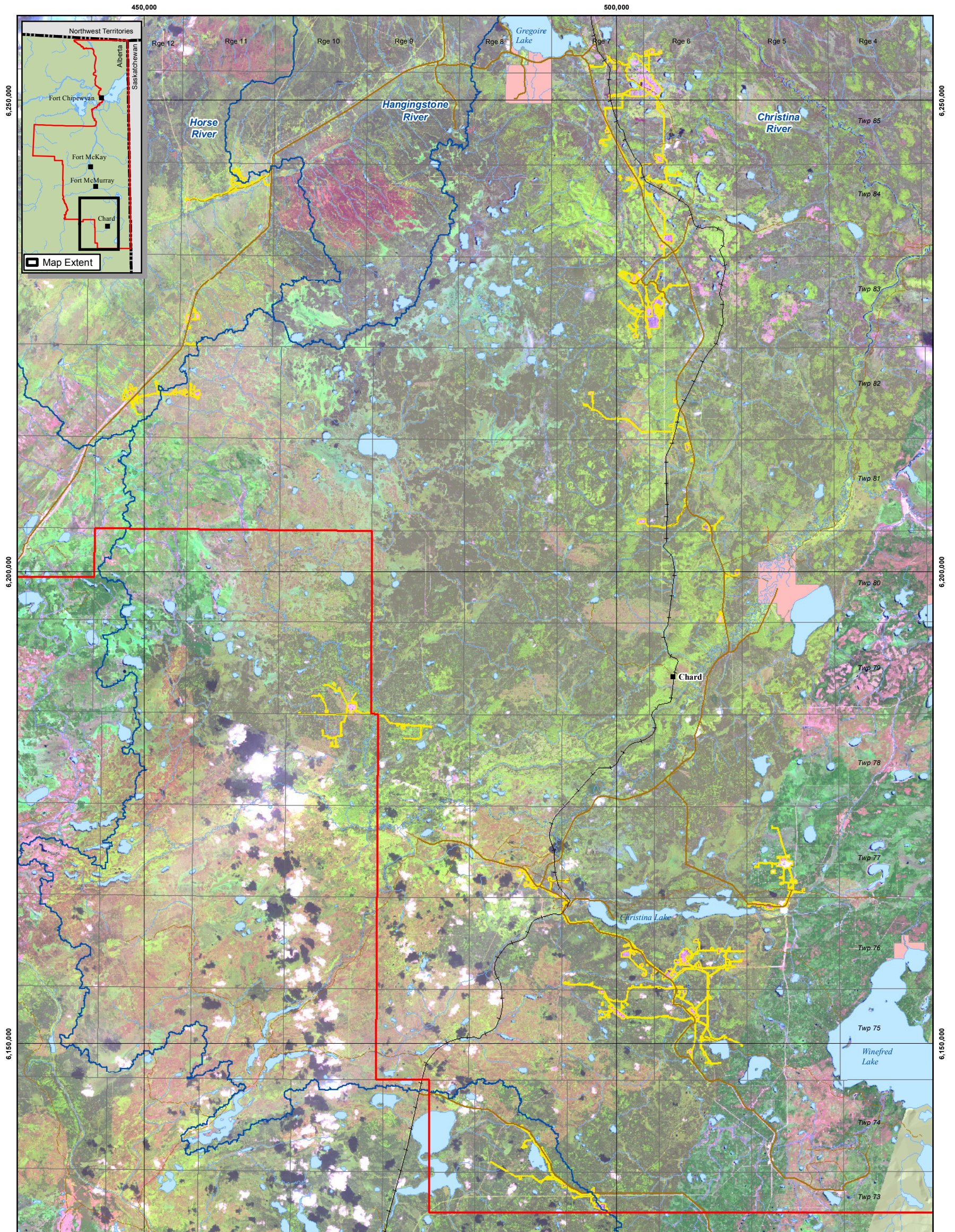


Figure A.3-3 RAMP land change classes derived from SPOT-5 (June and August 2011) and Landsat-5 (May 2011) satellite imagery, south of Fort McMurray.



LEGEND		<p>Data Sources:</p> <p>a) Lake/Pond, River/Stream, Major Road, Secondary Road, Railway, First Nation Reserve, and Hillshade from 1:250,000 National Topographic Data Base (NTDB), East Athabasca Road, in the Muskeg River Watershed, Derived by RAMP, 2011.</p> <p>b) Inset Map Lake and River at 1:2,000,000 from the Atlas of Canada.</p> <p>c) Watershed Boundaries Modified from Cumulative Environmental Management Association (CEMA).</p> <p>d) Land Change Area as of 2011 Related to Focal Projects and Other Oil Sands Development. Land Change Areas Delineated from 10m SPOT-5 (June, July, and August 2011) and 30m Landsat-5 (May 2011) Multispectral Imagery.</p> <p>Township and Range designations are relative to W4M.</p>	
<ul style="list-style-type: none"> Lake/Pond River/Stream Watershed Boundary Major Road Secondary Road Railway First Nations Reserve 	<ul style="list-style-type: none"> RAMP Regional Study Area Boundary RAMP Focus Study Area Town of Fort McMurray <p>Land Change Area as of 2011^d</p> <ul style="list-style-type: none"> Not Hydrologically Closed-Circuited Hydrologically Closed-Circuited 		

Figure A.3-4 RAMP land change classes overlaid on satellite imagery mosaics of SPOT-5 (June and August 2011) and Landsat-5 (May 2011), south of Fort McMurray.



LEGEND		<p>Data Sources:</p> <p>a) Lake/Pond, River/Stream, Major Road, Secondary Road, Railway, First Nation Reserve, and Hillshade from 1:250,000 National Topographic Data Base (NTDB), East Athabasca Road, in the Muskeg River Watershed, Derived by RAMP, 2011.</p> <p>b) Inset Map Lake and River at 1:2,000,000 from the Atlas of Canada.</p> <p>c) Watershed Boundaries Modified from Cumulative Environmental Management Association (CEMA).</p> <p>d) Land Change Area as of 2011 Related to Focal Projects and Other Oil Sands Development. Land Change Areas Delineated from 10m SPOT-5 (June, July, and August 2011) and 30m Landsat-5 (May 2011) Multispectral Imagery.</p> <p>Township and Range designations are relative to W4M.</p>	
<ul style="list-style-type: none"> Lake/Pond River/Stream Watershed Boundary Major Road Secondary Road Railway 	<ul style="list-style-type: none"> First Nations Reserve RAMP Regional Study Area Boundary Town of Fort McMurray Land Change Area as of 2011^d 		

Scale 1:425,000
Projection: UTM Zone 12 NAD83

Appendix B

**Quality Assurance and Quality
Control Procedures for 2011**

B QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES FOR 2011

B.1 QUALITY ASSURANCE PROCEDURES

Each technical component under RAMP is required to complete a series of procedures to facilitate the collection of a high level of data quality. Environment Canada (2010) defines quality assurance (QA) as:

Plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure that the collection of data of known quality matches the intended use of the data.

The following sections present the general procedures used by the RAMP implementation team for all RAMP-related data collection, handling and management. More detailed information regarding quality control for each technical component of RAMP follows the presentation of this general information.

A more detailed explanation of the sampling procedures used by the RAMP implementation team can be found in Appendix A4 of the RAMP Technical Design and Rationale document (RAMP 2009b or www.ramp-alberta.org).

B.1.1 Field Staff Training

All personnel participating in 2011 field studies were professional biologists/engineers or technicians with specific training in the subject-matter area in which they were involved. Field crews were assembled based on level of expertise and seniority; although qualifications varied based on level of experience, crews typically included a field crew leader who may be either a B.Sc.- or Master's- level professional and a trained environmental field technician (B.Sc. or Dip. Tech.). All 2011 field-crew members had experience conducting data collection in support of scientifically defensible environmental monitoring programs.

Field crew responsibilities were clearly established prior to beginning fieldwork through the use of Field Work Instructions (FWIs) prepared by the component or task leader. FWIs contained detailed information regarding sampling locations (e.g., coordinate location, access method), appropriate collection methodology, and required supporting variables (e.g., water velocity, field water chemistry). FWIs were prepared and discussed prior to each field sampling trip (typically when the crew was still in the office).

2011 crew members had been trained in field sampling techniques through traditional education (i.e., university or college), work experience and participation in workshops/seminars. In addition, crews had training in Standard First Aid and CPR, as well as any oil sands-specific site training that may have been necessary to access mine sites. In many cases, field personnel have additional training on the Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods (TDG) Regulations, Pleasure Craft Operators (as required by the Federal government), swift water rescue, ice safety training, and wilderness first aid.

B.1.2 Field Operations

B.1.2.1 Equipment

Sampling gear and equipment used for the RAMP field programs were maintained at the offices of the respective RAMP team members (i.e., Hatfield – Fort McMurray and North Vancouver). Each RAMP component manager (i.e., lead consultant responsible for a RAMP component) controlled specialized field equipment used to complete field studies. Where necessary, routine maintenance was conducted according to manufacturer's instructions to ensure valid data collection.

General field equipment that were used during field surveys (all components) included:

- Provincial sampling permits (e.g., fish collection permits from Alberta Sustainable Resource Development);
- Waterproof paper/data sheets, waterproof labels, indelible markers, pencils, pens, and other stationery (for recording data);
- Topographical maps, hydrographic charts, and/or aerial photos of the oil sands area;
- Garmin 45, 45XL, 12XL or GPSII Global Positioning System (GPS) for obtaining data on sampling station position (latitude and longitude; accurate to approximately ± 15 m);
- Digital camera (to record sampling areas, specimens captured, unusual features in the environment, etc.);
- Instruments for measuring the following water quality variables *in situ*: temperature, dissolved oxygen, conductivity, pH, current velocity and depth;
- Miscellaneous equipment: tarpaulin, rope, measuring tape, coolers, plastic buckets, and tool box;
- Waterproof clothing, including rain suits, rubber boots, etc.;
- Floater jackets and/or survival suits, first aid kit and other safety equipment (including boat safety equipment); and
- Publications and previous reports for reference.

Field operations were coordinated through the Hatfield Fort McMurray office. This role included coordination of personnel, sample handling and shipping, and end-of-day safety check-in for field crews.

Information regarding specialized field equipment used for the RAMP program is provided in the following sections and in Appendices C to G for specific components.

B.1.2.2 Data Collection, Data Tracking and Field Data Sheets

The following general data were typically recorded for field sampling activities conducted for RAMP (with some minor variability among technical components):

- Date and time of sampling;
- Sample numbers;

- Station location (UTM coordinate, datum, zone);
- Initials of field crew members;
- Sampling methods/gear used;
- Number of samples collected (water/sediment/benthos), number of specimens retained/ released/dissected/archived (biota), number of measurements taken (climate and hydrology);
- Volume of sample collected (water/sediment);
- Number of samples in a composite sample;
- Handling techniques, preservation methods, sampling containers used; and
- Photographs of sampling stations.

Field data collection was conducted according to procedures used for all previous RAMP studies (as described in RAMP 2009b).

B.1.3 Laboratory Analyses

Laboratories used to analyze water, sediment and fish tissue samples collected under the RAMP program are required to be accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). Responsibilities associated with this accreditation include participation in an annual performance evaluation assessment of the laboratory's procedures, methods and internal quality control.

Other samples, such as benthic invertebrate sorting and taxonomy, fish tissue analyses, and fish ageing, are conducted for RAMP by small independent laboratories or boutique consulting companies. These laboratories and companies are required to conduct QA/QC procedures that are considered industry standard for the respective disciplines. For example, QA/QC procedures for benthic invertebrate taxonomy meet or exceed guidelines established by Environment Canada (2010) for environmental effects monitoring (EEM) studies.

B.1.4 Data Management

Field data were entered into Microsoft Excel spreadsheets to facilitate production of tables, figures, etc., for reports. Employees transcribing data into tables checked 100% of the table numbers with the original dataset. Those persons creating graphs checked 100% of the graph numbers with the original dataset.

Information on samples collected (biota/benthos/sediment/water) were carefully recorded on field data sheets, and secured at the end of each field day. All data sheets, field notes, photographs, maps and other supporting documentation were filed within appropriate team members' secure offices. All hard-copy information will be retained for five years after the sampling date.

All products of field sampling (e.g., field notes, analytical results) were checked upon receipt for errors, analytical limits, and reasonable results and, prior to data analysis and reporting, entered data were checked for transcription errors.

Data received from laboratories and measured using field instruments previously entered into a spreadsheet must be checked once they are transposed into a Hatfield

database. A random 10% sample of these data is checked to ensure there is <2% error rate (less than 2 errors for every 100 data points). If the error rate is higher than 2%, the errors are corrected and another random 10% sample of the data is checked.

B.1.5 Sample Management

All samples were handled (including preservation, storage and shipping) in accordance with established procedures (RAMP 2009b) and with guidelines from respective laboratories. Sample tracking was conducted by field crew leaders (or Fort McMurray-based team members).

Detailed lists of samples shipped to analytical laboratories were made, such that samples could be tracked from point of shipment to the laboratory (water/sediment/benthic taxonomy). Chain of Custody (COC) forms (commonly issued by the receiving laboratory) were used to notify receiving laboratories of the number and type of samples that were being shipped. Data provided on this sheet included date, project, sample type (fish, sediment, water, benthic invertebrates, etc.), sampling location, sender's name, and any preservation added/required. Sample numbers of all specimens/containers collected, corresponding to field sample numbers, were listed. A description of each sample shipped was provided (i.e., station number, sediment, date and time collected, analyses to be performed). The receiver was required to check the shipping list to ensure all samples were accounted for and in good condition, and confirm (via fax and/or e-mail) samples received, date, and analyses to be performed. To facilitate this process, a standard RAMP COC form was used by the Hatfield team, which simplified the management of sample processing and analysis.

B.1.6 RAMP Quality Assurance Plan

In 2002, a formal RAMP-specific Quality Assurance Plan (QAP) was developed and implemented to cover all routine QA-related activities for the project. These methods were used in 2011 by the Hatfield RAMP team to ensure consistency of methods among years. Activities covered in the RAMP QAP include:

- Pre-field meetings to discuss field methods (i.e., FWIs) and specifics of field tasks;
- Post-field meetings to discuss results of the field activities and identify areas for improvement in future;
- Routine check-in with component leaders (24 or 48-hour interval) or the RAMP project manager during field work, as required;
- Designation of a staff member for each component/trip (i.e., water quality, fall field trip) to track sample handling, labeling (including COC forms), shipping and to confirm timely receipt of samples by the analytical laboratory;
- Internal check of COC forms by component leaders upon the return of the field crew (to confirm analyses requested were correct);
- Internal check of data upon receipt from external laboratories; and
- Internal check of entered field data for transcription errors.

B.2 QUALITY CONTROL PROCEDURES

Quality control (QC) is a component of QA that pertains to internal techniques used to measure and assess data quality (APHA 2000, in RAMP 2009b). QC activities for each RAMP technical component used in 2011 are described below.

B.2.1 Climate and Hydrology Component

B.2.1.1 Quality Control Activities – Field

Climatic and hydrologic data collection and processing were subject to the following quality control field procedures to ensure that the published data were as accurate as possible:

- Stream discharge measurements and water level surveys were performed in accordance with standard procedures. Each discharge measurement was qualified according to the criteria presented in the standard operating procedures in RAMP (2009b), based on observations of station conditions and analysis of the collected data;
- Sensors at climatic and hydrologic monitoring stations were calibrated on a regular basis. Sensors at climatic stations have been rotated with spare units on a two-year frequency and the units retrieved from the field were recalibrated by the manufacturer. Calibration curves for pressure transducers were verified prior to installation. Consistency between water level surveys and pressure transducer readings was checked during every field visit for all stations. Pressure transducers were exchanged with calibrated sensors after being installed for two years at year-round stations unless a deviation from surveyed water levels was observed at which time sensors were exchanged prior to the standard two-year service;
- Manual discharge measurements and concurrent water levels were compared on a plot of stage versus discharge, to check for consistency between measurements and consistency with previously established stage-discharge relationships. Rating curve shifts due to changes in channel geometry, beaver dams and obstructions or roughness changes were accounted for by revision of stage-discharge rating curves or application of backwater shift corrections; and
- Snow course surveys were performed according to standard protocols as presented in RAMP (2009b).

B.2.1.2 Quality Control Activities – Office

Climatic and hydrologic data collection and processing were subject to the following quality control office procedures to ensure that the published data were as accurate as possible:

- Apparent transducer elevations were calculated after each field visit as the difference between the surveyed water surface elevation and the sensor reading. The history of apparent transducer elevations was plotted for each station to check for physical sensor movement or calibration drift. Continuous water levels measured by the transducer were subsequently converted to elevations, adjusting for movement or drift.

- Rainfall, snowfall, air temperature, humidity, and wind speed data from automated climate sensors were compared to other local and regional records as well as manual observations recorded during site visits.
- All discharge measurements and station visit records were prepared by one person and checked by another.
- Velocity distributions at measurement cross sections were plotted and reviewed to ensure reasonable variation in velocity with flow depth and bed roughness.
- Hydrographs computed from continuous water level measurements and the stage-discharge rating curve were compared with manual measurements on the same plot. The resulting hydrographs were reviewed for consistency.
- Anomalies in the hydrographs, such as rapid changes in water level or discharge, were examined in detail to confirm authenticity. In cases where the data were inconsistent with other local and regional data (for instance, an isolated high water reading, without a subsequent recession curve), they were interpreted or discarded.
- Hydrographs computed for different stations in the same region were compared to identify anomalies and verify similarity in the timing and magnitude of runoff responses. Hydrographs were also analyzed to ensure anticipated effects such as time lag, attenuation by river or lake routing and increments in discharge with drainage area were apparent in the records.

B.2.2 Water Quality Component

B.2.2.1 Methods

Field Collections

The following precautions were used in the field to prevent sample contamination:

- All sample bottles used were provided to the RAMP sampling team as “certified clean” by the laboratories (ultra-trace mercury bottles were pre-filled using specific procedures stipulated by AITF);
- Grab samples were collected upstream of the boat and/or the person collecting the sample to avoid disturbing the substrate or otherwise contaminating the sample;
- Powder-free latex or nitrile gloves were worn during sample collection;
- Sample containers were kept covered during collection of composite samples;
- Winter samples were collected from approximately 20 cm below the ice where possible to minimize potential contamination from auger disturbance, using a peristaltic pump with fresh tubing at each station; and
- Samples for analysis of dissolved metals were filtered in the laboratory instead of in the field, following laboratory direction.

Potential contamination of samples during collection, handling, and transport was assessed using field blanks and trip blanks. Field blanks were used to assess potential contamination from sample handling, and were prepared in the field by filling sample bottles with deionized water provided by the laboratory. Trip blanks were prepared in

the analytical laboratory prior to sampling and kept sealed for the duration of the sampling trip; these were used to evaluate potential contamination from the sample container and the efficacy of storage conditions. Field blanks and trip blanks were utilized in all four seasons of sampling, and were analyzed for the same variables as RAMP samples. Field and trip blanks were labeled with dummy RAMP-style codes (i.e., BAR-1, DAR-1) to ensure “blind” laboratory analysis.

Field and trip blank analytical results were compared to analytical detection limits. Analyte concentrations greater than five times the detection limit in the blank samples may demonstrate potential contamination of samples during sample collection or analysis or analytical error. Blanks with analyte concentrations below or near detection limits represent samples that were collected, handled, and analyzed without contamination or potential errors.

Duplicate samples were collected from the Athabasca River, east bank downstream of all developments (ATR-DD-E, winter), Athabasca River, east bank upstream of Donald Creek (ATR-DC-E, summer), upper Beaver River (BER-2, fall), and upper MacKay River upstream of Suncor MacKay developments (MAR-2, fall). Duplicate samples were taken to assess environmental heterogeneity and laboratory precision. Analytical results for duplicate samples were compared, and the relative percent difference (RPD, difference between data values / average of data values, multiplied by 100%) was calculated for each analyte. Relative percent differences greater than 20% were noted as potentially unacceptable levels of precision. However, because precision decreases as the analyte concentration approaches the detection limits, relative percent differences greater than 20% were considered to be of significance only if analyte concentrations in both samples were greater than five times the detection limit. This target 20% RPD between duplicates is identical to QA thresholds used internal by contracted laboratories for most variables measured, although acceptable internal laboratory RPDs for some organic compounds (e.g., CCME hydrocarbons, some PAHs, etc.) may be higher (e.g., 30 or 40%).

Sample Analysis

Chemical laboratories analyzed a number of their own QA/QC samples to ensure that sample contamination did not occur during analysis and that results reported were precise and accurate. A method blank, consisting of a de-ionized water sample prepared at the initiation of the analysis, was used to assess potential contamination during analyses. A sample split into two aliquots (split sample, also called a laboratory duplicate) was used to assess the precision of the analyses. Spiked samples, reference standards, and other controls were used by the analytical laboratories to establish the accuracy and precision of the analyses.

All laboratory QA/QC samples were assessed using in-house laboratory protocols to identify potential contamination and determine the precision and accuracy of the analyses, where these data were provided with analytical results (all laboratories used by RAMP for water and sediment-quality analyses reported internal QA/QC results except AITF). Any deviations from QA/QC criteria were identified in the laboratory reports and are noted in the results section that follows.

Any anomalous values identified in laboratory reports were followed up with the laboratory to determine if the value was a measurable value or due to a transcription or analytical error.

B.2.2.2 Results and Discussion

Field and Trip Blanks

Field blanks were completed during winter, summer, and fall sampling seasons – one field blank was filled in winter and summer, and two field blanks were filled in fall. Concentrations of all conventional variables, major ions, nutrients, hydrocarbons, dissolved and total metals and polycyclic aromatic hydrocarbons (PAHs) in field blanks were less than five times the detection limit in 2011 (Table B.2-1), with the exception of total phenols, C4 phenanthrenes/anthracenes, C4 naphthalenes, and flourene in summer. All conventional variables, major ions, nutrients, and hydrocarbons were below analytical detection limits in the field blank sample collected on September 15, 2011; total metals, dissolved metals, naphthenic acids, and oil sands acid extractable were measured at levels consistent with ambient water quality samples. These results were identified as a laboratory error and were excluded from analysis.

Trip blanks were completed during winter, spring, summer, and fall sampling seasons – one trip blank was filled in the winter, spring and summer, and two trip blanks were filled in fall. Concentrations of all conventional variables, major ions, nutrients, hydrocarbons, dissolved and total metals and PAHs in trip blanks were less than five times the detection limits (Table B.2-2) with the exception of total phenols (summer). An investigation was initiated by the laboratory to identify possible sources of total phenols contamination in both the trip and field blank during summer sampling. No sources were identified, but the contamination was not expected to affect other summer water quality samples.

Duplicate Samples

Duplicate samples were taken at four stations in 2011: ATR-DD-E in winter, ATR-DC-E in summer, and BER-2 and MAR-2 in fall. Conventional variables, major ions, nutrients, and hydrocarbon concentrations were generally quite similar in the duplicate samples. The RPD for all conventional variables, major ions, nutrients, and hydrocarbons was less than 20% for those analytes where concentrations in both samples were greater than five times the detection limit (Table B.2-3 to Table B.2-6), with the exception of AITF naphthenic acids at ATR-DD-E (winter) and MAR-2 (fall); dissolved phosphorus at ATR-DC-E (summer) and BER-2 (fall); total phenols at ATR-DC-E (summer) and total dissolved solids, total phosphorus, and AITF oil sands acid-extractables at BER-2 (fall).

The RPD for most analytes was less than 20% for those analytes where concentrations in one or both samples were less than five times the detection limit (Table B.2-3 to Table B.2-6) with the exception of total suspended solids at both ATR-DD-E (winter) and BER-2 (fall), sulphide at ATR-DC-E (summer) and sulphide and total Kjeldahl nitrogen at BER-2 (fall).

The number of metals concentrations with RPD >20% in duplicate samples varied among stations, suggesting that different rivers exhibited varying degrees of environmental heterogeneity. The RPD was less than 20% for all analytes where one or both samples were greater than five times the detection limit with the following exceptions:

- ATR-DD-E (winter): dissolved copper, titanium and zinc, and total copper;
- ATR-DC-E (summer): dissolved manganese and mercury, total lithium and ultra-trace mercury, and most PAHs;

- MAR-2 (fall): dissolved copper, and total aluminum, copper and titanium; and
- BER-2 (fall): dissolved copper and lead, and dissolved titanium and zinc.

The RPD was less than 20% for all analytes where one or both samples were less than five times the detection limit with the following exceptions:

- ATR-DD-E (winter): dissolved nickel, and ultra-trace mercury;
- ATR-DC-E (summer): dissolved chromium, dissolved lead, and total silver; and
- BER-2 (fall): dissolved chromium, dissolved zinc, and ultra-trace mercury.

The RPD of most PAHs in duplicate samples was high in the summer sample from ATR-DC-E, but in fall were below 20% for all PAHs in duplicate samples at MAR-2 and BER-2 (where only retene exceeded) (Table B.2-4, Table B.2-5). The high variability of PAH values between duplicates in summer versus fall may be related to the high suspended solids in the summer samples (i.e., nearly 500 mg/L), versus fall (i.e., <3 mg/L for MAR-2 and less than 15 mg/L for BER-2); given most waterborne PAHs are likely associated with particulate matter (see Section 5), the large amount of particulate matter in the summer ATR-DC-E sample may have contributed to high variability in concentrations of individual PAHs.

B.2.2.3 Conclusions and Recommendations

Results from the QA/QC evaluation of water quality data indicated that overall, data collected for the water quality component was of high quality. The results of trip and field blank analyses suggested that laboratory-generated concentrations were reliable. The analysis of duplicate samples indicated some variability within stations, likely related to local-scale heterogeneity among samples.

Table B.2-1 Results of analysis of field blanks prepared during RAMP water quality surveys in winter, spring, summer and fall, 2011.

Variable	Unit	Detection Limit	Concentration in Field Blank			
			23-Mar-11	14-Jul-11	6-Sep-11	15-Sep-11
Conventional Variables						
Conductivity	µS/cm	0.2	0.57	0.42	0.67	0.9
Dissolved Organic Carbon	mg/L	1	1.2	1.5	1	1.1
Hardness (as CaCO ₃)	mg/L	-	<1	<1	<1	<1
pH	pH units	0.1	5.73	5.83	5.94	5.85
Total Alkalinity	mg/L	5	<5	<5	<5	<5
Total Dissolved Solids	mg/L	10	<10	-	-	-
Total Dissolved Solids	mg/L	30	-	<30	<30	<30
Total Organic Carbon	mg/L	1	<1	1.5	<1	<1
Total Suspended Solids	mg/L	3	3	<3	<3	<3
True Colour	T.C.U.	2	<2	<2	<2	<2
Major Ions						
Bicarbonate (HCO ₃)	mg/L	5	<5	<5	<5	<5
Calcium (Ca)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5
Carbonate (CO ₃)	mg/L	5	<5	<5	<5	<5
Chloride (Cl)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5
Hydroxide (OH)	mg/L	5	<5	<5	<5	<5
Magnesium (Mg)	mg/L	0.1	<0.1	<0.1	<0.1	<0.1
Potassium (K)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5
Sodium (Na)	mg/L	1	<1	<1	<1	<1
Sulfate (SO ₄)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5
Sulphide (S ₂)	mg/L	0.002	<0.002	<0.002	<0.002	<0.002
Nutrients and BOD						
Ammonia-N	mg/L	0.05	<0.05	<0.05	<0.05	<0.05
Biochemical Oxygen Demand	mg/L	2	<2	<2	<2	<2
Nitrate+Nitrite	mg/L	0.071	<0.071	<0.071	<0.071	<0.071
Phosphorus, dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus, total	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Total Kjeldahl Nitrogen	mg/L	0.2	<0.2	<0.2	<0.2	<0.2
Hydrocarbons						
Naphthenic Acids	mg/L	0.02	0.00	0.00	0.00	-
OilSands Acid Extractable	mg/L	0.1	0.00	0.00	0.00	-
Total Phenols	mg/L	0.001	<0.001	0.0056	<0.001	<0.001
Total Rec. Hydrocarbons	mg/L	1	<1	<1	<1	<1
Hydrocarbons and Organic Compounds						
Benzene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005
CCME Fraction 1 (BTEX)	mg/L	0.1	-	<0.1	<0.1	<0.1
CCME Fraction 1 (C6-C10)	mg/L	0.1	-	<0.1	<0.1	<0.1
CCME Fraction 2 (C10-C16)	mg/L	0.25	-	<0.25	<0.25	<0.25
CCME Fraction 3 (C16-C34)	mg/L	0.25	-	<0.25	<0.25	<0.25
CCME Fraction 4 (C34-C50)	mg/L	0.25	-	<0.25	<0.25	<0.25
Ethylbenzene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005
m+p-Xylene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005
o-Xylene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005
Toluene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005
Xylenes	mg/L	0.00071	-	<0.00071	<0.00071	<0.00071

Indicates sample concentration is greater than five times the detection limit.

Table B.2-1 (Cont'd.)

Variable	Unit	Detection Limit	Concentration in Field Blank			
			23-Mar-11	14-Jul-11	6-Sep-11	15-Sep-11
Dissolved Metals						
Aluminum (Al)	mg/L	0.001	<0.001	<0.001	<0.001	-
Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	-
Arsenic (As)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Barium (Ba)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Boron (B)	mg/L	0.0008	<0.0008	<0.0008	<0.0008	-
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Calcium (Ca)	mg/L	0.1	<0.1	<0.1	<0.1	-
Chlorine (Cl)	mg/L	0.3	<0.3	<0.3	<0.3	-
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	-
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Copper (Cu)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Iron (Fe)	mg/L	0.004	<0.004	<0.004	<0.004	-
Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Lithium (Li)	mg/L	0.0002	<0.0002	<0.0002	<0.0002	-
Manganese (Mn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	-
Molybdenum (Mo)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Nickel (Ni)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	-
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	-
Strontium (Sr)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Sulphur (S)	mg/L	2	<2	<2	<2	-
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Titanium (Ti)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Uranium (U)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Vanadium (V)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Zinc (Zn)	mg/L	0.0002	<0.0002	<0.0002	0.000203	-
Total Metals						
Aluminum (Al)	mg/L	0.003	<0.003	<0.003	<0.003	-
Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	-
Arsenic (As)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Barium (Ba)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Boron (B)	mg/L	0.0008	<0.0008	<0.0008	<0.0008	-
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Calcium (Ca)	mg/L	0.1	<0.1	<0.1	<0.1	-
Chlorine (Cl)	mg/L	0.3	<0.3	<0.3	<0.3	-
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	-
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Copper (Cu)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Iron (Fe)	mg/L	0.004	<0.004	<0.004	<0.004	-
Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-

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Indicates sample concentration is greater than five times the detection limit.

Table B.2-1 (Cont'd.)

Variable	Unit	Detection Limit	Concentration in Field Blank			
			23-Mar-11	14-Jul-11	6-Sep-11	15-Sep-11
Total Metals (cont'd.)						
Lithium (Li)	mg/L	0.0002	<0.0002	<0.0002	<0.0002	-
Manganese (Mn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	-
Mercury (Hg), ultra-trace	ng/L	0.6	<0.6	<0.6	<0.6	-
Molybdenum (Mo)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Nickel (Ni)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	-
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	-
Strontium (Sr)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Sulphur (S)	mg/L	2	<2	<2	<2	-
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Titanium (Ti)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Uranium (U)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Vanadium (V)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	-
Zinc (Zn)	mg/L	0.0002	0.000344	0.000221	0.000211	-
PAHs						
Acenaphthene	ng/L	0.43	-	0.62	<0.43	<0.43
Acenaphthylene	ng/L	0.16	-	0.56	<0.16	<0.16
Anthracene	ng/L	0.11	-	0.18	<0.11	<0.11
Benz[a]anthracene	ng/L	0.06	-	<0.06	<0.06	<0.06
Benzo[a]pyrene	ng/L	0.14	-	<0.14	<0.14	<0.14
Benzo[b,j,k]fluoranthene	ng/L	0.19	-	<0.19	<0.19	<0.19
Benzo[g,h,i]perylene	ng/L	0.17	-	<0.17	<0.17	<0.17
Biphenyl	ng/L	1.09	-	3.49	<1.09	<1.09
C1-Acenaphthenes	ng/L	0.15	-	0.41	<0.15	<0.15
C1-Benz[a]anthracenes/Chrysenes	ng/L	0.48	-	<0.48	<0.48	<0.48
C1-Benzofluoranthenes/Benzopyrenes	ng/L	0.92	-	<0.92	<0.92	<0.92
C1-Biphenyls	ng/L	5.08	-	<5.08	<5.08	<5.08
C1-Dibenzothiophenes	ng/L	0.15	-	0.18	<0.15	<0.15
C1-Fluoranthenes/Pyrenes	ng/L	1.65	-	<1.65	<1.65	<1.65
C1-Fluorenes	ng/L	4.49	-	<4.49	<4.49	<4.49
C1-Naphthalenes	ng/L	12.24	-	13.40	<12.24	<12.24
C1-Phenanthrenes/Anthracenes	ng/L	1.00	-	<1.00	<1.00	<1.00
C2-Benz[a]anthracenes/Chrysenes	ng/L	0.70	-	<0.70	<0.70	<0.70
C2-Benzofluoranthenes/Benzopyrenes	ng/L	0.75	-	<0.75	<0.75	<0.75
C2-Biphenyls	ng/L	49.03	-	<49.03	<49.03	<49.03
C2-Dibenzothiophenes	ng/L	1.56	-	<1.56	<1.56	<1.56
C2-Fluoranthenes/Pyrenes	ng/L	1.99	-	<1.99	<1.99	<1.99
C2-Fluorenes	ng/L	3.60	-	6.43	<3.60	<3.60
C2-Naphthalenes	ng/L	4.34	-	10.80	<4.34	<4.34
C2-Phenanthrenes/Anthracenes	ng/L	3.01	-	19.20	<3.01	<3.01
C3-Dibenzothiophenes	ng/L	1.65	-	<1.65	<1.65	<1.65
C3-Fluoranthenes/Pyrenes	ng/L	1.14	-	<1.14	<1.14	<1.14
C3-Fluorenes	ng/L	15.86	-	<15.86	<15.86	<15.86
C3-Naphthalenes	ng/L	3.14	-	11.10	<3.14	<3.14

Indicates sample concentration is greater than five times the detection limit.

Table B.2-1 (Cont'd.)

Variable	Unit	Detection Limit	Concentration in Field Blank			
			23-Mar-11	14-Jul-11	6-Sep-11	15-Sep-11
PAHs (cont'd.)						
C3-Phenanthrenes/Anthracenes	ng/L	3.25	-	<3.25	<3.25	<3.25
C4-Dibenzothiophenes	ng/L	2.30	-	<2.30	<2.30	<2.30
C4-Naphthalenes	ng/L	5.55	-	79.50	<5.55	<5.55
C4-Phenanthrenes/Anthracenes	ng/L	7.72	-	<7.72	<7.72	<7.72
Chrysene	ng/L	0.23	-	<0.23	<0.23	<0.23
Dibenz[a,h]anthracene	ng/L	0.10	-	<0.10	<0.10	<0.10
Dibenzothiophene	ng/L	0.19	-	0.63	<0.19	<0.19
Fluoranthene	ng/L	0.51	-	<0.51	<0.51	<0.51
Fluorene	ng/L	0.24	-	1.28	<0.24	<0.24
Indeno[1,2,3-c,d]-pyrene	ng/L	0.31	-	<0.31	<0.31	<0.31
Naphthalene	ng/L	14.13	-	25.40	<14.13	<14.13
Phenanthrene	ng/L	0.89	-	3.33	<0.89	<0.89
Pyrene	ng/L	0.43	-	<0.43	<0.43	<0.43
Retene	ng/L	2.07	-	<2.07	<2.07	<2.07

Indicates sample concentration is greater than five times the detection limit.

Table B.2-2 Results of analysis of trip blanks prepared during RAMP water quality surveys in winter, spring, summer and fall, 2011.

Variable	Unit	Detection Limit	Concentration in Trip Blank				
			23-Mar-11	18-May-11	14-Jul-11	6-Sep-11	15-Sep-11
Conventional Variables							
Conductivity	µS/cm	0.2	0.51	0.23	0.36	0.63	0.7
Dissolved Organic Carbon	mg/L	1	1.2	<1	1	1.1	1.3
Hardness (as CaCO ₃)	mg/L	-	<1	<1	<1	<1	<1
pH	pH units	0.1	5.5	5.68	5.66	5.63	5.66
Total Alkalinity	mg/L	5	<5	<5	<5	<5	<5
Total Dissolved Solids	mg/L	10	20	<10	-	-	-
Total Dissolved Solids	mg/L	30	-	-	<30	<30	<30
Total Organic Carbon	mg/L	1	1.3	<1	1	1	1.3
Total Suspended Solids	mg/L	3	<3	<3	<3	3	<3
True Colour	T.C.U.	2	<2	<2	<2	<2	<2
Major Ions							
Bicarbonate (HCO ₃)	mg/L	5	<5	<5	<5	<5	<5
Calcium (Ca)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbonate (CO ₃)	mg/L	5	<5	<5	<5	<5	<5
Chloride (Cl)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hydroxide (OH)	mg/L	5	<5	<5	<5	<5	<5
Magnesium (Mg)	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Potassium (K)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sodium (Na)	mg/L	1	<1	<1	<1	<1	<1
Sulfate (SO ₄)	mg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Sulphide (S ₂)	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nutrients and BOD							
Ammonia-N	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Biochemical Oxygen Demand	mg/L	2	<2	<2	<2	<2	<2
Nitrate+Nitrite	mg/L	0.071	<0.071	<0.071	<0.071	<0.071	<0.071
Phosphorus, dissolved	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus, total	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Kjeldahl Nitrogen	mg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
General Organics							
Naphthenic Acids	mg/L	0.02	0.00	0.00	0.00	0.00	-
OilSands Acid Extractable	mg/L	0.1	0.00	0.00	0.00	0.00	-
Oil and Grease	mg/L	1	<1	-	-	-	-
Total Phenols	mg/L	0.001	<0.001	<0.001	0.013	0.0014	<0.001
Total Rec. Hydrocarbons	mg/L	1	-	<1	<1	<1	<1
Hydrocarbons and Organic Compounds							
Benzene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005
CCME Fraction 1 (BTEX)	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1
CCME Fraction 1 (C6-C10)	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1
CCME Fraction 2 (C10-C16)	mg/L	0.25	-	<0.25	<0.25	<0.25	<0.25
CCME Fraction 3 (C16-C34)	mg/L	0.25	-	<0.25	<0.25	<0.25	<0.25
CCME Fraction 4 (C34-C50)	mg/L	0.25	-	<0.25	<0.25	<0.25	<0.25
Ethylbenzene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005
m+p-Xylene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005
o-Xylene	mg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005
Toluene	mg/L	0.0005	-	<0.0005	<0.0005	0.00124	0.00087
Xylenes	mg/L	0.00071	-	<0.00071	<0.00071	<0.00071	<0.00071

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Indicates sample concentration is greater than five times the detection limit.

Table B.2-2 (Cont'd.)

Variable	Unit	Detection Limit	Concentration in Trip Blank				
			23-Mar-11	18-May-11	14-Jul-11	6-Sep-11	15-Sep-11
Dissolved Metals							
Aluminum (Al)	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Arsenic (As)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium (Ba)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron (B)	mg/L	0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium (Ca)	mg/L	0.1	<0.1	<0.1	<0.1	<0.10	<0.10
Chlorine (Cl)	mg/L	0.3	<0.3	<0.3	<0.3	<0.30	<0.30
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (Cu)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Iron (Fe)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium (Li)	mg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Manganese (Mn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Molybdenum (Mo)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (Ni)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium (Sr)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sulphur (S)	mg/L	2	<2	<2	<2	<2	<2
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium (Ti)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Uranium (U)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium (V)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc (Zn)	mg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Total Metals							
Aluminum (Al)	mg/L	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Arsenic (As)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Barium (Ba)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Boron (B)	mg/L	0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium (Ca)	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorine (Cl)	mg/L	0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (Cu)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Iron (Fe)	mg/L	0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

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Indicates sample concentration is greater than five times the detection limit.

Table B.2-2 (Cont'd.)

Variable	Unit	Detection Limit	Concentration in Trip Blank				
			23-Mar-11	18-May-11	14-Jul-11	6-Sep-11	15-Sep-11
Total Metals (Cont'd.)							
Lithium (Li)	mg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Manganese (Mn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Mercury (Hg), ultra-trace	ng/L	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Molybdenum (Mo)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (Ni)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium (Sr)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sulphur (S)	mg/L	2	<2	<2	<2	<2	<2
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium (Ti)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.000113
Uranium (U)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Vanadium (V)	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Zinc (Zn)	mg/L	0.0002	0.000288	<0.0002	<0.0002	<0.0002	<0.0002
PAHs							
Acenaphthene	ng/L	0.43	-	<0.43	<0.43	<0.43	<0.43
Acenaphthylene	ng/L	0.16	-	<0.16	<0.16	<0.16	<0.16
Anthracene	ng/L	0.11	-	<0.11	0.15	<0.11	<0.11
Benz[a]anthracene	ng/L	0.06	-	-	<0.06	<0.06	<0.06
Benz[a]anthracene	ng/L	0.22	-	<0.22	-	-	-
Benzo[a]pyrene	ng/L	0.14	-	<0.14	<0.14	<0.14	<0.14
Benzo[b,j,k]fluoranthene	ng/L	0.19	-	<0.19	<0.19	<0.19	<0.19
Benzo[g,h,i]perylene	ng/L	0.17	-	-	<0.17	<0.17	<0.17
Benzo[g,h,i]perylene	ng/L	0.24	-	<0.24	-	-	-
Biphenyl	ng/L	1.09	-	<1.09	<1.09	<1.09	<1.09
C1-Acenaphthenes	ng/L	0.15	-	0.55	<0.15	<0.15	<0.15
C1-Benzo[a]anthracenes/Chrysenes	ng/L	0.48	-	<0.48	<0.48	<0.48	<0.48
C1-Benzofluoranthenes/Benzopyrenes	ng/L	0.92	-	<0.92	<0.92	<0.92	<0.92
C1-Biphenyls	ng/L	5.08	-	<5.08	<5.08	<5.08	<5.08
C1-Dibenzothiophenes	ng/L	0.15	-	<0.15	<0.15	<0.15	<0.15
C1-Fluoranthenes/Pyrenes	ng/L	1.65	-	<1.65	<1.65	<1.65	<1.65
C1-Fluorenes	ng/L	4.49	-	<4.49	<4.49	<4.49	<4.49
C1-Naphthalenes	ng/L	12.24	-	<12.24	<12.24	<12.24	<12.24
C1-Phenanthrenes/Anthracenes	ng/L	1.00	-	<1.00	<1.00	<1.00	<1.00
C2-Benzo[a]anthracenes/Chrysenes	ng/L	0.70	-	<0.70	<0.70	<0.70	<0.70
C2-Benzofluoranthenes/Benzopyrenes	ng/L	0.75	-	<0.75	<0.75	<0.75	<0.75
C2-Biphenyls	ng/L	49.03	-	<49.03	<49.03	<49.03	<49.03
C2-Dibenzothiophenes	ng/L	1.56	-	<1.56	<1.56	<1.56	<1.56
C2-Fluoranthenes/Pyrenes	ng/L	1.99	-	<1.99	<1.99	<1.99	<1.99
C2-Fluorenes	ng/L	3.60	-	<3.60	<3.60	<3.60	<3.60
C2-Naphthalenes	ng/L	4.34	-	<4.34	<4.34	<4.34	<4.34
C2-Phenanthrenes/Anthracenes	ng/L	3.01	-	<3.01	<3.01	<3.01	<3.01
C3-Dibenzothiophenes	ng/L	1.65	-	<1.65	<1.65	<1.65	<1.65
C3-Fluoranthenes/Pyrenes	ng/L	1.14	-	<1.14	<1.14	<1.14	<1.14
C3-Fluorenes	ng/L	15.86	-	<15.86	<15.86	<15.86	<15.86

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Indicates sample concentration is greater than five times the detection limit.

Table B.2-2 (Cont'd.)

Variable	Unit	Detection Limit	Concentration in Trip Blank				
			23-Mar-11	18-May-11	14-Jul-11	6-Sep-11	15-Sep-11
PAHs (Cont'd.)							
C3-Naphthalenes	ng/L	3.14	-	<3.14	<3.14	<3.14	<3.14
C3-Phenanthrenes/Anthracenes	ng/L	3.25	-	<3.25	<3.25	<3.25	<3.25
C4-Dibenzothiophenes	ng/L	2.30	-	<2.30	<2.30	<2.30	<2.30
C4-Naphthalenes	ng/L	5.55	-	<5.55	<5.55	<5.55	<5.55
C4-Phenanthrenes/Anthracenes	ng/L	7.72	-	<7.72	<7.72	<7.72	<7.72
Chrysene	ng/L	0.23	-	<0.23	<0.23	<0.23	<0.23
Dibenz[a,h]anthracene	ng/L	0.10	-	<0.10	<0.10	<0.10	<0.10
Dibenzothiophene	ng/L	0.19	-	<0.19	<0.19	<0.19	<0.19
Fluoranthene	ng/L	0.51	-	<0.51	<0.51	<0.51	<0.51
Fluorene	ng/L	0.24	-	<0.24	<0.24	<0.24	<0.24
Indeno[1,2,3-c,d]-pyrene	ng/L	0.31	-	<0.31	<0.31	<0.31	<0.31
Naphthalene	ng/L	14.13	-	<14.13	<14.13	<14.13	<14.13
Phenanthrene	ng/L	0.89	-	<0.89	<0.89	<0.89	<0.89
Pyrene	ng/L	0.43	-	<0.43	<0.43	<0.43	<0.43
Retene	ng/L	2.07	-	<2.07	<2.07	<2.07	<2.07

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Indicates sample concentration is greater than five times the detection limit.

Table B.2-3 Relative percent difference between duplicate water quality samples collected from the Athabasca River (ATR-DD-E), winter 2011.

Analyte	Unit	Detection Limit	ATR-DD-E 24-Mar-11	Duplicate 24-Mar-11	Relative Percent Difference (%)
Conventional Variables					
Conductivity	µS/cm	0.2	474	477	0.6
Dissolved Organic Carbon	mg/L	1	7.6	7.7	1.3
Hardness (as CaCO ₃)	mg/L	-	158	159	0.6
pH	pH units	0.1	7.89	7.84	0.6
Total Alkalinity	mg/L	5	152	151	0.7
Total Dissolved Solids	mg/L	10	288	271	6.1
Total Organic Carbon	mg/L	1	7.7	7.7	0.0
Total Suspended Solids	mg/L	3	3	4	28.6
True Colour	T.C.U.	2	19	19	0.0
Major Ions					
Bicarbonate (HCO ₃)	mg/L	5	186	184	1.1
Calcium (Ca)	mg/L	0.5	43.4	43.9	1.1
Carbonate (CO ₃)	mg/L	5	<5	<5	0.0
Chloride (Cl)	mg/L	0.5	31.5	31.8	0.9
Hydroxide (OH)	mg/L	5	<5	<5	0.0
Magnesium (Mg)	mg/L	0.1	12.1	11.9	1.7
Potassium (K)	mg/L	0.5	1.95	1.98	1.5
Sodium (Na)	mg/L	1	35.4	36.2	2.2
Sulfate (SO ₄)	mg/L	0.5	41.4	41.7	0.7
Sulphide (S ₂)	mg/L	0.002	0.0039	0.0036	8.0
Nutrients and BOD					
Ammonia-N	mg/L	0.05	<0.05	<0.05	0.0
Biochemical Oxygen Demand	mg/L	2	<2	<2	0.0
Nitrate+Nitrite	mg/L	0.071	0.227	0.227	0.0
Phosphorus, dissolved	mg/L	0.001	0.018	0.0182	1.1
Phosphorus, total	mg/L	0.001	0.0321	0.0325	1.2
Total Kjeldahl Nitrogen	mg/L	0.2	0.34	0.34	0.0
Total Nitrogen	mg/L	-	0.567	0.567	0.0
Hydrocarbons					
Naphthenic Acids	mg/L	0.02	0.52	0.88	51.4
OilSands Acid Extractable	mg/L	0.1	2.17	1.88	14.3
Total Phenols	mg/L	0.001	0.0027	0.0024	11.8
Total Rec. Hydrocarbons	mg/L	1	<1	<1	0.0
Dissolved Metals					
Aluminum (Al)	mg/L	0.001	0.00313	0.00322	2.8
Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005	0.0
Arsenic (As)	mg/L	0.0001	0.000346	0.000384	10.4
Barium (Ba)	mg/L	0.0001	0.0607	0.0595	2.0
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	0.0
Boron (B)	mg/L	0.0008	0.0377	0.0386	2.4
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-3 (Cont'd.)

Analyte	Unit	Detection Limit	ATR-DD-E 24-Mar-11	Duplicate 24-Mar-11	Relative Percent Difference (%)
Dissolved Metals (cont'd.)					
Calcium (Ca)	mg/L	0.1	42.8	43.2	0.9
Chlorine (Cl)	mg/L	0.3	29.5	30.3	2.7
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	0.0
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	0.0
Copper (Cu)	mg/L	0.0001	0.000546	0.00072	27.5
Iron (Fe)	mg/L	0.004	0.128	0.12	6.5
Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001	0.0
Lithium (Li)	mg/L	0.0002	0.00834	0.00814	2.4
Manganese (Mn)	mg/L	0.0001	0.0102	0.00977	4.3
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Molybdenum (Mo)	mg/L	0.0001	0.000807	0.000785	2.8
Nickel (Ni)	mg/L	0.0001	0.000163	0.000126	25.6
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	0.0
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	0.0
Strontium (Sr)	mg/L	0.0001	0.302	0.301	0.3
Sulphur (S)	mg/L	2	14	13.3	5.1
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001	0.0
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.0001	0.00121	0.000923	26.9
Uranium (U)	mg/L	0.0001	0.000372	0.000364	2.2
Vanadium (V)	mg/L	0.0001	0.000239	0.000239	0.0
Zinc (Zn)	mg/L	0.0002	0.00155	0.00229	38.5
Total Metals					
Aluminum (Al)	mg/L	0.003	0.0732	0.0617	17.0
Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005	0.0
Arsenic (As)	mg/L	0.0001	0.000505	0.000486	3.8
Barium (Ba)	mg/L	0.0001	0.0636	0.0659	3.6
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	0.0
Boron (B)	mg/L	0.0008	0.0411	0.041	0.2
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	0.0
Calcium (Ca)	mg/L	0.1	44.2	46.4	4.9
Chlorine (Cl)	mg/L	0.3	30.3	32.2	6.1
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	0.0
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	0.0
Copper (Cu)	mg/L	0.0001	0.000552	0.000728	27.5
Iron (Fe)	mg/L	0.004	0.335	0.344	2.7
Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001	0.0
Lithium (Li)	mg/L	0.0002	0.00883	0.00897	1.6
Manganese (Mn)	mg/L	0.0001	0.0153	0.0156	1.9
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-3 (Cont'd.)

Analyte	Unit	Detection Limit	ATR-DD-E 24-Mar-11	Duplicate 24-Mar-11	Relative Percent Difference (%)
Total Metals (cont'd.)					
Mercury (Hg), ultra-trace	ng/L	0.6	<0.6	0.8	28.6
Molybdenum (Mo)	mg/L	0.0001	0.000829	0.000823	0.7
Nickel (Ni)	mg/L	0.0001	0.000215	0.000215	0.0
Selenium (Se)	mg/L	0.0003	0.000308	0.00032	3.8
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	0.0
Strontium (Sr)	mg/L	0.0001	0.313	0.324	3.5
Sulphur (S)	mg/L	2	14.2	14.4	1.4
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001	0.0
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.0001	0.0025	0.00205	19.8
Uranium (U)	mg/L	0.0001	0.000399	0.000399	0.0
Vanadium (V)	mg/L	0.0001	0.000518	0.000484	6.8
Zinc (Zn)	mg/L	0.0002	0.00254	0.00256	0.8

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

- # Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.
- # Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-4 Relative percent difference between duplicate water quality samples collected from the Athabasca River (ATR-DC-E), summer 2011.

Analyte	Unit	Detection Limit	ATR-DC-E 14-July-11	Duplicate 14-July-11	Relative Percent Difference (%)
Conventional Variables					
Conductivity	µS/cm	0.2	187	186	0.5
Dissolved Organic Carbon	mg/L	1	21.6	19.6	9.7
Hardness (as CaCO ₃)	mg/L	-	81	79.9	1.4
pH	pH units	0.1	8.1	8.08	0.2
Total Alkalinity	mg/L	5	79.7	77.8	2.4
Total Dissolved Solids	mg/L	10	97	103	6.0
Total Organic Carbon	mg/L	1	21.5	22.5	4.5
Total Suspended Solids	mg/L	3	464	495	6.5
True Colour	T.C.U.	2	123	123	0.0
Major Ions					
Bicarbonate (HCO ₃)	mg/L	5	97.2	95	2.3
Calcium (Ca)	mg/L	0.5	23.2	23	0.9
Carbonate (CO ₃)	mg/L	5	<5	<5	0.0
Chloride (Cl)	mg/L	0.5	4.42	4.48	1.3
Hydroxide (OH)	mg/L	5	<5	<5	0.0
Magnesium (Mg)	mg/L	0.1	5.61	5.46	2.7
Potassium (K)	mg/L	0.5	1.32	1.3	1.5
Sodium (Na)	mg/L	1	8.1	8	1.2
Sulfate (SO ₄)	mg/L	0.5	9.11	9.1	0.1
Sulphide (S ₂)	mg/L	0.002	0.0095	<0.002	130.4
Nutrients and BOD					
Ammonia-N	mg/L	0.05	<0.05	0.053	5.8
Biochemical Oxygen Demand	mg/L	2	<2	<2	0.0
Nitrate+Nitrite	mg/L	0.071	<0.071	<0.071	0.0
Phosphorus, dissolved	mg/L	0.001	0.0232	0.018	25.2
Phosphorus, total	mg/L	0.001	0.722	0.712	1.4
Total Kjeldahl Nitrogen	mg/L	0.2	1.72	1.54	11.0
Total Nitrogen	mg/L	-	1.791	1.611	10.6
Hydrocarbons					
Naphthenic Acids	mg/L	0.02	0.00	0.00	0.0
OilSands Acid Extractable	mg/L	0.1	0.00	0.00	0.0
Total Phenols	mg/L	0.001	0.0099	0.0065	41.5
Total Rec. Hydrocarbons	mg/L	1	<1	<1	0.0
Hydrocarbons and Organic Compounds					
Benzene	mg/L	0.0005	<0.0005	<0.0005	0.0
Ethylbenzene	mg/L	0.0005	<0.0005	<0.0005	0.0
F1(C6-C10)	mg/L	0.1	<0.1	<0.1	0.0
F1-BTEX	mg/L	0.1	<0.1	<0.1	0.0
F2 (>C10-C16)	mg/L	0.25	<0.25	<0.25	0.0
F3 (C16-C34)	mg/L	0.25	<0.25	<0.25	0.0
F4 (C34-C50)	mg/L	0.25	<0.25	<0.25	0.0
m+p-Xylene	mg/L	0.0005	<0.0005	<0.0005	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-4 (Cont'd.)

Analyte	Unit	Detection Limit	ATR-DC-E 14-July-11	Duplicate 14-July-11	Relative Percent Difference (%)
Hydrocarbons and Organic Compounds (cont'd.)					
o-Xylene	mg/L	0.0005	<0.0005	<0.0005	0.0
Toluene	mg/L	0.0005	<0.0005	<0.0005	0.0
Xylenes	mg/L	0.00071	<0.00071	<0.00071	0.0
Dissolved Metals					
Aluminum (Al)	mg/L	0.001	0.0762	0.0707	7.5
Antimony (Sb)	mg/L	0.00005	0.000159	0.000159	0.0
Arsenic (As)	mg/L	0.0001	0.000868	0.000889	2.4
Barium (Ba)	mg/L	0.0001	0.0484	0.0445	8.4
Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	0.0
Boron (B)	mg/L	0.0008	0.0216	0.0246	13.0
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	0.0
Calcium (Ca)	mg/L	0.1	20.2	22	8.5
Chlorine (Cl)	mg/L	0.3	2.43	2.88	16.9
Chromium (Cr)	mg/L	0.0003	0.000313	0.000523	50.2
Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001	0.0
Copper (Cu)	mg/L	0.0001	0.00508	0.00446	13.0
Iron (Fe)	mg/L	0.004	0.295	0.254	14.9
Lead (Pb)	mg/L	0.0001	0.000433	0.00026	49.9
Lithium (Li)	mg/L	0.0002	0.00304	0.00645	71.9
Manganese (Mn)	mg/L	0.0001	0.00224	0.00176	24.0
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Molybdenum (Mo)	mg/L	0.0001	0.000222	0.000212	4.6
Nickel (Ni)	mg/L	0.0001	0.00295	0.00288	2.4
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	0.0
Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001	0.0
Strontium (Sr)	mg/L	0.0001	0.115	0.117	1.7
Sulphur (S)	mg/L	2	2.18	2.59	17.2
Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.0001	0.000188	0.000174	7.7
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.0001	0.0112	0.0106	5.5
Uranium (U)	mg/L	0.0001	0.000408	0.000376	8.2
Vanadium (V)	mg/L	0.0001	0.000714	0.000663	7.4
Zinc (Zn)	mg/L	0.0002	0.00186	0.00178	4.4
Total Metals					
Aluminum (Al)	mg/L	0.003	12.3	10.3	17.7
Antimony (Sb)	mg/L	0.00005	0.000161	0.000161	0.0
Arsenic (As)	mg/L	0.0001	0.00343	0.00336	2.1
Barium (Ba)	mg/L	0.0001	0.297	0.27	9.5
Beryllium (Be)	mg/L	0.0001	0.000535	0.000555	3.7
Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001	0.0
Boron (B)	mg/L	0.0008	0.0312	0.0317	1.6

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-4 (Cont'd.)

Analyte	Unit	Detection Limit	ATR-DC-E 14-July-11	Duplicate 14-July-11	Relative Percent Difference (%)
Total Metals (cont'd).					
Cadmium (Cd)	mg/L	0.0001	0.00028	0.000261	7.0
Calcium (Ca)	mg/L	0.1	25.2	28.2	11.2
Chlorine (Cl)	mg/L	0.3	2.46	2.91	16.8
Chromium (Cr)	mg/L	0.0003	0.0138	0.0126	9.1
Cobalt (Co)	mg/L	0.0001	0.00547	0.00524	4.3
Copper (Cu)	mg/L	0.0001	0.0125	0.0119	4.9
Iron (Fe)	mg/L	0.004	12.7	12.1	4.8
Lead (Pb)	mg/L	0.0001	0.0106	0.0098	7.8
Lithium (Li)	mg/L	0.0002	0.0157	0.0199	23.6
Manganese (Mn)	mg/L	0.0001	0.312	0.306	1.9
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Mercury (Hg), ultra-trace	ng/L	0.6	9.2	12.3	23.3
Molybdenum (Mo)	mg/L	0.0001	0.000224	0.000214	4.6
Nickel (Ni)	mg/L	0.0001	0.0155	0.0149	3.9
Selenium (Se)	mg/L	0.0003	<0.0003	0.000355	16.8
Silver (Ag)	mg/L	0.00001	0.000043	<0.00001	124.5
Strontium (Sr)	mg/L	0.0001	0.13	0.129	0.8
Sulphur (S)	mg/L	2	2.2	2.62	17.4
Thallium (Tl)	mg/L	0.0001	0.000244	0.00022	10.3
Thorium (Th)	mg/L	0.0001	0.00337	0.00299	11.9
Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.0001	0.0689	0.0571	18.7
Uranium (U)	mg/L	0.0001	0.00135	0.00131	3.0
Vanadium (V)	mg/L	0.0001	0.0232	0.0207	11.4
Zinc (Zn)	mg/L	0.0002	0.0418	0.04	4.4
PAHs					
Acenaphthene	mg/L	0.43	2.95	1.78	49.5
Acenaphthylene	mg/L	0.16	0.31	<0.16	60.7
Anthracene	mg/L	0.11	0.95	0.57	49.6
Benz[a]anthracene	mg/L	0.06	2.09	1.24	51.1
Benzo[a]pyrene	mg/L	0.14	5.39	2.70	66.5
Benzo[b,j,k]fluoranthene	mg/L	0.19	10.20	6.55	43.6
Benzo[g,h,i]perylene	mg/L	0.17	6.99	3.81	58.9
Biphenyl	mg/L	1.09	5.70	2.83	67.3
C1-Acenaphthenes	mg/L	0.15	0.72	0.31	79.3
C1-Benzo[a]anthracenes/Chrysenes	mg/L	0.48	37.40	23.20	46.9
C1-Benzofluoranthenes/Benzopyrenes	mg/L	0.92	44.40	24.90	56.3
C1-Biphenyls	mg/L	5.08	7.49	<5.08	38.4
C1-Dibenzothiophenes	mg/L	0.15	7.57	2.38	104.3
C1-Fluoranthenes/Pyrenes	mg/L	1.65	95.70	53.60	56.4
C1-Fluorenes	mg/L	4.49	18.50	9.71	62.3
C1-Naphthalenes	mg/L	12.24	21.10	<12.24	53.1
C1-Phenanthrenes/Anthracenes	mg/L	1.00	31.50	15.80	66.4

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-4 (Cont'd.)

Analyte	Unit	Detection Limit	ATR-DC-E 14-July-11	Duplicate 14-July-11	Relative Percent Difference (%)
PAHs (cont'd.)					
C2-Benzo[a]anthracenes/Chrysenes	mg/L	0.70	39.50	29.60	28.7
C2-Benzofluoranthenes/Benzopyrenes	mg/L	0.75	15.60	10.50	39.1
C2-Biphenyls	mg/L	49.03	<49.03	<49.03	0.0
C2-Dibenzothiophenes	mg/L	1.56	56.30	40.20	33.4
C2-Fluoranthenes/Pyrenes	mg/L	1.99	135.00	89.30	40.7
C2-Fluorenes	mg/L	3.60	45.30	29.20	43.2
C2-Naphthalenes	mg/L	4.34	45.20	19.40	79.9
C2-Phenanthrenes/Anthracenes	mg/L	3.01	52.90	31.20	51.6
C3-Dibenzothiophenes	mg/L	1.65	82.60	60.20	31.4
C3-Fluoranthenes/Pyrenes	mg/L	1.14	96.60	69.20	33.1
C3-Fluorenes	mg/L	15.86	63.20	37.80	50.3
C3-Naphthalenes	mg/L	3.14	67.50	25.50	90.3
C3-Phenanthrenes/Anthracenes	mg/L	3.25	57.10	40.20	34.7
C4-Dibenzothiophenes	mg/L	2.30	73.10	60.10	19.5
C4-Naphthalenes	mg/L	5.55	87.20	36.70	81.5
C4-Phenanthrenes/Anthracenes	mg/L	7.72	273.00	184.00	38.9
Chrysene	mg/L	0.23	13.60	7.30	60.3
Dibenz[a,h]anthracene	mg/L	0.10	1.22	0.69	55.8
Dibenzothiophene	mg/L	0.19	2.29	1.00	78.7
Fluoranthene	mg/L	0.51	5.79	2.66	74.1
Fluorene	mg/L	0.24	2.43	1.31	59.9
Indeno[1,2,3-c,d]-pyrene	mg/L	0.31	4.19	1.98	71.6
Naphthalene	mg/L	14.13	<14.13	<14.13	0.0
Phenanthrene	mg/L	0.89	17.00	7.98	72.2
Pyrene	mg/L	0.43	10.90	5.45	66.7
Retene	mg/L	2.07	98.10	58.10	51.2

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

- # Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.
- # Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-5 Relative percent difference between duplicate water quality samples collected from the MacKay River (MAR-2), fall 2011.

Analyte	Unit	Detection Limit	MAR-2 15-Sep-11	Duplicate 15-Sept-11	Relative Percent Difference (%)
Conventional Variables					
Conductivity	µS/cm	0.2	228	228	0.0
Dissolved Organic Carbon	mg/L	1	33.5	33.8	0.9
Hardness (as CaCO ₃)	mg/L	-	102	94	8.2
pH	pH units	0.1	8.27	8.27	0.0
Total Alkalinity	mg/L	5	104	103	1.0
Total Dissolved Solids	mg/L	10	207	211	1.9
Total Organic Carbon	mg/L	1	35.7	35.5	0.6
Total Suspended Solids	mg/L	3	<3	<3	0.0
True Colour	T.C.U.	2	197	203	3.0
Major Ions					
Bicarbonate (HCO ₃)	mg/L	5	127	126	0.8
Calcium (Ca)	mg/L	0.5	26.2	24.7	5.9
Carbonate (CO ₃)	mg/L	5	<5	<5	0.0
Chloride (Cl)	mg/L	0.5	0.66	0.65	1.5
Hydroxide (OH)	mg/L	5	<5	<5	0.0
Magnesium (Mg)	mg/L	0.1	8.77	7.85	11.1
Potassium (K)	mg/L	0.5	0.66	0.66	0.0
Sodium (Na)	mg/L	1	13.6	12.4	9.2
Sulfate (SO ₄)	mg/L	0.5	13.1	13.1	0.0
Sulphide (S ₂)	mg/L	0.002	0.0215	0.0213	0.9
Nutrients and BOD					
Ammonia-N	mg/L	0.05	<0.05	<0.05	0.0
Biochemical Oxygen Demand	mg/L	2	<2	<2	0.0
Nitrate+Nitrite	mg/L	0.071	<0.071	<0.071	0.0
Phosphorus, dissolved	mg/L	0.001	0.0371	0.0388	4.5
Phosphorus, total	mg/L	0.001	0.053	0.0531	0.2
Total Kjeldahl Nitrogen	mg/L	0.2	1.06	1.1	3.7
Total Nitrogen	mg/L	-	1.131	1.171	3.5
Hydrocarbons					
Naphthenic Acids	mg/L	0.02	0.25	0.19	27.3
Oilsands Acid Extractable			0.79	0.67	16.4
Total Phenols	mg/L	0.001	0.0078	0.0084	7.4
Total Rec. Hydrocarbons	mg/L	1	<1	<1	0.0
Hydrocarbons and Organic Compounds					
Benzene	mg/L	0.0005	<0.0005	<0.0005	0.0
CCME Fraction 1 (BTEX)	mg/L	0.1	<0.1	<0.1	0.0
CCME Fraction 1 (C6-C10)	mg/L	0.1	<0.1	<0.1	0.0
CCME Fraction 2 (C10-C16)	mg/L	0.25	<0.25	<0.25	0.0
CCME Fraction 3 (C16-C34)	mg/L	0.25	<0.25	<0.25	0.0
CCME Fraction 4 (C34-C50)	mg/L	0.25	<0.25	<0.25	0.0
Ethylbenzene	mg/L	0.0005	<0.0005	<0.0005	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-5 (Cont'd.)

Analyte	Unit	Detection Limit	MAR-2 15-Sep-11	Duplicate 15-Sept-11	Relative Percent Difference (%)
Hydrocarbons and Organic Compounds (cont'd).					
m+p-Xylene	mg/L	0.0005	<0.0005	<0.0005	0.0
o-Xylene	mg/L	0.0005	<0.0005	<0.0005	0.0
Toluene	mg/L	0.0005	<0.0005	<0.0005	0.0
Xylenes	mg/L	0.00071	<0.00071	<0.00071	0.0
Dissolved Metals					
Aluminum (Al)	mg/L	0.001	0.0224	0.0226	0.9
Antimony (Sb)	mg/L	0.000001	<0.00005	<0.00005	0.0
Arsenic (As)	mg/L	0.00004	0.000862	0.000846	1.9
Barium (Ba)	mg/L	0.0001	0.0164	0.016	2.5
Beryllium (Be)	mg/L	0.00001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.00001	<0.0001	<0.0001	0.0
Boron (B)	mg/L	0.0008	0.0577	0.0571	1.0
Cadmium (Cd)	mg/L	0.000006	<0.0001	<0.0001	0.0
Calcium (Ca)	mg/L	0.1	24.2	24.1	0.4
Chlorine (Cl)	mg/L	0.3	0.572	0.536	6.5
Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003	0.0
Cobalt (Co)	mg/L	0.00001	0.000119	0.000114	4.3
Copper (Cu)	mg/L	0.0001	0.000566	0.000791	33.2
Iron (Fe)	mg/L	0.004	0.841	0.823	2.2
Lead (Pb)	mg/L	0.00001	0.000105	0.000101	3.9
Lithium (Li)	mg/L	0.0002	0.0163	0.0165	1.2
Manganese (Mn)	mg/L	0.00003	0.0175	0.0177	1.1
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Molybdenum (Mo)	mg/L	0.000008	0.000308	0.000294	4.7
Nickel (Ni)	mg/L	0.00006	0.000322	0.000284	12.5
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	0.0
Silver (Ag)	mg/L	0.000005	<0.00001	<0.00001	0.0
Strontium (Sr)	mg/L	0.000008	0.125	0.123	1.6
Sulphur (S)	mg/L	0.6	4.25	4.13	2.9
Thallium (Tl)	mg/L	0.000003	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.00003	<0.0001	<0.0001	0.0
Tin (Sn)	mg/L	0.00007	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.00007	0.00199	0.00201	1.0
Uranium (U)	mg/L	0.000003	0.000133	0.000135	1.5
Vanadium (V)	mg/L	0.00005	0.000375	0.000364	3.0
Zinc (Zn)	mg/L	0.0002	0.000869	0.000865	0.5
Total Metals					
Aluminum (Al)	mg/L	0.002	0.131	0.104	23.0
Antimony (Sb)	mg/L	0.000001	<0.00005	<0.00005	0.0
Arsenic (As)	mg/L	0.00004	0.00109	0.00107	1.9
Barium (Ba)	mg/L	0.0001	0.0194	0.0194	0.0
Beryllium (Be)	mg/L	0.00001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.00001	<0.0001	<0.0001	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.
Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-5 (Cont'd.)

Analyte	Unit	Detection Limit	MAR-2 15-Sep-11	Duplicate 15-Sept-11	Relative Percent Difference (%)
Total Metals (cont'd).					
Cadmium (Cd)	mg/L	0.000006	<0.0001	<0.0001	0.0
Calcium (Ca)	mg/L	0.1	27.2	27.4	0.7
Chlorine (Cl)	mg/L	0.3	0.612	0.597	2.5
Chromium (Cr)	mg/L	0.0003	0.000344	<0.0003	13.7
Cobalt (Co)	mg/L	0.00001	0.000159	0.000154	3.2
Copper (Cu)	mg/L	0.0001	0.000572	0.0008	33.2
Iron (Fe)	mg/L	0.004	1.23	1.21	1.6
Lead (Pb)	mg/L	0.00001	0.000149	0.000145	2.7
Lithium (Li)	mg/L	0.0002	0.0189	0.0188	0.5
Manganese (Mn)	mg/L	0.00003	0.0294	0.0291	1.0
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Mercury (Hg), ultra-trace	ng/L	0.6	0.6	<0.6	0.0
Molybdenum (Mo)	mg/L	0.000008	0.000332	0.000332	0.0
Nickel (Ni)	mg/L	0.00006	0.000326	0.000311	4.7
Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003	0.0
Silver (Ag)	mg/L	0.000005	<0.00001	<0.00001	0.0
Strontium (Sr)	mg/L	0.000008	0.139	0.139	0.0
Sulphur (S)	mg/L	0.6	4.68	4.68	0.0
Thallium (Tl)	mg/L	0.000003	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.00003	<0.0001	<0.0001	0.0
Tin (Sn)	mg/L	0.00007	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.00007	0.00348	0.00231	40.4
Uranium (U)	mg/L	0.000003	0.000152	0.000144	5.4
Vanadium (V)	mg/L	0.00005	0.000672	0.000638	5.2
Zinc (Zn)	mg/L	0.0002	0.000969	0.00105	8.0
PAHs ²					
Acenaphthene	mg/L	-	<0.43	<0.87	66.7
Acenaphthylene	mg/L	-	<0.31	<0.33	5.7
Anthracene	mg/L	-	<0.16	<0.21	31.4
Benz[a]anthracene	mg/L	-	<0.06	<0.13	66.7
Benzo[a]pyrene	mg/L	-	<0.15	<0.29	62.1
Benzo[b,j,k]fluoranthene	mg/L	-	<0.19	<0.38	66.7
Benzo[g,h,i]perylene	mg/L	-	<0.17	<0.34	66.7
Biphenyl	mg/L	-	1.23	<2.18	55.9
C1-Acenaphthenes	mg/L	-	<0.41	<0.29	33.8
C1-Benzo[a]anthracenes/Chrysenes	mg/L	-	<0.48	<0.95	66.7
C1-Benzofluoranthenes/Benzopyrenes	mg/L	-	<0.92	<1.84	66.7
C1-Biphenyls	mg/L	-	<5.08	<10.15	66.7
C1-Dibenzothiophenes	mg/L	-	0.61	<0.29	70.4
C1-Fluoranthenes/Pyrenes	mg/L	-	6.73	<3.31	68.2
C1-Fluorenes	mg/L	-	<4.49	<8.98	66.7
C1-Naphthalenes	mg/L	-	<12.24	<24.48	66.7

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

² PAH detection limits were variable and therefore are not displayed

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Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-5 (Cont'd.)

Analyte	Unit	Detection Limit	MAR-2 15-Sep-11	Duplicate 15-Sept-11	Relative Percent Difference (%)
PAHs (cont'd).²					
C1-Phenanthrenes/Anthracenes	mg/L	-	4.85	<1.99	83.5
C2-Benzo[a]anthracenes/Chrysenes	mg/L	-	<0.70	<1.41	66.7
C2-Benzofluoranthenes/Benzopyrenes	mg/L	-	<0.75	<1.49	66.7
C2-Biphenyls	mg/L	-	<49.03	<98.07	66.7
C2-Dibenzothiophenes	mg/L	-	4.42	<3.12	34.6
C2-Fluoranthenes/Pyrenes	mg/L	-	3.33	<3.98	17.7
C2-Fluorenes	mg/L	-	4.17	<7.21	53.4
C2-Naphthalenes	mg/L	-	<4.34	<8.68	66.7
C2-Phenanthrenes/Anthracenes	mg/L	-	11.30	<6.02	61.0
C3-Dibenzothiophenes	mg/L	-	6.46	<3.30	64.8
C3-Fluoranthenes/Pyrenes	mg/L	-	<1.14	<2.29	66.7
C3-Fluorenes	mg/L	-	<15.86	<31.71	66.7
C3-Naphthalenes	mg/L	-	3.94	<6.28	45.8
C3-Phenanthrenes/Anthracenes	mg/L	-	10.70	<6.49	48.9
C4-Dibenzothiophenes	mg/L	-	4.40	<4.60	4.4
C4-Naphthalenes	mg/L	-	7.38	<11.10	40.3
C4-Phenanthrenes/Anthracenes	mg/L	-	9.47	<15.45	48.0
Chrysene	mg/L	-	<0.23	<0.45	66.7
Dibenz[a,h]anthracene	mg/L	-	<0.10	<0.19	66.7
Dibenzothiophene	mg/L	-	0.22	<0.38	54.0
Fluoranthene	mg/L	-	<0.51	<1.02	66.7
Fluorene	mg/L	-	<0.24	<0.48	66.7
Indeno[1,2,3-c,d]-pyrene	mg/L	-	<0.31	<0.63	66.7
Naphthalene	mg/L	-	<14.13	<28.26	66.7
Phenanthrene	mg/L	-	<0.89	<1.78	66.7
Pyrene	mg/L	-	0.91	<0.87	4.1
Retene	mg/L	-	<2.07	<4.14	66.7

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

² PAH detection limits were variable and therefore are not displayed

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.
#	Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-6 Relative percent difference between duplicate water quality samples collected from the Beaver River (BER-2), fall 2011.

Analyte	Unit	Detection Limit	BER-2 6-Sep-11	Duplicate 6-Sep-11	Relative Percent Difference (%)
Conventional Variables					
Conductivity	µS/cm	0.2	511	513	0.4
Dissolved Organic Carbon	mg/L	1	22.5	23.3	3.5
Hardness (as CaCO ₃)	mg/L	-	135	134	0.7
pH	pH units	0.1	8.35	8.33	0.2
Total Alkalinity	mg/L	5	266	267	0.4
Total Dissolved Solids	mg/L	30	348	279	22.0
Total Organic Carbon	mg/L	1	22.4	20.9	6.9
Total Suspended Solids	mg/L	3	9	14	43.5
True Colour	T.C.U.	2	82.8	90.4	8.8
Major Ions					
Bicarbonate (HCO ₃)	mg/L	5	321	323	0.6
Calcium (Ca)	mg/L	0.5	34.1	33.5	1.8
Carbonate (CO ₃)	mg/L	5	<5	<5	0.0
Chloride (Cl)	mg/L	0.5	1.35	1.34	0.7
Hydroxide (OH)	mg/L	5	<5	<5	0.0
Magnesium (Mg)	mg/L	0.1	12.2	12.3	0.8
Potassium (K)	mg/L	0.5	1.61	1.66	3.1
Sodium (Na)	mg/L	1	67.7	67.2	0.7
Sulfate (SO ₄)	mg/L	0.5	12.5	12.4	0.8
Sulphide (S ₂)	mg/L	0.002	0.0061	0.0045	30.2
Nutrients and BOD					
Ammonia-N	mg/L	0.05	<0.05	<0.05	0.0
Biochemical Oxygen Demand	mg/L	2	<2	<2	0.0
Nitrate+Nitrite	mg/L	0.071	<0.0710	<0.0710	0.0
Phosphorus, dissolved	mg/L	0.001	0.0563	0.0767	30.7
Phosphorus, total	mg/L	0.001	0.133	0.176	27.8
Total Kjeldahl Nitrogen	mg/L	0.2	0.82	0.67	20.1
Total Nitrogen	mg/L	-	0.891	0.741	18.4
Hydrocarbons					
Naphthenic Acids	mg/L	0.02	0.44	0.38	14.6
Oilsands Acid Extractable	mg/L	0.1	0.88	1.33	40.7
Total Phenols	mg/L	0.001	0.0061	0.0061	0.0
Total Rec. Hydrocarbons	mg/L	1	<1	<1	0.0
Hydrocarbons and Organic Compounds					
Benzene	mg/L	0.0005	<0.0005	<0.0005	0.0
CCME Fraction 1 (BTEX)	mg/L	0.1	<0.1	<0.1	0.0
CCME Fraction 1 (C6-C10)	mg/L	0.1	<0.1	<0.1	0.0
CCME Fraction 2 (C10-C16)	mg/L	0.25	<0.25	<0.25	0.0
CCME Fraction 3 (C16-C34)	mg/L	0.25	<0.25	<0.25	0.0
CCME Fraction 4 (C34-C50)	mg/L	0.25	<0.25	<0.25	0.0
Ethylbenzene	mg/L	0.0005	<0.0005	<0.0005	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-6 (Cont'd.)

Analyte	Unit	Detectio n Limit	BER-2 6-Sep-11	Duplicate 6-Sep-11	Relative Percent Difference (%)
Hydrocarbons and Organic Compounds (cont'd).					
m+p-Xylene	mg/L	0.0005	<0.0005	<0.0005	0.0
o-Xylene	mg/L	0.0005	<0.0005	<0.0005	0.0
Toluene	mg/L	0.0005	<0.0005	<0.0005	0.0
Xylenes	mg/L	0.00071	<0.00071	<0.00071	0.0
Dissolved Metals					
Aluminum (Al)	mg/L	0.001	0.0177	0.0201	12.7
Antimony (Sb)	mg/L	0.000001	0.0000606	0.0000585	3.5
Arsenic (As)	mg/L	0.00006	0.00112	0.0011	1.8
Barium (Ba)	mg/L	0.0001	0.0303	0.0305	0.7
Beryllium (Be)	mg/L	0.00001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.00001	<0.0001	<0.0001	0.0
Boron (B)	mg/L	0.0008	0.4	0.386	3.6
Cadmium (Cd)	mg/L	0.000006	<0.0001	<0.0001	0.0
Calcium (Ca)	mg/L	0.1	33.8	33.8	0.0
Chlorine (Cl)	mg/L	0.3	1.09	1.1	0.9
Chromium (Cr)	mg/L	0.0003	<0.0003	0.000375	22.2
Cobalt (Co)	mg/L	0.00001	<0.0001	<0.0001	0.0
Copper (Cu)	mg/L	0.0001	0.00096	0.00119	21.4
Iron (Fe)	mg/L	0.004	0.737	0.742	0.7
Lead (Pb)	mg/L	0.000006	0.000105	0.000133	23.5
Lithium (Li)	mg/L	0.0002	0.0445	0.0422	5.3
Manganese (Mn)	mg/L	0.00003	0.00494	0.00506	2.4
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Molybdenum (Mo)	mg/L	0.000008	0.000611	0.000629	2.9
Nickel (Ni)	mg/L	0.00006	<0.0001	<0.0001	0.0
Selenium (Se)	mg/L	0.0002	<0.0003	<0.0003	0.0
Silver (Ag)	mg/L	0.000005	<0.00001	<0.00001	0.0
Strontium (Sr)	mg/L	0.000008	0.244	0.243	0.4
Sulphur (S)	mg/L	0.6	4.19	4.18	0.2
Thallium (Tl)	mg/L	0.000003	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.00003	<0.0001	<0.0001	0.0
Tin (Sn)	mg/L	0.00007	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.00007	0.00226	0.00225	0.4
Uranium (U)	mg/L	0.000003	0.000309	0.000321	3.8
Vanadium (V)	mg/L	0.00005	0.000929	0.000957	3.0
Zinc (Zn)	mg/L	0.0002	0.000688	0.00137	66.3
Total Metals					
Aluminum (Al)	mg/L	0.002	0.501	0.469	6.6
Antimony (Sb)	mg/L	0.000001	0.0000613	0.0000592	3.5
Arsenic (As)	mg/L	0.00006	0.00161	0.00161	0.0
Barium (Ba)	mg/L	0.0001	0.0413	0.0406	1.7
Beryllium (Be)	mg/L	0.00001	<0.0001	<0.0001	0.0
Bismuth (Bi)	mg/L	0.00001	<0.0001	<0.0001	0.0

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

#	Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.
#	Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-6 (Cont'd.)

Analyte	Unit	Detection Limit	BER-2 6-Sep-11	Duplicate 6-Sep-11	Relative Percent Difference (%)
Total Metals (cont'd).					
Boron (B)	mg/L	0.0008	0.424	0.414	2.4
Cadmium (Cd)	mg/L	0.000006	<0.0001	<0.0001	0.0
Calcium (Ca)	mg/L	0.1	36.7	36	1.9
Chlorine (Cl)	mg/L	0.3	1.17	1.14	2.6
Chromium (Cr)	mg/L	0.0003	0.000619	0.0006	3.1
Cobalt (Co)	mg/L	0.00001	0.000184	0.000186	1.1
Copper (Cu)	mg/L	0.0001	0.00108	0.0012	10.5
Iron (Fe)	mg/L	0.004	1.86	1.86	0.0
Lead (Pb)	mg/L	0.000006	0.000321	0.00035	8.6
Lithium (Li)	mg/L	0.0002	0.0483	0.0465	3.8
Manganese (Mn)	mg/L	0.00003	0.0581	0.0576	0.9
Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005	0.0
Mercury (Hg), ultra-trace	ng/L	1.2	0.9	1.1	20.0
Molybdenum (Mo)	mg/L	0.000008	0.000634	0.000633	0.2
Nickel (Ni)	mg/L	0.00006	<0.0001	<0.0001	0.0
Selenium (Se)	mg/L	0.0002	<0.0003	<0.0003	0.0
Silver (Ag)	mg/L	0.000005	<0.00001	0.0000117	15.7
Strontium (Sr)	mg/L	0.000008	0.267	0.262	1.9
Sulphur (S)	mg/L	0.6	4.51	4.33	4.1
Thallium (Tl)	mg/L	0.000003	<0.0001	<0.0001	0.0
Thorium (Th)	mg/L	0.00003	0.0001	<0.0001	0.0
Tin (Sn)	mg/L	0.00007	<0.0001	<0.0001	0.0
Titanium (Ti)	mg/L	0.00007	0.0141	0.00929	41.1
Uranium (U)	mg/L	0.000003	0.000342	0.00034	0.6
Vanadium (V)	mg/L	0.0002	0.00237	0.00231	2.6
Zinc (Zn)	mg/L	0.0002	0.00201	0.00327	47.7
PAHs ²					
Acenaphthene	mg/L	-	<0.43	<0.87	66.7
Acenaphthylene	mg/L	-	<0.16	<0.33	66.7
Anthracene	mg/L	-	<0.11	<0.21	66.7
Benz[a]anthracene	mg/L	-	<0.06	<0.13	66.7
Benzo[a]pyrene	mg/L	-	<0.14	<0.29	66.7
Benzo[b,j,k]fluoranthene	mg/L	-	<0.19	<0.38	66.7
Benzo[g,h,i]perylene	mg/L	-	<0.17	<0.34	66.7
Biphenyl	mg/L	-	<1.09	<2.18	66.7
C1-Acenaphthenes	mg/L	-	<0.15	<0.29	66.7
C1-Benzo[a]anthracenes/Chrysenes	mg/L	-	<0.48	<0.95	66.7
C1-Benzofluoranthenes/Benzopyrenes	mg/L	-	<0.92	<1.84	66.7
C1-Biphenyls	mg/L	-	<5.08	<10.15	66.7
C1-Dibenzothiophenes	mg/L	-	<0.15	<0.29	66.7
C1-Fluoranthenes/Pyrenes	mg/L	-	<1.65	<3.31	66.7
C1-Fluorenes	mg/L	-	<4.49	<8.98	66.7

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

² PAH detection limits were variable and therefore are not displayed

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicates but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

Table B.2-6 (Cont'd.)

Analyte	Unit	Detection Limit	BER-2 6-Sep-11	Duplicate 6-Sep-11	Relative Percent Difference (%)
PAHs (cont'd)					
C1-Naphthalenes	mg/L	-	<12.24	<24.48	66.7
C1-Phenanthrenes/Anthracenes	mg/L	-	<1.00	<1.99	66.7
C2-Benzof[a]anthracenes/Chrysenes	mg/L	-	<0.70	<1.41	66.7
C2-Benzofluoranthenes/Benzopyrenes	mg/L	-	<0.75	<1.49	66.7
C2-Biphenyls	mg/L	-	<49.03	<98.07	66.7
C2-Dibenzothiophenes	mg/L	-	<1.56	<3.12	66.7
C2-Fluoranthenes/Pyrenes	mg/L	-	<1.99	<3.98	66.7
C2-Fluorenes	mg/L	-	<3.60	<7.21	66.7
C2-Naphthalenes	mg/L	-	<4.34	<8.68	66.7
C2-Phenanthrenes/Anthracenes	mg/L	-	<3.01	<6.02	66.7
C3-Dibenzothiophenes	mg/L	-	<1.65	<3.30	66.7
C3-Fluoranthenes/Pyrenes	mg/L	-	<1.14	<2.29	66.7
C3-Fluorenes	mg/L	-	<15.86	<31.71	66.7
C3-Naphthalenes	mg/L	-	<3.14	<6.28	66.7
C3-Phenanthrenes/Anthracenes	mg/L	-	<3.25	<6.49	66.7
C4-Dibenzothiophenes	mg/L	-	<2.30	<4.60	66.7
C4-Naphthalenes	mg/L	-	<5.55	<11.10	66.7
C4-Phenanthrenes/Anthracenes	mg/L	-	<7.72	<15.45	66.7
Chrysene	mg/L	-	<0.23	<0.45	66.7
Dibenz[a,h]anthracene	mg/L	-	<0.10	<0.19	66.7
Dibenzothiophene	mg/L	-	<0.19	<0.38	66.7
Fluoranthene	mg/L	-	<0.51	<1.02	66.7
Fluorene	mg/L	-	<0.24	<0.48	66.7
Indeno[1,2,3-c,d]-pyrene	mg/L	-	<0.31	<0.63	66.7
Naphthalene	mg/L	-	<14.13	<28.26	66.7
Phenanthrene	mg/L	-	<0.89	<1.78	66.7
Pyrene	mg/L	-	<0.43	<0.87	66.7
Retene	mg/L	-	2.86	<4.14	36.6

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable analytes (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

² PAH detection limits were variable and therefore are not displayed

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Analytes differ by > 20% between duplicates and concentrations are > 5 times the detection limit.

B.2.3 Benthic Invertebrate Communities Component

B.2.3.1 Quality Control Activities – Field

Field methods used for benthic invertebrate collection are considered to follow accepted methods for environmental effects monitoring (Anderson 1990, Environment Canada, 2010). Instruments used for measuring supporting variables (e.g., temperature, dissolved oxygen, conductivity, pH, current velocity and depth) were calibrated according to manufacturer instructions (generally daily for water quality meters).

B.2.3.2 Quality Control Activities – Laboratory

Taxonomic samples were sorted and identified by Dr. Jack Zloty of Summerland, BC, who has analyzed benthic invertebrate samples on behalf of RAMP consistently since the program began. Laboratory methods used by Dr. Zloty in 2011 included resorting of 5% of samples as a confirmation of the overall sorting efficiency of all samples. In 2011, a total of 14 samples were re-sorted. Sorted portions were verified by an independent analyst. As a result of large volumes of organic material and low abundance in some samples collected from depositional sites, a minimum removal efficiency of 90% was considered acceptable (as for previous RAMP studies). This objective is considered acceptable by Environment Canada under current Environmental Effects Monitoring (EEM) strategies (Environment Canada 2010).

Data were received in electronic format (Microsoft Excel) from the taxonomist. All data were checked upon data entry for transcription errors or other inconsistencies. Data analysis was conducted iteratively, using duplicate data files for processing. Original data were retained in back-up files for the project. Printed output from statistical analyses was retained in project files in the event that analyses may be reviewed and reproduced if needed.

B.2.3.3 Quality Control Activities – Results

Results for quality control samples (5% re-sorts) from the 2011 RAMP benthic invertebrate community component indicated that this objective was consistently achieved (Table B.2-7).

Invertebrate sorting efficiency was always greater than 96%, with an average of 98.6%. Based on the criterion of 90% sorting efficiency, these results were considered acceptable and additional QC activities were not required.

$$\text{sorting efficiency} = \left(1 - \frac{A}{A + B}\right) * 100,$$

where,

A is the number of animals found in the re-sorted sample; and

B is the number of animals found in the original sorting of that sample.

Table B.2-7 Results of quality control checks on sorting efficiency of RAMP benthic invertebrate samples, 2011.

Reach	% Sorting Efficiency
MCL-1 #3	$[1-(16/(1026+16))] * 100 = 98.5$
ISL-1 #1	$[1-(4/(366+4))] * 100 = 98.9$
BPC-1 #5	$[1-(4/(249+4))] * 100 = 98.4$
FLC-1 #5	$[1-(0/(3+0))] * 100 = 100$
TAR-E2 #1	$[1-(3/(127+3))] * 100 = 97.5$
JAC-D2 #5	$[1-(5/(238+5))] * 100 = 97.9$
CLR-D2 #2	$[1-(1/(147+1))] * 100 = 99.3$
TAR-D1 #5	$[1-(0/(10+0))] * 100 = 100$
MAR-E2 #5	$[1-(13/(922+13))] * 100 = 98.6$
ELR-D1 #3	$[1-(4/(463+4))] * 100 = 99.1$
BER-D2 #1	$[1-(12/(504+12))] * 100 = 97.7$
HHR-E1 #5	$[1-(15/(694+15))] * 100 = 97.9$
ELR-E2A #3	$[1-(6/(271+6))] * 100 = 97.8$
MAR-E3 #4	$[1-(4/(386+4))] * 100 = 99.0$

Note: Average efficiency – 98,6%; 14 samples - ~5% of all samples.

B.2.4 Sediment Quality Component

The 2011 RAMP sediment quality QA/QC program was conducted to assess potential sample contamination during collection and analysis, the precision and accuracy of the chemical and toxicological analyses, and environmental heterogeneity.

B.2.4.1 Methods

The following field procedures were used to prevent sample contamination:

- Sampling equipment was washed with metal-free soap and rinsed with ambient site water, rinsed with hexane and then acetone, and triple-rinsed with ambient water prior to sample collection at a given station;
- Sample grabs were kept only if they contained no large foreign objects, obtained adequate sediment penetration depth, and were not overfilled or leaking; and
- Staff wore powder-free latex gloves during equipment washing and sampling.

Split samples (in which a single, large sample was subsampled) and duplicate samples (in which two unique samples were taken from the same location) were collected from Muskeg River (MUR-D3) and the Ells River (ELR-D1).

Duplicate samples were taken to assess environmental heterogeneity. The relative percent difference (RPD) in the results obtained for the split and duplicate samples was calculated. Analytes for which the relative percent difference between duplicate / split sample and the site sample exceeded 20% (with concentrations greater than five times the detection limit in both samples were considered to exhibit potentially unacceptable levels of imprecision).

In addition, two sampling-equipment rinsate blanks were collected in fall 2011. Sampling equipment (i.e., Ekman dredge, stainless-steel tray, and spoons) were washed with Liquinox soap, ambient water, hexane, acetone, and deionized water, as per the standard operating procedure at sampling locations; rinsate samples were collected by washing down the dredge with deionized water, which was collected into the tray (containing spoons) and decanted into a sample analysis bottle. The rinsate was analyzed for PAHs (at ng/L) by AXYS Analytical Services (the same laboratory that analyzed PAHs in sediments); and for metals (at mg/L) by AITF in Edmonton. Concentrations of metals in sediments were compared against 5 times their analytical detection limit and PAHs were assessed against 5 times the laboratory blank concentration, to assess potential sample contamination related to equipment.

B.2.4.2 Results and Discussion

Duplicate Samples

Concentrations of several metals and PAHs differed by over 20% between duplicate samples collected at stations MUR-D3 and ELR-D1 (Table B.2-8 and Table B.2-9). These results suggested high within-location variability in metal and PAH concentrations, which has been observed historically, in both laboratory-generated and field-collected duplicates.

Split Samples

Several variables in the split samples at stations MUR-D3 and ELR-D1 differed by greater than 20% from the sample (Table B.2-8 and Table B.2-9); there was more variation in split samples analyzed for PAHs than for samples analyzed for metals. These results are consistent with split-sample analyses undertaken in previous years of RAMP, suggesting that although concentrations of metals are generally consistent within the sediment matrix in a given sample, PAHs were unevenly distributed in sediments, or within a single sample.

Rinsate Samples

Several dissolved metals were detected at concentrations greater than five times the analytical detection limit in the rinsate sample collected at station ELR-D1 (Table B.2-10), including dissolved aluminum, barium, copper, iron, manganese, strontium, tin, titanium, and zinc. No dissolved metals were found to exceed five times the detection limit in the rinsate sample collected at station MUR-D3, and no total metals were found to exceed concentrations of five times the detection limit in either rinsate sample (Table B.2-10). Several PAHs were also detected at concentrations greater than five times the analytical detection limit in both rinsate samples in fall 2011 (Table B.2-11); most of these were detected in the rinsate collected from station ELR-D1. The majority of PAHs measured above (>5x) detection limits in both rinsates were lighter, more soluble species, such as parent and alkylated naphthalenes and biphenyl, as well as phenanthrenes. These results for PAHs were consistent with previous years' rinsate samples.

B.2.4.3 Conclusions and Recommendations

Results of QA/QC samples collected for sediments by the RAMP program in 2011 were consistent with those collected in previous years of the RAMP program. These samples generally indicate high variability of PAHs in sediments within a sampling location and that spatial variation can occur on a scale smaller than the Ekman dredge. Concentrations of metals are generally more consistent within samples and within locations, although some variability between samples from a given station may occur.

Some metals and PAHs were present at low concentrations in rinsate blanks, which may suggest insufficient rinsing of sampling equipment with deionized water to remove all traces of ambient (creek) waters prior to decanting of deionized waters for rinsate analysis, and/or insufficient scrubbing or solvent use in advance of sampling to remove attached all particulates from sampler/tray surfaces. Most traces of metals and PAHs were detected in the rinsate sample collected from station ELR-D1. Concentrations were generally very low relative to concentrations measured in sediment (e.g., for PAHs, parts per trillion in rinsate versus parts per million in sediment); therefore, these concentrations in rinsate would not likely substantially affect measured concentrations in sediment. However, clean technique remains critical in sampling of sediments, particularly for strongly hydrophobic variables like many PAHs.

Table B.2-8 Relative percent difference between duplicate and split sediment quality samples, lower Muskeg River (MUR-D3), September 2011.

Category	Analyte	Unit	DLs	Sample			RPD ¹ from JAC-D1	
				Station	Split	Duplicate	Split	Duplicate
				MUR-D3	PAC-1	JBC-1	PAC-1	JBC-1
Organic Compounds	Benzene	mg/kg	0.03	<0.03	<0.03	<0.03	0.0	0.0
	CCME Fraction 1 (BTEX)	mg/kg	60	<60	<60	<60	0.0	0.0
	CCME Fraction 1 (C6-C10)	mg/kg	60	<60	<60	<60	0.0	0.0
	CCME Fraction 2 (C10-C16)	mg/kg	77	<77	<77	<77	0.0	0.0
	CCME Fraction 3 (C16-C34)	mg/kg	77	111	80	99	32.5	11.4
	CCME Fraction 4 (C34-C50)	mg/kg	77	<77	<77	<77	0.0	0.0
	Total Hydrocarbons (C6-C50)	mg/kg	77	185	80	99	79.2	60.6
	Ethylbenzene	mg/kg	0.09	<0.09	<0.09	<0.09	0.0	0.0
	m+p-Xylene	mg/kg	0.3	<0.3	<0.3	<0.3	0.0	0.0
	o-Xylene	mg/kg	0.3	<0.3	<0.3	<0.3	0.0	0.0
	Toluene	mg/kg	0.3	<0.3	<0.3	<0.3	0.0	0.0
	Xylenes	mg/kg	0.6	<0.6	<0.6	<0.6	0.0	0.0
	PAHs	% Moisture_PAH sample	mg/kg	-	0.0715	0.0703	0.0703	1.7
Acenaphthene		mg/kg	-	<0.0003	<0.0002	0.0002	37.0	41.3
Acenaphthylene		mg/kg	-	<0.0003	<0.0001	<0.0001	75.3	80.2
Anthracene		mg/kg	-	0.0010	0.0010	0.0012	7.0	17.9
Benz[a]anthracene		mg/kg	-	0.0004	0.0005	0.0004	34.8	6.4
Benzo[a]pyrene		mg/kg	-	0.0004	0.0004	0.0005	7.5	24.4
Benzo[b,j,k]fluoranthene		mg/kg	-	0.0010	0.0011	0.0014	12.3	37.0
Benzo[g,h,i]perylene		mg/kg	-	0.0008	0.0007	0.0010	5.7	25.5
Biphenyl		mg/kg	-	0.0018	0.0017	0.0015	0.6	18.1
C1-Acenaphthenes		mg/kg	-	<0.0003	<0.0003	<0.0002	11.3	25.0
C1-Benzo[a]anthracenes/Chrysenes		mg/kg	-	0.0034	0.0043	0.0055	24.1	47.8
C1-Benzofluoranthenes/Benzopyrenes		mg/kg	-	0.0015	0.0024	0.0035	47.1	82.0
C1-Biphenyls		mg/kg	-	0.0008	0.0010	0.0006	18.9	23.4
C1-Dibenzothiophenes		mg/kg	-	0.0035	0.0027	0.0033	25.8	6.4
C1-Fluoranthenes/Pyrenes		mg/kg	-	0.0220	0.0240	0.0376	8.7	52.3
C1-Fluorenes		mg/kg	-	0.0069	0.0088	0.0116	23.5	50.5
C1-Naphthalenes		mg/kg	-	0.0015	0.0036	0.0032	81.6	69.2
C1-Phenanthrenes/Anthracenes		mg/kg	-	0.0106	0.0103	0.0092	2.9	14.7
C2-Benzo[a]anthracenes/Chrysenes		mg/kg	-	0.0029	0.0042	0.0038	38.8	28.3
C2-Benzofluoranthenes/Benzopyrenes		mg/kg	-	0.0015	0.0008	0.0030	63.1	68.1
C2-Biphenyls		mg/kg	-	0.0033	0.0034	0.0028	2.1	15.4
C2-Dibenzothiophenes		mg/kg	-	0.0303	0.0310	0.0318	2.3	4.8
C2-Fluoranthenes/Pyrenes		mg/kg	-	0.0186	0.0204	0.0296	9.2	45.6
C2-Fluorenes		mg/kg	-	0.0151	0.0182	0.0179	18.6	17.0
C2-Naphthalenes		mg/kg	-	0.0792	0.0436	0.0480	58.0	49.1
C2-Phenanthrenes/Anthracenes		mg/kg	-	0.0189	0.0210	0.0224	10.5	16.9
C3-Dibenzothiophenes		mg/kg	-	0.0314	0.0286	0.0386	9.3	20.6
C3-Fluoranthenes/Pyrenes		mg/kg	-	0.0047	0.0057	0.0097	19.7	70.6
C3-Fluorenes		mg/kg	-	0.0361	0.0351	0.0335	2.8	7.5

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable variables (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicate/split but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicate/split and concentrations are > 5 times the detection limit, or for PAHs, are both detectable.

Table B.2-8 (Cont'd.)

Category	Analyte	Unit	DLs	Sample			RPD ¹ from JAC-D1	
				Station	Split	Duplicate	Split	Duplicate
				MUR-D3	PAC-1	JBC-1	PAC-1	JBC-1
PAHs (Cont'd.)	C3-Naphthalenes	mg/kg	-	0.0059	0.0069	0.0069	16.2	14.9
	C3-Phenanthrenes/Anthracenes	mg/kg	-	0.0236	0.0270	0.0305	13.4	25.5
	C4-Dibenzothiophenes	mg/kg	-	0.0171	0.0191	0.0177	11.0	3.4
	C4-Naphthalenes	mg/kg	-	0.0093	0.0192	0.0079	69.6	16.4
	C4-Phenanthrenes/Anthracenes	mg/kg	-	0.0385	0.0541	0.0723	33.7	61.0
	Chrysene	mg/kg	-	0.0030	0.0034	0.0057	12.0	62.5
	Dibenz[a,h]anthracene	mg/kg	-	<0.0003	<0.0003	<0.0002	8.7	32.5
	Dibenzothiophene	mg/kg	-	0.0009	0.0007	0.0008	18.8	11.0
	Fluoranthene	mg/kg	-	0.0024	0.0029	0.0023	19.2	2.1
	Fluorene	mg/kg	-	0.0024	0.0022	0.0023	5.2	0.9
	Indeno[1,2,3-c,d]-pyrene	mg/kg	-	0.0009	0.0008	0.0008	9.7	10.2
	Naphthalene	mg/kg	-	<0.0075	<0.0145	0.0013	64.1	140.3
	Phenanthrene	mg/kg	-	0.0042	0.0044	0.0042	5.1	0.2
	Pyrene	mg/kg	-	0.0081	0.0097	0.0107	17.8	27.5
Retene	mg/kg	-	0.0155	0.0169	0.0322	8.6	70.0	
Total Metals	Total Aluminum (Al)	mg/kg	50	592	504	671	16.1	12.5
	Total Antimony (Sb)	mg/kg	0.1	<0.1	<0.1	<0.1	0.0	0.0
	Total Arsenic (As)	mg/kg	0.1	0.63	0.59	0.67	6.6	6.2
	Total Barium (Ba)	mg/kg	0.5	273	283	254	3.6	7.2
	Total Beryllium (Be)	mg/kg	0.2	<0.2	<0.2	<0.2	0.0	0.0
	Total Bismuth (Bi)	mg/kg	0.2	<0.2	<0.2	<0.2	0.0	0.0
	Total Cadmium (Cd)	mg/kg	0.1	0.23	0.17	0.16	30.0	35.9
	Total Calcium (Ca)	mg/kg	100	247000	260000	266000	5.1	7.4
	Total Chromium (Cr)	mg/kg	0.5	2.46	2.04	2.36	18.7	4.1
	Total Cobalt (Co)	mg/kg	0.1	0.91	0.88	1.11	3.4	19.8
	Total Copper (Cu)	mg/kg	0.5	2.01	2.01	2.28	0.0	12.6
	Total Iron (Fe)	mg/kg	200	8700	6330	8680	31.5	0.2
	Total Lead (Pb)	mg/kg	0.5	<0.5	0.51	0.62	2.0	21.4
	Total Lithium (Li)	mg/kg	0.5	1.69	1.83	1.93	8.0	13.3
	Total Magnesium (Mg)	mg/kg	20	7870	8030	7970	2.0	1.3
	Total Manganese (Mn)	mg/kg	1	457	479	546	4.7	17.7
	Total Mercury (Hg)	mg/kg	0.05	<0.05	<0.05	<0.05	0.0	0.0
	Total Molybdenum (Mo)	mg/kg	0.1	1.62	1.09	0.75	39.1	73.4
	Total Nickel (Ni)	mg/kg	0.5	6.64	7.11	8.22	6.8	21.3
	Total Phosphorus (P)	mg/kg	100	310	290	350	6.7	12.1
	Total Potassium (K)	mg/kg	100	<100	<100	120	0.0	18.2
	Total Selenium (Se)	mg/kg	0.2	0.49	0.37	0.41	27.9	17.8
	Total Silver (Ag)	mg/kg	0.2	<0.2	<0.2	<0.2	0.0	0.0
	Total Sodium (Na)	mg/kg	100	220	200	200	9.5	9.5
	Total Strontium (Sr)	mg/kg	1	800	873	782	8.7	2.3
	Total Thallium (Tl)	mg/kg	0.05	<0.05	<0.05	<0.05	0.0	0.0
	Total Tin (Sn)	mg/kg	2	<2	<2	<2	0.0	0.0
	Total Titanium (Ti)	mg/kg	1	17.8	17.6	22.9	1.1	25.1
	Total Uranium (U)	mg/kg	0.05	0.21	0.189	0.219	10.5	4.2
	Total Vanadium (V)	mg/kg	0.2	3.47	3.44	4.59	0.9	27.8
Total Zinc (Zn)	mg/kg	5	19.8	20.5	18.6	3.5	6.3	

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable variables (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Analytes differ by > 20% between duplicate/split but 1 or both concentrations are < 5 times the detection limit.

Analytes differ by > 20% between duplicate/split and concentrations are > 5 times the detection limit, or for PAHs, are both detectable.

Table B.2-9 Relative percent difference between duplicate and split sediment quality samples, lower ELLs River (ELR-D1), September 2011.

Category	Analyte	Unit	DLs	Sample			RPD ¹ from JAC-D1		
				Station	Split	Duplicate	Split	Duplicate	
				ELR-D1	MKW-D1	NDO-D1	MKW-D1	NDO-D1	
Organic Compounds²	Benzene	mg/kg	0.015	<0.015	<0.015	<0.015	0.0	0.0	
	CCME Fraction 1 (BTEX)	mg/kg	30	<30	<30	<30	0.0	0.0	
	CCME Fraction 1 (C6-C10)	mg/kg	30	<30	<30	<30	0.0	0.0	
	CCME Fraction 2 (C10-C16)	mg/kg	30	198	46	191	124.6	3.6	
	CCME Fraction 3 (C16-C34)	mg/kg	30	1690	453	1430	115.4	16.7	
	CCME Fraction 4 (C34-C50)	mg/kg	30	899	269	713	107.9	23.1	
	Total Hydrocarbons (C6-C50)	mg/kg	30	2790	768	2330	113.7	18.0	
	Ethylbenzene	mg/kg	0.045	<0.045	<0.045	<0.045	0.0	0.0	
	m+p-Xylene	mg/kg	0.15	<0.15	<0.15	<0.15	0.0	0.0	
	o-Xylene	mg/kg	0.15	<0.15	<0.15	<0.15	0.0	0.0	
	Toluene	mg/kg	0.15	0.64	<0.15	0.75	124.1	15.8	
	Xylenes	mg/kg	0.21	<0.21	<0.21	<0.21	0.0	0.0	
	PAHs	% Moisture_PAH sample	mg/kg	-	0.0437	0.0454	0.0423	3.8	3.3
		Acenaphthene	mg/kg	-	0.0042	0.0041	0.0025	2.2	50.4
Acenaphthylene		mg/kg	-	0.0003	0.0005	0.0002	59.4	34.5	
Anthracene		mg/kg	-	0.0027	0.0024	0.0009	9.9	103.1	
Benz[a]anthracene		mg/kg	-	0.1340	0.0172	0.0130	154.5	164.6	
Benzo[a]pyrene		mg/kg	-	0.0158	0.0163	0.0136	3.1	15.0	
Benzo[b,j,k]fluoranthene		mg/kg	-	0.0240	0.0296	0.0242	20.9	0.8	
Benzo[g,h,i]perylene		mg/kg	-	0.0291	0.0304	0.0220	4.4	27.8	
Biphenyl		mg/kg	-	0.0047	0.0076	0.0045	47.5	5.3	
C1-Acenaphthenes		mg/kg	-	0.0022	0.0015	0.0007	36.9	105.6	
C1-Benzo[a]anthracenes/Chrysenes		mg/kg	-	0.5240	0.4350	0.3070	18.6	52.2	
C1-Benzofluoranthenes/Benzopyrenes		mg/kg	-	0.3730	0.2330	0.2000	46.2	60.4	
C1-Biphenyls		mg/kg	-	0.0039	0.0040	0.0040	3.0	3.8	
C1-Dibenzothiophenes		mg/kg	-	0.0470	0.1020	0.0671	73.8	35.2	
C1-Fluoranthenes/Pyrenes		mg/kg	-	0.6260	0.6080	0.5010	2.9	22.2	
C1-Fluorenes		mg/kg	-	0.0703	0.0726	0.0428	3.2	48.6	
C1-Naphthalenes		mg/kg	-	0.0168	0.0185	0.0148	9.6	12.7	
C1-Phenanthrenes/Anthracenes		mg/kg	-	0.1670	0.1600	0.1220	4.3	31.1	
C2-Benzo[a]anthracenes/Chrysenes		mg/kg	-	0.8310	0.7500	0.5080	10.2	48.2	
C2-Benzofluoranthenes/Benzopyrenes		mg/kg	-	0.1280	0.1430	0.0843	11.1	41.2	
C2-Biphenyls		mg/kg	-	0.0135	0.0128	0.0140	5.3	3.6	
C2-Dibenzothiophenes		mg/kg	-	1.2400	1.2100	0.8000	2.4	43.1	
C2-Fluoranthenes/Pyrenes		mg/kg	-	1.2400	1.2100	0.9840	2.4	23.0	
C2-Fluorenes		mg/kg	-	0.3560	0.3100	0.1960	13.8	58.0	
C2-Naphthalenes		mg/kg	-	0.0491	0.0471	0.0436	4.2	11.9	
C2-Phenanthrenes/Anthracenes		mg/kg	-	0.6900	0.5640	0.4420	20.1	43.8	
C3-Dibenzothiophenes		mg/kg	-	2.6700	2.6600	1.7800	0.4	40.0	
C3-Fluoranthenes/Pyrenes		mg/kg	-	0.8650	0.7620	0.6770	12.7	24.4	
C3-Fluorenes		mg/kg	-	0.9080	0.8180	0.5340	10.4	51.9	

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable variables (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

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Analytes differ by > 20% between duplicate/split and concentrations are > 5 times the detection limit, or for PAHs, are both detectable.

Table B.2-9 (Cont'd.)

Category	Analyte	Unit	DLs	Sample			RPD ¹ from JAC-D1	
				Station	Split	Duplicate	Split	Duplicate
				ELR-D1	MKW-D1	NDO-D1	MKW-D1	NDO-D1
PAHs (Cont'd.)	C3-Naphthalenes	mg/kg	-	0.1670	0.1740	0.1580	4.1	5.5
	C3-Phenanthrenes/Anthracenes	mg/kg	-	1.3800	1.3700	0.8880	0.7	43.4
	C4-Dibenzothiophenes	mg/kg	-	1.8400	2.2300	1.5700	19.2	15.8
	C4-Naphthalenes	mg/kg	-	0.5850	0.6010	0.5020	2.7	15.3
	C4-Phenanthrenes/Anthracenes	mg/kg	-	3.7700	3.4700	2.4800	8.3	41.3
	Chrysene	mg/kg	-	0.1010	0.1290	0.1020	24.3	1.0
	Dibenz[a,h]anthracene	mg/kg	-	0.0061	0.0075	0.0052	21.1	15.1
	Dibenzothiophene	mg/kg	-	0.0072	0.0062	0.0045	14.1	45.6
	Fluoranthene	mg/kg	-	0.0069	0.0087	0.0096	23.5	33.4
	Fluorene	mg/kg	-	0.0036	0.0037	0.0029	4.1	20.6
	Indeno[1,2,3-c,d]-pyrene	mg/kg	-	0.0132	0.0133	0.0100	0.8	27.6
	Naphthalene	mg/kg	-	0.0042	0.0126	0.0041	99.6	2.4
	Phenanthrene	mg/kg	-	0.0322	0.0357	0.0273	10.3	16.5
	Pyrene	mg/kg	-	0.0295	0.0441	0.0336	39.7	13.0
Retene	mg/kg	-	0.7130	0.4420	0.2690	46.9	90.4	
Total Metals	Total Aluminum (Al)	mg/kg	50	9500	7800	7240	19.7	27.0
	Total Antimony (Sb)	mg/kg	0.1	0.35	0.32	0.31	9.0	12.1
	Total Arsenic (As)	mg/kg	0.1	7.66	6.89	7.42	10.6	3.2
	Total Barium (Ba)	mg/kg	0.5	150	163	143	8.3	4.8
	Total Beryllium (Be)	mg/kg	0.2	0.6	0.46	0.44	26.4	30.8
	Total Bismuth (Bi)	mg/kg	0.2	<0.2	<0.2	<0.2	0.0	0.0
	Total Cadmium (Cd)	mg/kg	0.1	0.29	0.25	0.24	14.8	18.9
	Total Calcium (Ca)	mg/kg	100	12500	16200	10000	25.8	22.2
	Total Chromium (Cr)	mg/kg	0.5	15.3	15.6	14.7	1.9	4.0
	Total Cobalt (Co)	mg/kg	0.1	9.9	9.25	9.16	6.8	7.8
	Total Copper (Cu)	mg/kg	0.5	18.4	16.3	16.2	12.1	12.7
	Total Iron (Fe)	mg/kg	200	25500	22400	22700	12.9	11.6
	Total Lead (Pb)	mg/kg	0.5	10.3	9.28	9.21	10.4	11.2
	Total Lithium (Li)	mg/kg	0.5	15.4	13.3	13.7	14.6	11.7
	Total Magnesium (Mg)	mg/kg	20	6020	5920	4740	1.7	23.8
	Total Manganese (Mn)	mg/kg	1	643	536	559	18.2	14.0
	Total Mercury (Hg)	mg/kg	0.05	0.05	<0.05	<0.05	0.0	0.0
	Total Molybdenum (Mo)	mg/kg	0.1	1.47	1.1	1.22	28.8	18.6
	Total Nickel (Ni)	mg/kg	0.5	22.5	21.3	20.1	5.5	11.3
	Total Phosphorus (P)	mg/kg	100	700	580	600	18.8	15.4
	Total Potassium (K)	mg/kg	100	1270	1150	1250	9.9	1.6
	Total Selenium (Se)	mg/kg	0.2	0.56	0.51	0.54	9.3	3.6
	Total Silver (Ag)	mg/kg	0.2	<0.2	<0.2	<0.2	0.0	0.0
	Total Sodium (Na)	mg/kg	100	130	110	100	16.7	26.1
	Total Strontium (Sr)	mg/kg	1	58.2	56.7	48.1	2.6	19.0
	Total Thallium (Tl)	mg/kg	0.05	0.115	<0.05	0.083	78.8	32.3
	Total Tin (Sn)	mg/kg	2	<2	<2	<2	0.0	0.0
	Total Titanium (Ti)	mg/kg	1	44.6	46.9	46.1	5.0	3.3
Total Uranium (U)	mg/kg	0.05	1.14	1.03	0.938	10.1	19.4	
Total Vanadium (V)	mg/kg	0.2	28.2	25.8	27.3	8.9	3.2	
Total Zinc (Zn)	mg/kg	5	74.4	56.4	57.5	27.5	25.6	

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. RPD for undetectable variables (i.e., < detection limit) was calculated assuming a concentration equal to the detection limit.

Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

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Table B.2-10 Concentration of metals in the rinsate blank taken from sediment sampling equipment, September 2011.

Analyte Category	Analyte	Units	DL	Rinsate sample	
				RIC-1 (=MUR-D3)	ABY-D1 (=ELR-D1)
Dissolved Metals	Aluminum (Al)	mg/L	0.001	<0.001	0.0225
	Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005
	Arsenic (As)	mg/L	0.0001	<0.0001	<0.0001
	Barium (Ba)	mg/L	0.0001	<0.0001	0.000606
	Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001
	Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001
	Boron (B)	mg/L	0.0008	<0.0008	0.00323
	Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001
	Calcium (Ca)	mg/L	0.1	<0.1	0.3
	Chlorine (Cl)	mg/L	0.3	<0.3	<0.3
	Chromium (Cr)	mg/L	0.0003	<0.0003	0.00132
	Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001
	Copper (Cu)	mg/L	0.0001	<0.0001	0.00208
	Iron (Fe)	mg/L	0.004	<0.004	0.0327
	Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001
	Lithium (Li)	mg/L	0.0002	<0.0002	0.000787
	Manganese (Mn)	mg/L	0.0001	<0.0001	0.00616
	Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005
	Molybdenum (Mo)	mg/L	0.0001	<0.0001	<0.0001
	Nickel (Ni)	mg/L	0.0001	<0.0001	0.000361
	Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003
	Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001
	Strontium (Sr)	mg/L	0.0001	<0.0001	0.00122
	Sulphur (S)	mg/L	2	<2	<2
	Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001
	Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001
	Tin (Sn)	mg/L	0.0001	<0.0001	0.0166
Titanium (Ti)	mg/L	0.0001	<0.0001	0.00135	
Uranium (U)	mg/L	0.0001	<0.0001	<0.0001	
Vanadium (V)	mg/L	0.0001	<0.0001	0.000161	
Zinc (Zn)	mg/L	0.0002	0.000269	0.00395	
Total Metals	Aluminum (Al)	mg/L	0.003	<0.003	<0.003
	Antimony (Sb)	mg/L	0.00005	<0.00005	<0.00005
	Arsenic (As)	mg/L	0.0001	<0.0001	<0.0001
	Barium (Ba)	mg/L	0.0001	<0.0001	<0.0001
	Beryllium (Be)	mg/L	0.0001	<0.0001	<0.0001
	Bismuth (Bi)	mg/L	0.0001	<0.0001	<0.0001
	Boron (B)	mg/L	0.0008	<0.0008	<0.0008
	Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001
	Calcium (Ca)	mg/L	0.1	<0.1	<0.1
	Chlorine (Cl)	mg/L	0.3	<0.3	<0.3
	Chromium (Cr)	mg/L	0.0003	<0.0003	<0.0003
	Cobalt (Co)	mg/L	0.0001	<0.0001	<0.0001
	Copper (Cu)	mg/L	0.0001	<0.0001	<0.0001
	Iron (Fe)	mg/L	0.004	<0.004	<0.004
	Lead (Pb)	mg/L	0.0001	<0.0001	<0.0001
	Lithium (Li)	mg/L	0.0002	<0.0002	<0.0002
Manganese (Mn)	mg/L	0.0001	<0.0001	<0.0001	
#	Variables are > 5 times the detection limit				

Table B.2-10 (Cont'd.)

Analyte Category	Analyte	Units	DL	Rinsate sample	
Total Metals (Cont'd.)	Mercury (Hg)	mg/L	0.00005	<0.00005	<0.00005
	Molybdenum (Mo)	mg/L	0.0001	<0.0001	<0.0001
	Nickel (Ni)	mg/L	0.0001	<0.0001	<0.0001
	Selenium (Se)	mg/L	0.0003	<0.0003	<0.0003
	Silver (Ag)	mg/L	0.00001	<0.00001	<0.00001
	Strontium (Sr)	mg/L	0.0001	<0.0001	<0.0001
	Sulphur (S)	mg/L	2	<2	<2
	Thallium (Tl)	mg/L	0.0001	<0.0001	<0.0001
	Thorium (Th)	mg/L	0.0001	<0.0001	<0.0001
	Tin (Sn)	mg/L	0.0001	<0.0001	<0.0001
	Titanium (Ti)	mg/L	0.0001	<0.0001	<0.0001
	Uranium (U)	mg/L	0.0001	<0.0001	<0.0001
	Vanadium (V)	mg/L	0.0001	<0.0001	<0.0001
	Zinc (Zn)	mg/L	0.0002	0.000373	0.000373
#	Variables are > 5 times the detection limit				

Table B.2-11 Concentration of PAHs in the rinsate blank taken from sediment sampling equipment, September 2011.

Analyte	Units	Rinsate sample			
		RIC-1 (=MUR-D3)		ABY-D1 (=ELR-D1)	
		DL	Rinsate	DL	Rinsate
Acenaphthene	ng/L	1.77	1.94	3.35	-3.35
Acenaphthylene	ng/L	0.68	0.96	0.76	1.12
Anthracene	ng/L	0.26	0.35	0.40	0.93
Benz[a]anthracene	ng/L	0.10	0.18	0.27	1.13
Benzo[a]pyrene	ng/L	0.68	<0.68	0.95	3.30
Benzo[b,j,k]fluoranthene	ng/L	0.44	<0.44	0.68	2.41
Benzo[g,h,i]perylene	ng/L	0.25	0.42	0.62	16.20
Biphenyl	ng/L	1.09	6.05	1.21	7.95
C1-Acenaphthenes	ng/L	0.82	-0.82	0.82	-0.82
C1-Benzo[a]anthracenes/Chrysenes	ng/L	0.48	0.77	0.48	11.40
C1-Benzofluoranthenes/Benzopyrenes	ng/L	0.92	1.03	1.15	8.84
C1-Biphenyls	ng/L	5.08	19.10	5.08	20.20
C1-Dibenzothiophenes	ng/L	0.51	-0.51	0.43	7.93
C1-Fluoranthenes/Pyrenes	ng/L	1.65	3.30	1.65	30.70
C1-Fluorenes	ng/L	4.49	25.80	4.49	29.30
C1-Naphthalenes	ng/L	12.24	18.40	12.24	27.10
C1-Phenanthrenes/Anthracenes	ng/L	1.00	5.22	1.00	16.60
C2-Benzo[a]anthracenes/Chrysenes	ng/L	0.70	1.46	0.72	11.70
C2-Benzofluoranthenes/Benzopyrenes	ng/L	0.75	<0.75	1.07	4.07
C2-Biphenyls	ng/L	49.03	191.00	49.03	179.00
C2-Dibenzothiophenes	ng/L	1.56	6.48	1.56	66.40
C2-Fluoranthenes/Pyrenes	ng/L	1.99	3.60	1.99	47.80
C2-Fluorenes	ng/L	3.60	18.30	3.60	44.60
C2-Naphthalenes	ng/L	4.34	17.70	4.34	25.70
C2-Phenanthrenes/Anthracenes	ng/L	3.01	5.03	3.01	27.30
C3-Dibenzothiophenes	ng/L	1.65	7.01	1.65	102.00
C3-Fluoranthenes/Pyrenes	ng/L	1.14	3.28	1.30	32.20
C3-Fluorenes	ng/L	15.86	28.90	15.86	77.40
C3-Naphthalenes	ng/L	3.14	13.20	3.67	49.60
C3-Phenanthrenes/Anthracenes	ng/L	3.25	4.42	3.25	36.10
C4-Dibenzothiophenes	ng/L	2.30	7.84	2.30	60.10
C4-Naphthalenes	ng/L	5.55	56.60	5.55	93.80
C4-Phenanthrenes/Anthracenes	ng/L	7.72	11.30	7.72	110.00
Chrysene	ng/L	0.23	0.46	0.34	3.68
Dibenz[a,h]anthracene	ng/L	0.22	<0.22	0.72	-0.72
Dibenzothiophene	ng/L	0.31	1.13	0.40	1.74
Fluoranthene	ng/L	0.51	0.95	0.51	23.50
Fluorene	ng/L	0.55	1.19	0.92	2.31
Indeno[1,2,3-c,d]-pyrene	ng/L	0.31	<0.31	0.70	4.24
Naphthalene	ng/L	14.13	55.60	14.13	53.60
Phenanthrene	ng/L	0.89	4.16	0.89	10.90
Pyrene	ng/L	0.43	0.68	0.43	88.50
Retene	ng/L	2.07	<2.07	2.20	8.85

* Values shown for the detection limit are concentrations found in the lab blank.

#

Indicates the sample concentration was greater than five times the concentration in the lab blank.

B.2.5 Fish Populations Component

B.2.5.1 Quality Control Activities – Field

Fish and fish habitat field activities were conducted in accordance with field methods considered to be standard scientific practice (e.g., Environment Canada 2010) and methods used in previous RAMP studies (RAMP 2009b). Prior to every field program, fieldwork instructions (FWIs) were prepared by the Component Manager. These FWIs provided technical detail on all field data collection activities planned for the program and were reviewed by all members of the field crew prior to starting the field program.

All field personnel were trained in the proper use of all field equipment to ensure accurate and safe data collection. Instruments used for measuring supporting field water quality variables (e.g., temperature, dissolved oxygen, conductivity, pH, current velocity and depth) were calibrated according to recommendations from the respective manufacturer (as frequently as daily for pH and dissolved oxygen meters). Station locations were recorded using a GPS unit. All sampling details (e.g., date, time, methods used, personnel, measurements) were recorded on project-specific field data sheets and/or in waterproof field books. Upon completion of the fieldwork, all datasheets and field books were stored in a fireproof cabinet in the Hatfield office.

Sample shipping (e.g., for fish tissues sent to Flett Research Ltd. and ALS Environmental Ltd.) was conducted using CoC forms provided by the laboratory.

B.2.5.2 Quality Control Activities – Laboratory

Fish Tissue

Results of fish tissue analyses by Flett Research Ltd. (Flett) included a description of QC techniques used. If relevant, comments on the results of the analyses were indicated on the printed results received from the laboratory. QC results met acceptable guidelines for the laboratory's own internal quality procedures (a condition of membership in the Canadian Association for Environmental Analytical Laboratories [CAEAL]). In the event alternate procedures were required to achieve a result, this information was also detailed on the laboratory output. QC procedures used by Flett included laboratory duplicates, spike samples, calibration control, use of certified reference standards and internal standards. Duplicate samples for mercury analyses were completed for fifty-five individual tissue samples (Table B.2-12).

Data were received in electronic format (Microsoft Excel®) from the analytical laboratory or entered by hand for other field programs. All data were checked upon data entry for transcription errors or other inconsistencies. Analysis of collected data was done using an iterative approach, using duplicate data files for processing. Original data were retained in back-up files for the project. Where used, printed output from statistical analyses was retained in project files in the event that analyses may be reviewed and reproduced if needed.

Laboratory duplicate samples exhibited low variability between the original sample and the duplicate samples. The relative percent difference was less than 20% for all samples where QA/QC analyses were performed, indicating consistent laboratory procedures for analyzing mercury in fish tissue.

Table B.2-12 Relative percent difference between duplicate mercury fish tissue samples collected from the Athabasca River, fall 2011.

Waterbody	Sample ID	Units	Sample Date	Sample	Duplicate	Relative Percent Difference	Type of Sample
Athabasca River	WALL-36-5B	ng/g wet weight	22-Sept-11	806	724	11.3	Duplicate
	LKWH-13-11A	ng/g wet weight	22-Sept-11	61.4	61.8	-0.6	Duplicate
	WALL-15-5B	ng/g wet weight	22-Sept-11	324	316	2.5	Duplicate

Fish Ageing

Results of fish ageing analyses by North/South Consultants included a description of QC techniques used. All ageing structures were viewed (read) a minimum of two times. If consistency was met within the two reads the final age was assigned, if consistency was not met the structure was read a third time. If consistency was not accomplished within three reads the structure was deemed un-ageable and no age was assigned. All readings were conducted as “blind” (independent from each other). Quality control and quality assurance was then conducted by an alternate ageing technician on at least 10% of randomly selected structures (unless readings one and two were conducted by different technicians, in which case the quality control and quality assurance was already completed). The QA/QC readings were also conducted “blind” to determine consistency and accuracy.

Data were received in electronic format (Microsoft Excel[®]) from the analytical laboratory. All data were checked upon data entry for transcription errors or other inconsistencies. Analysis of collected data was done using an iterative approach, using duplicate data files for processing. Original data were retained in back-up files for the project. Where used, printed output from statistical analyses was retained in project files in the event that analyses may be reviewed and reproduced if needed.

Laboratory readings of the ageing structures exhibited low variability between the two reads. The relative percent difference was less than 20% for all structures where QA/QC analyses were performed (205 structures), indicating consistent laboratory procedures for analyzing ages in fin ray samples.

B.2.6 Acid-Sensitive Lakes Component

Field sampling under the Acid-Sensitive Lakes Component of RAMP is conducted entirely by personnel from Alberta Environment and Water. Water samples collected at each lake were analyzed by the University of Alberta Limnology Laboratory. The laboratory uses a series of set procedures, outlined in detail below, for analytical quality control; the procedures used are identical to those used in previous RAMP studies (e.g., RAMP 2010).

B.2.6.1 Quality Control Activities – Field

Water sample collection in the field utilized standard practices for quality control of samples to avoid contamination. Field instruments (e.g., water quality meters) were cared for so as to maximize data quality (i.e., proper calibration according to manufacturer specifications). Procedures used included the following:

- Collection of samples away from the influence of the boat or float plane (i.e., to minimize chance of sample contamination from fuel that may be in the water);
- All sampling equipment was thoroughly cleaned between lakes;
- Sample containers were tripled-rinsed prior to filling (cap included);
- Sample containers were filled to the top (i.e., no head space);
- Samples were stored under cool (4°C) conditions and in the dark (i.e., in a refrigerator); and
- Samples were submitted to the appropriate analytical laboratory within established maximum holding period (typically 48 hours).

Duplicate samples were collected during the ASL component sampling program, which accounted for 6% of the total number of samples collected. Variability between duplicate samples was assessed as high when the relative percent difference between sample concentrations for an analyte was greater than 20% when both concentrations were greater than or equal to five times the MDL.

B.2.6.2 Quality Control Activities – Laboratory

The University of Alberta Limnology Laboratory maintains an internal QA/QC program to maximize the quality of analytical results. The laboratory QA/QC program includes use of standard reference samples and periodic comparison samples (i.e., blanks) sent to other laboratories. The laboratory prepares standard QC samples for each group of analytes from analytical grade chemicals or standard reference samples. In the event that QC objectives are not achieved, corrective actions are initiated to determine the cause.

Annually, ten samples of known chemistry are submitted by Environment Canada's National Water Research Institute (NWRI) for blind analysis and comparison. Two times per year, quality control samples are sent to the University of Alberta Limnology Laboratory by the Norwegian Institute for Water Research for analysis and comparison.

In all cases, analytical samples are run along with standard laboratory reference samples to create a standard results curve. QC solutions are then run in duplicate. If results for the QC samples are consistent for a series of analyses, no additional QC testing is required. If results from QC samples are divergent from the standards, corrective action is initiated to

determine the cause and results that may be affected. When new QC samples are prepared, each one is tested against the previous QC samples (for a given variable) to assess comparability.

B.2.6.3 Results and Discussion

Duplicate Field Samples

Duplicate samples were taken in three of the 50 lakes for conventional variables, ions, and nutrients (Table B.2-13). All of the analytes were compliant with the criteria stated above with the exception of sodium in Lake SM5 and chloride in Lake NE11.

Laboratory Quality Control Results

The results from the analysis of the University of Alberta Laboratory reference standards are presented in Table B.2-14. The table provides the measured and theoretical concentrations of each QC standard as well as the percent bias (discrepancy). An allowable bias of 10% was applied and all analytes were within this criterion.

Table B.2-13 Relative percent difference between duplicate water quality samples collected for conventional variables from three RAMP lakes sampled in 2011.

Analyte	Unit	Detection Limit	SM5 29-Aug-11	Duplicate 29-Aug-11	Relative Percent Difference (%) ¹	WF4 17-Aug-11	Duplicate 17-Aug-11	Relative Percent Difference (%)	NE11 1-Sep-11	Duplicate 1-Sep-11	Relative Percent Difference (%)
Conventional Variables											
Conductivity	µS/cm	-	10.77	10.94	-1.6	110.2	110.8	-0.5	182.5	179.4	1.7
pH	mg/L	-	5.97	5.97	0.0	7.19	7.21	-0.3	8.08	8.03	0.6
Total Dissolved Solids	mg/L	0.04	36.0	39.0	-8.0	147	-	-	186.4	178.6	4.3
Total Suspended Solids	mg/L	0.05	2.27	2.00	12.6	63.0	-	-	4.5	5.2	-14.4
Total alkalinity	mg/L	-	3.37	3.43	-1.8	33.4	33.8	-1.1	94.7	94.3	0.4
Gran alkalinity	mg/L	-	2.20	2.16	1.8	34.7	34.3	1.1	95.5	95.2	0.3
Dissolved Organic C.	mg/L	0.1	15.4	15.6	-1.3	49.2	48.1	2.3	24.6	23.2	5.9
Dissolved Inorganic C.	mg/L	0.4	1.10	1.00	9.5	5.9	5.8	1.7	21.6	21.5	0.5
Colour	mg/L	1	78.2	79.5	-1.7	220	223	-1.5	32.7	34.4	-5.0
Major Ions											
Bicarbonate (HCO ₃)	mg/L	-	4.11	4.19	-1.9	40.8	41.3	-1.1	115.5	115.1	0.3
Carbonate (CO ₃)	mg/L	-	0.00	0.00	0.0	0.00	0.00	0.0	0.00	0.00	0.0
Chloride (Cl)	mg/L	0.03	0.16	0.12	28.6	0.32	0.30	6.5	0.24	0.33	-31.6
Sulfate (SO ₄)	mg/L	0.04	0.46	0.50	-8.3	15.05	15.0	0.3	2.39	2.37	0.8
Sodium (Na)	mg/L	0.02	0.58	1.33	-78.5	7.13	-	-	12.34	11.58	6.4
Potassium (K)	mg/L	0.01	0.31	0.26	17.5	1.18	-	-	0.74	0.74	0.0
Calcium (Ca)	mg/L	0.01	1.43	1.40	2.1	12.08	-	-	21.82	21.42	1.9
Magnesium (Mg)	mg/L	0.01	0.48	0.48	0.0	5.61	-	-	8.03	7.96	0.9
Iron (Fe)	mg/L	0.02	0.07	0.06	15.4	0.03	-	-	0.020	<LOD	120
Nutrients											
Ammonia-N	µg/L	2	32.2	32.8	-1.8	26.0	26.0	0.0	54.00	40.00	29.8
Nitrate+Nitrite	µg/L	1	12.9	12.6	2.4	4.00	5.00	-22.2	2.53	6.00	-81.4
Nitrite		1	2.00	<LOD	-	6.00	5.00	18.2	<LOD	<LOD	0.0
Total Nitrogen	µg/L	5	712	800	-11.6	3452	-	-	1210	1204	0.5
Total Dissolve N		5	601	541	10.5	1694	-	-	943	924	2.0
Total Kjeldahl Nitrogen	µg/L	5	680	767	-12.1	1694	-	-	1156	1164	-0.7
Total Dissolved Phosphorus	µg/L	1	5.0	6.0	-18.2	18.0	18.0	0.0	5.00	5.00	0.0
Total Phosphorus	µg/L	1	23.0	22.0	4.4	101.0	110.0	-8.5	27.00	30.00	-10.5
Chlorophyll	µg/L	0.02	7.83	8.00	-2.1	74.9	74.4	0.7	11.52	11.93	-3.5

Note: <LOD = less than detection limit

¹ Relative percent difference (RPD) = (difference between sample 1 and 2)/(average of sample 1 and 2) x 100%. Precision is influenced by how close the analytical value is to the method detection limit. Thus, assessing percent mean differences is valid only for analytical values that are at least five times the detection limit.

Table B.2-14 Percent bias between measured and theoretical values for laboratory reference standards.

Control Samples	Unit	Measured Conc.	Theoretical Conc.	Percentage Bias	Percentage Bias Criteria	Passed QC
Ammonium	µg/L	49	50	2	10	Yes
	µg/L	990	1000	1	10	Yes
Nitrite/Nitrate	µg/L	50	50	0	10	Yes
	µg/L	963	1000	4	10	Yes
Nitrite	µg/L	52	50	4	10	Yes
Total Nitrogen	µg/L	54	50	8	10	Yes
	µg/L	181	200	10	10	Yes
	µg/L	941	1000	6	10	Yes
	µg/L	4010	4000	0	10	Yes
Total Diss. N	µg/L	47	50	6	10	Yes
	µg/L	196	200	2	10	Yes
	µg/L	1000	1000	0	10	Yes
	µg/L	4040	4000	1	10	Yes
Total P	µg/L	50	50	0	10	Yes
	µg/L	1020	1000	2	10	Yes
Total Diss. P	µg/L	48	50	4	10	Yes
	µg/L	1040	1000	4	10	Yes
Diss. Inorganic C.	mg/L	10.3	10	3	10	Yes
Diss. Organic C.	mg/L	2.3	2.5	8	10	Yes
	mg/L	25.8	25	3	10	Yes
Calcium	mg/L	5.27	5	5	10	Yes
	mg/L	99.12	100	1	10	Yes
Iron	mg/L	5.39	5	8	10	Yes
	mg/L	97.87	100	2	10	Yes
Potassium	mg/L	5.21	5	4	10	Yes
	mg/L	101.1	100	1	10	Yes
Magnesium	mg/L	5.48	5	9	10	Yes
	mg/L	101.3	100	1	10	Yes
Sodium	mg/L	5.14	5	3	10	Yes
	mg/L	97.7	100	2	10	Yes
Chloride	mg/L	1.87	2	7	10	Yes
	mg/L	9.79	10	2	10	Yes
Sulfate	mg/L	1.92	2	4	10	Yes
	mg/L	10.07	10	1	10	Yes
Alkanity	mg/L	98.38	100	2	10	Yes
	mg/L	20.52	20	3	10	Yes
Conductivity	µS/cm	148.3	147	1	10	Yes
pH		3.87	4	3	10	Yes
		6.93	7	1	10	Yes
		9.94	10	1	10	Yes
Color	mg/L	50.41	50	1	10	Yes

Appendix C

**Climate and Hydrology
Component**

C CLIMATE AND HYDROLOGY COMPONENT

This appendix summarizes the data collected for the RAMP Climate and Hydrology component in the 2011 water year (WY). The 2011 WY was defined as the period from November 1, 2010 to October 31, 2011. The appendix presents descriptions of the climate and hydrometric stations used to collect these data, along with other station-related information.

C.1 2011 CLIMATE AND HYDROLOGY STATIONS

A list of the climate and hydrometric stations is provided in Table C.1-1.

Table C.1-1 RAMP climate, hydrometric and snowcourse stations monitored in 2011.

RAMP Station	Name	UTM Coordinates ¹		Operating Season	Variables Measured
		Easting	Northing		
C1	Aurora Climate Station	475229	6344053	all year	air temperature, total precipitation, humidity, solar radiation, snow on the ground, wind speed and direction
C2	Horizon Climate Station	443364	6360510	all year	air temperature, total precipitation, humidity, solar radiation, snow on the ground, barometric pressure, wind speed and direction
C3	Steepbank Climate Station	473950	6320500	all year	air temperature, total precipitation, humidity, solar radiation, snow on the ground, barometric pressure, wind speed and direction
C4	Pierre Climate Station	460898	6378737	all year ³	air temperature, total precipitation, humidity, solar radiation, snow on the ground, barometric pressure, wind speed and direction
C5	Surmont Climate Station	502542	6230964	all year ⁴	air temperature, total precipitation, humidity, solar radiation, snow on the ground, barometric pressure, wind speed and direction
L1	McClelland Lake	483398	6372186	all year	water level, total precipitation, humidity, air temperature, water temperature
L2	Kearl Lake	484815	6351080	all year	water level, total precipitation, humidity, air temperature, water temperature
L3	Isadore's Lake	463297	6342981	all year	water level
S2	Jackpine Creek at Canterra Road	474971	6344091	all year	level, discharge, water temperature
S3	Iynimin Creek above Kearl Lake	489423	6345196	open-water	level, discharge, rainfall
S5	Muskeg River above Stanley Creek	479761	6356759	all year	level, discharge, water temperature
S5A	Muskeg River above Muskeg Creek	476042	6351803	all year	level, discharge, barometric pressure, water temperature
S6	Mills Creek at Highway 63	463755	6344927	all year	level, discharge, water temperature
S7	Muskeg River near Fort McKay (07DA008)	465552	6338804	Winter ²	level, discharge, water temperature
S9	Kearl Lake Outlet	483983	6347020	all year	level, discharge, water temperature
S10	Wapasu Creek at Canterra Road	490276	6355968	all year	level, discharge, water temperature
S11	Poplar Creek at Highway 63 (07DA007)	471972	6307825	all year	level, discharge, water temperature
S12	Fort Creek at Highway 63	462620	6363554	open-water	level, discharge
S14A	Ells River at the Canadian Natural Bridge	455738	6344944	all year	level, discharge, water temperature

¹ UTM coordinate datum is NAD83 Zone 12V. In 2011, a differential GPS was used to increase the accuracy of UTM coordinates. Changes from previous coordinates reflects this increased accuracy and does not reflect a change in physical station location. Coordinates for WSC stations were based on WSC values posted for the stations (<http://www.wateroffice.ec.gc.ca>).

² WSC monitors water level and discharge at these stations during the open-water season.

³ C4 Pierre Climate Station began operation in July 2011.

⁴ C5 Pierre Climate Station began operation in October 2011.

⁵ S16A replaced CR-1 (CNRL) and former RAMP S16 which all monitor the Calumet River near the mouth.

⁶ Station began operation in August 2011.

⁷ Station began operation in May 2011.

Table C.1-1 (Cont'd.)

RAMP Station	Name	UTM Coordinates ¹		Operating Season	Variables Measured
S15A	Tar River near the mouth	458458	6353439	open-water	level, discharge, water temperature
S16A	Calumet River near the mouth	458096	6362020	open-water ⁵	level, discharge
S19	Tar River Lowland Tributary near the mouth	457326	6352850	open-water	level, discharge, rainfall
S20	Muskeg River Upland	492107	6355709	open-water	level, discharge
S22	Muskeg Creek near the mouth	480969	6349071	open-water	level, discharge
S24	Athabasca River below Eymundson Creek	466305	6372764	all year	level, discharge, water temperature
S25	Susan Lake Outlet	464513	6368477	open-water	level, discharge
S26	MacKay River near Fort McKay (07DB001)	458019	6341008	Winter ²	discharge
S27	Firebag River near the mouth (07DC001)	487914	6389855	Winter ²	discharge
S29	Christina River near Chard (07CE002)	508211	6187940	Winter ²	discharge
S31	Hangingstone Creek at North Star Road	469812	6236089	open-water	level, discharge, rainfall
S32	Surmont Creek at Highway 31	490250	6254524	open-water	level, discharge, water temperature
S33	Muskeg River at the Aurora/Albian Boundary	474878	6350204	all year	level, discharge, water temperature
S34	Tar River above Canadian Natural Lake	440745	6361662	all year	level, discharge, water temperature
S36	McClelland Lake Outlet above Firebag River	490635	6384056	open-water	level, discharge
S37	East Jackpine Creek near the 1300 m contour	487850	6325416	open-water	level, discharge
S38	Steepbank River near Fort McMurray (07DA006)	475296	6317398	Winter ²	discharge
S39	Beaver River above Syncrude (07DA018)	465560	6311437	Winter ²	discharge
S40	MacKay River at Petro-Canada Bridge	444949	6314178	all year	level, discharge, water temperature, rainfall
S42	Clearwater River above Christina River (07DC005)	504427	6279666	Winter ²	discharge
S43	Firebag River upstream of Suncor Firebag	531704	6354796	open-water	level, discharge, water temperature, rainfall
S44	Pierre River near Fort McKay (Formerly 07DA013)	460769	6369299	open-water	level, discharge
S45	Ells River above Joslyn Creek Diversion	440325	6342418	all year	level, discharge, water temperature
S46	Athabasca River near Embarras Airport	470241	6463209	all year ⁶	level, discharge, water temperature
S47	Christina River near the mouth	500697	6276412	all year ⁶	level, discharge, water temperature
S48	Big Creek	470817	6389113	open-water ⁷	level, discharge, water temperature
S49	Eymundson Creek near the mouth	465473	6372694	open-water ⁶	level, discharge, water temperature
S50	Red Clay Creek	474954	6396094	open-water ⁷	level, discharge, water temperature
CANR-JP-A		483996	6347096	winter	Snow depth, water equivalent
CANR-MD-A		484720	6351034	winter	Snow depth, water equivalent
CANR-FL-A		484780	6351200	winter	Snow depth, water equivalent
CANR-OP-A		484961	6351023	winter	Snow depth, water equivalent
NEX-OP-A		508424	6252327	winter	Snow depth, water equivalent
NEX-FL-A		508410	6252086	winter	Snow depth, water equivalent
NEX-JP-A		508747	6251781	winter	Snow depth, water equivalent
NEX-MD-A		508954	6251566	winter	Snow depth, water equivalent
CNRL-MD-A		443492	6360713	winter	Snow depth, water equivalent
CNRL-OP-A		443019	6360667	winter	Snow depth, water equivalent
CNRL-JP-A		440856	6361728	winter	Snow depth, water equivalent
CNRL-FL-A		440918	6361759	winter	Snow depth, water equivalent
MCLL-MD-A		483431	6372120	winter	Snow depth, water equivalent
MCLL-OP-A		483350	6372121	winter	Snow depth, water equivalent
MCLL-JP-A		482898	6369515	winter	Snow depth, water equivalent
MCLL-FL-A		482843	6369496	winter	Snow depth, water equivalent

¹ UTM coordinate datum is NAD83 Zone 12V. In 2011, a differential GPS was used to increase the accuracy of UTM coordinates. Changes from previous coordinates reflects this increased accuracy and does not reflect a change in physical station location. Coordinates for WSC stations were based on WSC values posted for the stations (<http://www.wateroffice.ec.gc.ca>).

² WSC monitors water level and discharge at these stations during the open-water season.

³ C4 Pierre Climate Station began operation in July 2011.

⁴ C5 Pierre Climate Station began operation in October 2011.

⁵ S16A replaced CR-1 (CNRL) and former RAMP S16 which all monitor the Calumet River near the mouth.

⁶ Station began operation in August 2011.

⁷ Station began operation in May 2011.

C.2 CLIMATE DATA COLLECTED IN THE 2011 WATER YEAR

Climate data were collected in the region during the 2011 WY, defined as the period between November 1, 2010 and October 31, 2011. Data were collected by RAMP, Environment Canada, and other organizations. This document focuses on RAMP data and incorporates data from government agencies to provide context and supplement the RAMP information.

C.2.1 RAMP Climate Data

In the 2011 WY, RAMP collected climatological data from five comprehensive climate stations, climate sensors at two RAMP lake stations, and through the use of five additional precipitation stations located in conjunction with select RAMP hydrometric stations. The following sections of this appendix present the data collected during the 2011 WY.

C.2.1.1 Aurora Climate Station (C1)

The Aurora Climate Station (C1) monitored air temperature, wind speed and direction, precipitation, solar radiation, and relative humidity during the 2011 WY. Table C.2-1 lists the data collected at the station. Monthly observations for the 2011 WY are summarized in Table C.2-2, and daily observations are contained in the RAMP database.

Table C.2-1 Data collected at the RAMP Aurora Climate Station (C1), 2011.

Climate Element and Sensor	Variable	Units	Derivation
Air Temperature Thermistor	Minimum	(°C)	Minimum of 1 minute means from readings every 5 sec.
	Mean	(°C)	Mean of readings every 5 sec.
	Maximum	(°C)	Maximum of 1 minute means from readings every 5 sec.
Total Precipitation OTT Pluvio2 Weighing Precipitation Gauge	Total	(mm)	Sum of 0.01 mm readings.
Depth of Snow on Ground Sonic level sensor	Total	(cm)	Average of 5 second readings made in the last minute of each 15 minutes.
Mean Relative Humidity Humidity sensor	Mean	(%)	Mean of readings every 5 sec.
Global Solar Radiation Pyranometer	Mean	(kW/m ²)	Mean of readings every 5 sec.
Wind Speed and Direction Wind Vane and Propeller	Direction	(degrees)	Direction of daily mean wind vector from readings averaged every 5 sec.
	5 sec. Gust Speed	(km/h)	Maximum scalar wind speed from 5 sec readings.
	2 min. Gust Speed	(km/h)	Maximum of 2 minute scalar wind speed means from readings every 5 sec.
	10 min. Gust Speed	(km/h)	Maximum of 10 minute scalar wind speed means from readings every 5 sec.

Table C.2-2 Summary of monthly climate data collected at the RAMP Aurora Climate Station (C1) during the 2011 WY.

Month	Temperature			Total Precipitation Pluvio2 (mm)	Month End Depth of Snow on Ground (cm)	Mean Relative Humidity (%)	Mean Total Global Solar Radiation (kW/m ²)	Maximum Sustained Wind Speeds		
	Min (°C)	Mean (°C)	Max (°C)					5 sec. (km/h)	2 min. (km/h)	10 min. (km/h)
Nov-10	-31.9	-7.8	12.5	15.0	4.9	81.5	0.022	50.2	26.6	23.1
Dec-10	-39.0	-17.7	-5.3	20.6	26.3	85.8	0.008	32.2	26.8	23.9
Jan-11	-38.5	-19.4	1.7	15.8	38.2	83.6	0.005	49.2	35.6	29.2
Feb-11	-36.9	-16.1	7.6	17.3	53.8	77.6	0.050	40.6	35.4	28.2
Mar-11	-39.4	-10.3	10.9	6.2	61.9	65.6	0.104	39.3	29.3	25.8
Apr-11	-10.8	2.6	18.2	7.2	7.5	58.1	0.175	44.8	32.3	28.6
May-11	-2.0	12.6	27.7	9.1	0.3	48.5	0.214	45.0	31.3	26.9
Jun-11	-2.1	15.6	30.3	39.0	0	61.9	0.205	47.3	35.2	30.1
Jul-11	7.5	18.0	30.3	69.5	0	71.7	0.189	46.6	36.5	28.7
Aug-11	5.8	16.5	30.8	34.8	0	70.2	0.175	46.5	32.5	30.0
Sep-11	-2.9	13.2	32.3	26.2	0	65.3	0.127	39.0	28.4	24.7
Oct-11	-6.1	4.7	15.1	12.3	0.6	78.4	0.054	42.0	28.5	22.4
2011 WY Annual	-39.4	1.0	32.3	273.0		70.7	0.1	50.2	36.5	30.1

Note: E = Estimated; M = Missing; P = Partial; See additional notes in sections C.2.1.1 and C.2.1.6.

C.2.1.2 Horizon Climate Station (C2)

The Horizon Climate Station (C2) was established in October 2008 and became fully operational in June 2009. The Horizon Station monitored air temperature, wind speed and direction, solar radiation, relative humidity, barometric pressure, snow depth, and precipitation during the 2011 WY. Table C.2-3 lists the data collected at the station. Monthly observations for 2011 WY are summarized in Table C.2-4, and daily observations are contained in the RAMP database.

During the 2011 WY the station's power supply was disconnected by an unknown source on August 26. Full functionality was reinstated on September 12 during the next available visit to the station.

Table C.2-3 Data collected at the RAMP Horizon Climate Station (C2), 2011.

Climate Element and Sensor	Parameter	Units	Derivation
Air Temperature Thermistor	Minimum	(°C)	Minimum of 1 minute means from readings every 5 sec.
	Mean	(°C)	Mean of readings every 5 sec.
	Maximum	(°C)	Maximum of 1 minute means from readings every 5 sec.
Total Precipitation Geonor Weighing Precipitation Gauge	Total	(mm)	Sum of 0.05 mm readings every 15 minutes.
Depth of Snow on Ground Sonic level sensor	Total	(cm)	Average of 5 second readings made in the last minute of each hour.
Mean Relative Humidity Humidity sensor	Mean	(%)	Mean of readings every 5 sec.
Global Solar Radiation Pyranometer	Mean	(kW/m ²)	Mean of readings every 5 sec.
Barometric pressure	Mean	KPa	Mean of readings every 5 sec.
Wind Speed and Direction Wind Vane and Propeller	Direction	(degrees)	Direction of daily mean wind vector from readings averaged every 5 sec.
	5 sec. Gust Speed	(km/h)	Maximum scalar wind speed from 5 sec readings.
	2 min. Gust Speed	(km/h)	Maximum of 2 minute scalar wind speed means from readings every 5 sec.
	10 min. Gust Speed	(km/h)	Maximum of 10 minute scalar wind speed means from readings every 5 sec.

Table C.2-4 Summary of monthly climate data collected at the RAMP Horizon Climate Station (C2) during the 2011 WY.

Month	Temperature			Total Precipitation (mm)	Month End Depth of Snow on Ground (cm)	Mean Relative Humidity (%)	Mean Total Global Solar Radiation (kW/m ²)	Station Pressure (kPa)	Maximum Sustained Wind Speeds		
	Min. (°C)	Mean (°C)	Max. (°C)						5 sec. (km/h)	2 min. (km/h)	10 min. (km/h)
Nov-10	-28.9	-7.5	12.0	27.5	22.8	79.7	0.029	96.5	47.1	30.9	27.2
Dec-10	-35.3	-17.3	-4.2	24.7	31.1	84.4	0.005	96.7	42.6	31.0	27.8
Jan-11	-35.9	-18.7	3.0	17.4	38.4	83.0	0.013	96.9	64.2	45.8	39.3
Feb-11	-34.9	-15.3	8.4	21.8	60.9	71.0	0.052	96.4	45.1	32.9	28.2
Mar-11	-35.4	-10.6	10.7	7.7	43.2	66.3	0.108	96.9	44.7	31.8	28.6
Apr-11	-10.9	2.0	17.9	10.2	0.0	56.3	0.186	96.1	65.6	39.7	33.9
May-11	-1.9	11.9	26.5	0.5	0.0	47.8	0.233	96.6	57.3	48.6	30.6
Jun-11	-3.4	14.8	27.2	50.8	0.0	62.1	0.217	96.0	47.9	31.3	27.0
Jul-11	8.9	17.4	27.6	101.3	0.0	71.3	0.210	95.8	42.6	28.3	24.8
Aug-11	4.8 P	16.0 P	28.6 P	50.7 P	0.0	72.2 P	0.200 P	95.9 P	51.4 P	36.5 P	32.4 P
Sep-11	-3.0 P	10.9 P	27.4 P	24.0 P	0.0	68.3 P	0.170 P	95.8 P	37.8 P	26.6 P	21.8 P
Oct-11	-6.9	4.5	15.2	24.5	0.0	77.0	0.113	95.9	49.3	37.6	34.6
2011 WY Annual	-35.9	0.7	28.6	360.9		69.9	0.128	96.3	65.6	48.6	39.3

Note: M = Missing, P = Partial. See additional notes in sections C.1.1.1 and C.2.1.6.

C.2.1.3 Steepbank Climate Station (C3)

The Steepbank Climate Station (C3) was upgraded to a full climate station in November 2010. During the 2011 WY, air temperature, wind speed and direction, solar radiation, relative humidity, barometric pressure, snow depth, and precipitation data were collected at this station as described in Table C.2-5. Monthly observations for 2011 WY are summarized in Table C.2-6, and daily observations are contained in the RAMP database.

Records at the station are complete for the full 2011 WY, with the exception of a two-day gap on June 12 and 13, 2011.

Table C.2-5 Data collected at the RAMP Steepbank Climate Station (C3), 2011.

Climate Element and Sensor	Parameter	Units	Derivation
Air Temperature Thermistor	Minimum	(°C)	Minimum of 1 minute means from readings every 5 sec.
	Mean	(°C)	Mean of readings every 5 sec.
	Maximum	(°C)	Maximum of 1 minute means from readings every 5 sec.
Total Precipitation OTT Pluvio2 Weighing Precipitation Gauge	Total	(mm)	Sum of 0.01 mm readings.
Depth of Snow on Ground Sonic level sensor	Total	(cm)	Average of 5 second readings made in the last minute of each hour.
Mean Relative Humidity Humidity sensor	Mean	(%)	Mean of readings every 5 sec.
Global Solar Radiation Pyranometer	Mean	(kW/m ²)	Mean of readings every 5 sec.
Barometric pressure	Mean	KPa	Recorded for every minute and averaged per 1 hour
Wind Speed and Direction Wind Vane and Propeller	Direction	(degrees)	Direction of daily mean wind vector from readings averaged every 5 sec.
	5 sec. Gust Speed	(km/h)	Maximum scalar wind speed from 5 sec readings.
	2 min. Gust Speed	(km/h)	Maximum of 2 minute scalar wind speed means from readings every 5 sec.
	10 min. Gust Speed	(km/h)	Maximum of 10 minute scalar wind speed means from readings every 5 sec.

Table C.2-6 Summary of monthly climate data collected at the RAMP Steepbank Climate Station (C3) during the 2011 WY.

Month	Temperature			Total Precipitation (mm)	Month End Depth of Snow on Ground (cm)	Mean Relative Humidity (%)	Mean Total Global Solar Radiation (kW/m ²)	Station Pressure (kPa)	Maximum Sustained Wind Speeds		
	Min. (°C)	Mean (°C)	Max. (°C)						5 sec. (km/h)	2 min. (km/h)	10 min. (km/h)
Nov-10	-32.7	-8.7	12.4	11.6	15.2	81.3	0.023	97.5	45.2	45.2	31.6
Dec-10	-36.2	-16.9	-4.4	17.0	31.3	83.8	0.015	97.7	43.9	43.9	30.1
Jan-11	-40.0	-19.2	3.1	11.2	47.6	82.9	0.021	98.0	51.2	51.2	37.1
Feb11	-39.9	-15.5	8.3	7.1	61.8	75.5	0.059	97.5	43.2	43.2	31.0
Mar-11	-40.1	-10.4	11.1	6.8	36.2	68.0	0.107	97.9	40.3	40.3	30.4
Apr-11	-10.0	2.8	18.5	6.0	0.0	58.9	0.188	97.0	51.6	51.6	34.3
May-11	-3.2	12.3	26.9	12.6	0.0	49.5	0.235	97.5	54.3	54.3	38.8
Jun-11	-3.9 P	15.3 P	28.8 P	39.7 P	0.0	61.4 P	0.210 P	96.9 P	50.6 P	50.6 P	34.2 P
Jul-11	8.5	18.3	29.5	47.3	0.0	65.3	0.209	96.8	45.2	45.2	29.5
Aug-11	6.1	16.7	30.3	23.6	0.0	66.0	0.189	96.9	73.2	73.2	40.8
Sep-11	-4.3	13.5	32.2	24.0	0.0	62.9	0.145	97.1	49.4	49.4	32.0
Oct-11	-6.9	5.1	15.7	9.2	0.0	74.0	0.064	97.0	42.6	42.6	27.7
2011 WY Annual	-40.1	-1.6	32.2	216.1		69.1	0.1	97.3	73.2	73.2	40.8

Note: M = Missing, P = Partial. See additional notes in sections C.1.1.1 and C.2.1.6.

C.2.1.4 Pierre Climate Station (C4)

The Pierre Climate Station (C4) was installed on July 25, 2011. This station monitored air temperature, wind speed and direction, solar radiation, relative humidity, barometric pressure, snow depth, and precipitation from August to October 2011. Table C.2-7 provides a list of the data collected at the station. Monthly observations for 2011 WY are summarized in Table C.2-8, and daily observations are contained in the RAMP database.

Table C.2-7 Data collected at the RAMP Pierre Climate Station (C4), 2011.

Climate Element and Sensor	Parameter	Units	Derivation
Air Temperature Thermistor	Minimum	(°C)	Minimum of 1 minute means from readings every 5 sec.
	Mean	(°C)	Mean of readings every 5 sec.
	Maximum	(°C)	Maximum of 1 minute means from readings every 5 sec.
Total Precipitation OTT Pluvio2 Weighing Precipitation Gauge	Total	(mm)	Sum of 0.01 mm readings.
Depth of Snow on Ground Sonic level sensor	Total	(cm)	Average of 5 second readings made in the last minute of each hour.
Mean Relative Humidity Humidity sensor	Mean	(%)	Mean of readings every 5 sec.
Global Solar Radiation Pyranometer	Mean	(kW/m ²)	Mean of readings every 5 sec.
Barometric pressure	Mean	KPa	Recorded for every minute and averaged per 1 hour
Wind Speed and Direction Wind Vane and Propeller	Direction	(degrees)	Direction of daily mean wind vector from readings averaged every 5 sec.
	5 sec. Gust Speed	(km/h)	Maximum scalar wind speed from 5 sec readings.
	2 min. Gust Speed	(km/h)	Maximum of 2 minute scalar wind speed means from readings every 5 sec.
	10 min. Gust Speed	(km/h)	Maximum of 10 minute scalar wind speed means from readings every 5 sec.

Table C.2-8 Summary of monthly climate data collected at the RAMP Pierre Climate Station (C4) during the 2011 WY.

Month	Temperature			Total Precipitation (mm)	Month End Depth of Snow on Ground (cm)	Mean Relative Humidity (%)	Mean Total Global Solar Radiation (kW/m ²)	Station Pressure (kPa)	Maximum Sustained Wind Speeds		
	Min. (°C)	Mean (°C)	Max. (°C)						5 sec. (km/h)	2 min. (km/h)	10 min. (km/h)
Nov-10	-	-	-	-	-	-	-	-	-	-	-
Dec-10	-	-	-	-	-	-	-	-	-	-	-
Jan-11	-	-	-	-	-	-	-	-	-	-	-
Feb11	-	-	-	-	-	-	-	-	-	-	-
Mar-11	-	-	-	-	-	-	-	-	-	-	-
Apr-11	-	-	-	-	-	-	-	-	-	-	-
May-11	-	-	-	-	-	-	-	-	-	-	-
Jun-11	-	-	-	-	-	-	-	-	-	-	-
Jul-11	6.9 P	17.2 P	27.2 P	38.3 P	0.0 P	76.6 P	0.185 P	97.1 P	44.5 P	44.5 P	22.8 P
Aug-11	2.3	15.6	29.4	45.4	0.0	73.6	0.189	97.3	44.8	44.8	23.4
Sep-11	-6.4	12.1	32.6	26.5	0.0	69.9	0.144	97.5	41.2	41.2	19.7
Oct-11	-9.4	3.6	16.9	24.5	0.0	79.7	0.061	97.4	40.6	40.6	21.0
2011 WY Annual											

Note: M = Missing, P = Partial. See additional notes in sections C.1.1.1 and C.2.1.6.

C.2.1.5 Climate Variables at Other RAMP Stations

Table C.2-9 summarizes the climate variables monitored at RAMP stations other than the Aurora, Horizon, Steepbank, and Pierre Climate stations.

Annual precipitation was monitored at stations L1 (using a Pluvio weighing gauge) and L2 (using a Geonor weighing gauge), with rainfall also being measured from April to October of 2011 at stations S3, S19, S31, S40, and S43 using tipping bucket rain gauges.

Barometric pressure was monitored at Station S5A throughout the 2011 WY.

Table C.2-9 to Table C.2-11 provide a monthly summary of the climate data collected at other RAMP stations. Daily monitoring data are included in the RAMP database. Daily cumulative precipitation and rainfall depths at the various stations are compared to precipitation recorded at other regional stations in Figure C.2-1 and Figure C.2-2.

Table C.2-9 Climate data collected at other RAMP stations, 2011.

Station	Variable	Sensor
L1 McClelland Lake	Precipitation	Weighing Gauge
	Water Temperature	Thermistor
	Air Temperature	Thermistor
	Relative Humidity	Humidity Sensor
L2 Kearl Lake	Precipitation	Geonor Precipitation Gauge
	Water Temperature	Thermistor
	Air Temperature	Thermistor
	Relative Humidity	Humidity Sensor
S3 Iyininim Creek above Kearl Lake	Rainfall	Tipping Bucket
S5A Muskeg River above Muskeg Creek	Barometric Pressure	Pressure Transducer
S19 Tar River Lowland Tributary near the mouth	Rainfall	Tipping Bucket
S31 Hangingstone Creek at North Star Road	Rainfall	Tipping Bucket
S40 MacKay River at Petro-Canada Bridge	Rainfall	Tipping Bucket
S43 Firebag River upstream of Suncor Firebag	Rainfall	Tipping Bucket

Table C.2-10 Summary of climate data collected at RAMP stations at McClelland Lake (L1) and Kearl Lake (L2) during the 2011 WY.

Station	L1 McClelland Lake				L2 Kearl Lake			
Period of Operation	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011	Nov 1, 2010 to Oct 31, 2011
Month	Precipitation Depth (mm)	Water Temperature (°C)	Air Temperature (°C)	Relative Humidity (%)	Precipitation Depth (mm)	Water Temperature (°C)	Air Temperature (°C)	Relative Humidity (%)
Nov-10	12.8	2.6	-8.0	82.7	10.1	2.8	-7.2	83.5
Dec-10	20.7	1.2	-17.9	84.1	14.6	1.3	-17.1	88.0
Jan-11	19.3	0.2	-20.4	82.5	23.9	0.7	-19.2	86.9
Feb-11	10.5	-1.1	-16.8	76.1	22.2	0.3	-16.1	79.3
Mar-11	4.7	-1.8	-10.9	64.2	5.7	0.1	-10.7	69.4
Apr-11	5.8	-0.1	1.4	63.1	4.7	0.1	2.2	57.6
May-11	1.9	5.1	11.6	53.3	10.0	5.7	12.4	49.5
Jun-11	24.1	15.5	15.3	64.0	17.6	10.7	15.5	60.6
Jul-11	86.6	19.7	18.2	70.8	64.0	13.2	18.2	68.6
Aug-11	34.1	18.7	16.7	71.5	47.9	13.8	16.6	68.3
Sep-11	18.0	14.3	13.2	67.7	42.4	13.0	13.6	63.1
Oct-11	14.0	7.7	4.5	78.9	12.8	10.8	5.3	72.9
Annual Sum	252.5				275.9			
Annual Mean		6.9	0.7	71.6		6.1	1.1	70.6

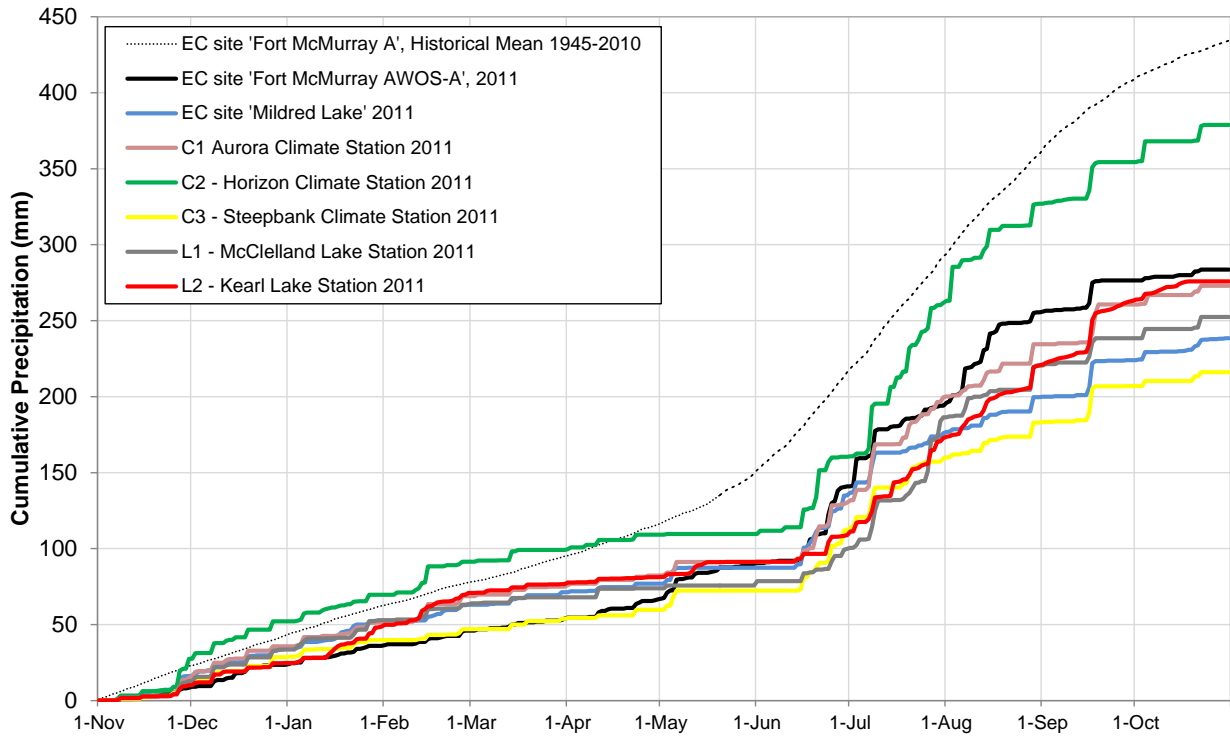
Note: M = Missing, P = Partial. See additional notes in sections C.1.1.1 and C.2.1.6.

Table C.2-11 Summary of total rainfall and atmospheric pressure data collected at other RAMP stations during the 2011 WY.

Station	S3 Iyinimin Creek above Kearl Lake	S19 Tar River Lowland Tributary near the mouth	S31 Hangingsone Creek at North Star Road	S40 MacKay River at Petro-Canada Bridge	S43 Firebag River upstream of Suncor Firebag	S5A Muskeg River above Muskeg Creek
Variable	Total Rainfall (mm)					Station Pressure (kPa)
Period of Operation	Apr 22 to Oct 29	Apr 18 to Oct 31	Apr 19 to Oct 31	Apr 4 to Oct 31	Apr 1 to Oct 31	Nov 1 to Oct 31
Nov-10	-	-	-	-	-	98.1
Dec-10	-	-	-	-	-	98.3
Jan-11	-	-	-	-	-	98.6
Feb-11	-	-	-	-	-	98.1
Mar-11	-	-	-	-	-	98.5
Apr-11	1.4 P	3.9 P	2.1 P	3.8 P	5.1 P	97.6
May-11	4.3	3.3	14.5	10.2	5.8	98.0
Jun-11	18.5	50.3	63.3	15.8	62.2	97.4
Jul-11	21.8	5.2	62	65.3	1.8	97.3
Aug-11	20.0	0	31.3	51.8	41.4	97.4
Sep-11	33.1	19.3	19.4	21.6	38.1	97.6
Oct-11	12.1 P	20.7	14.6	15.5	17.0	97.5
Annual Sum	111.2 P	102.7 P	207.2 P	227.1 P	171.5	-
Annual Mean	-	-	-	-	-	97.9

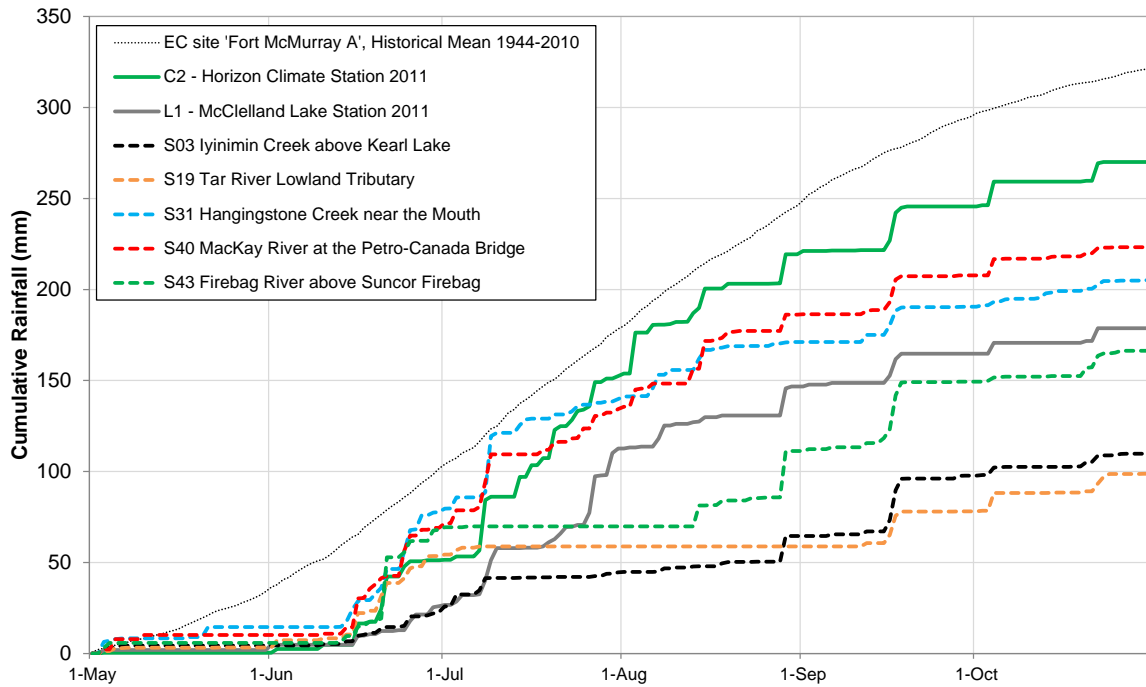
Note: M = Missing, P = Partial. See additional notes in sections C.1.1.1 and C.2.1.6.

Figure C.2-1 Annual Precipitation at Fort McMurray and RAMP climate stations, 2011 WY.



Note: Missing data at Station C2 was extrapolated using data from station C4 from August 26 to September 12.
 Missing data at Station C3 was extrapolated using EC Mildred Lake Station data.

Figure C.2-2 Rainfall at Fort McMurray and RAMP climate stations, 2011 WY.



Note: Missing data at Station C2 was extrapolated using data from station C4 from August 26 to September 12.

C.2.1.6 RAMP Database

RAMP Climate and Hydrology data are available on-line through the RAMP database (www.ramp-alberta.org). The 2011 WY data are published to the RAMP website in May 2012 upon the completion of the QA/QC process for data management. The following notes apply to the monthly climate data (Table C.2-2, C.2-5, C.2-6, C.2-8, C.2-9, C.2-10, C.2-11, and C.2-12) and to the daily data, which are publically available and provided in the RAMP database:

- Time distribution of snowfall is sometimes recorded with a lag-time of approximately three to six hours (and less than one day);
- Precipitation measurement, including tipping bucket rain gauges, do not differentiate between rainfall and snowfall; therefore, the values recorded represent total precipitation for the associated period of record;
- Wind direction, from which the wind is blowing, is reported in degrees clockwise from North;
- Reported monthly climate data include extreme minimum and maximum temperature data; mean temperature and relative humidity; and total precipitation and solar radiation; and
- Reported annual values include extreme minimum and maximum temperature; mean temperature, relative humidity and solar radiation; and total precipitation.

C.2.1.7 2011 Snow Course Survey Results

Snow course surveys were completed at sites representing four general terrain types across the RAMP study area:

- Flat low lying areas (FL);
- Open land or lake areas (OP);
- Mixed deciduous (MD); and
- Jackpine (JP).

Locations of the snow course surveys are shown on Figure 3.1-1 in the main report.

Snow course surveys were completed from February 8 to 12, March 7 to 14, March 31 to April 4, 2011, with selected extra surveys on April 13 following a late-season snowfall event. The results organized by land cover type are shown in Table C.2-12 and organized by region are shown in Table C.2-13. Snow survey data are also available through the RAMP database.

C.2.2 Climate Data from Government Agencies

Daily climate data published by Environment Canada for climate stations in the study area have been incorporated into the RAMP database. An inventory of data obtained from these stations is provided in Section C.5.

As of 2009, Environment Canada climate data includes data collected at the Fort McMurray and Mildred Lake stations. Data from the Forestry lookout station are no longer being processed by Environment Canada.

Table C.2-12 Summary of the RAMP snow course surveys organized by land cover type, winter 2011.

Terrain Type	Survey ID	February (Feb 8 to 12)		March (Mar 7 to 14)		April (Mar 31 to Apr 4)	
		Snow Depth (cm)	SWE (mm)	Snow Depth (cm)	SWE (mm)	Snow Depth (cm)	SWE (mm)
Flat Low Lying	CANR-FL-A	53	74	76	117	46	125
	CNRL-FL-A	58	110	61	114	51	118
	MCLL-FL-A	52	106	65	140	39	101
	NEX-FL-A	38	66	61	114	29	80
	<i>Average</i>	50	89	66	<u>121</u>	41	106
Open Land/Lake Area	CANR-OP-A	27	57	17	36	5	18
	CNRL-OP-A	44	94	56	125	24	66
	MCLL-OP-A	33	66	28	70	11	44
	NEX-OP-A	17	33	35	85	5	18
	<i>Average</i>	30	63	34	<u>79</u>	11	37
Mixed Deciduous	CANR-MD-A	41	75	58	114	34	119
	CNRL-MD-A	45	86	59	120	36	78
	MCLL-MD-A	46	90	55	110	39	98
	NEX-MD-A	28	52	53	96	37	95
	<i>Average</i>	40	76	56	<u>110</u>	37	98
Jackpine	CANR-JP-A	36	59	55	113	32	95
	CNRL-JP-A	47	88	45	91	49	103
	MCLL-JP-A	42	80	53	97	35	80
	NEX-JP-A	26	48	45	74	37	85
	<i>Average</i>	38	69	50	<u>94</u>	38	91

Note: Underlined average values denote the maximum observed values for a given terrain type in 2011. These values are plotted in Figure 4.1-4.

Table C.2-13 Summary of the RAMP snow course surveys organized by region, winter 2011.

Region	Survey ID	February (Feb 8 to 12)		March (Mar 7 to 14)		April (Mar 31 to Apr 4)	
		Snow Depth [cm]	SWE [mm]	Snow Depth [cm]	SWE [mm]	Snow Depth [cm]	SWE [mm]
Kearl Lake Area	CANR-FL-A	53	74	76	117	46	125
	CANR-OP-A	27	57	17	36	5	18
	CANR-MD-A	41	75	58	114	34	119
	CANR-JP-A	36	59	55	113	32	95
	Average	39	66	52	95	29	89
CNRL Lake Area	CNRL-FL-A	58	110	61	114	51	118
	CNRL-OP-A	44	94	56	125	24	66
	CNRL-MD-A	45	86	59	120	36	78
	CNRL-JP-A	47	88	45	91	49	103
	Average	49	95	55	113	40	91
McClelland Lake Area	MCLL-FL-A	52	106	65	140	39	101
	MCLL-OP-A	33	66	28	70	11	44
	MCLL-MD-A	46	90	55	110	39	98
	MCLL-JP-A	42	80	53	97	35	80
	Average	43	86	50	104	31	81
Sucker Lake Area	NEX-FL-A	38	66	61	114	29	80
	NEX-OP-A	17	33	35	85	5	18
	NEX-MD-A	28	52	53	96	37	95
	NEX-JP-A	26	48	45	74	37	85
	Average	27	50	49	92	27	70

C.3 HYDROMETRIC DATA COLLECTED IN THE 2011 WY

Hydrometric data for the region were collected throughout the 2011 WY. RAMP Climate and Hydrology data are available on-line through the RAMP website (www.ramp-alberta.org). The 2011 WY data is published to the RAMP website in May 2012 upon the completion of the QA/QC process for data management.

C.3.1 RAMP Hydrometric Data

Hydrometric data, including water level and discharge, were collected for the region during the 2011 WY. These data were collected at hydrometric monitoring stations where near-continuous water level data were recorded using pressure transducers and data loggers. Discharge rating curves, developed and maintained for each station, were applied to develop flow values from the recorded water level data. Suspended sediment samples were also collected at 34 RAMP hydrometric stations during the 2011 WY.

C.3.1.1 Water Level and Discharge

Table C.3-1 summarizes RAMP hydrometric monitoring in the 2011 WY. The quality assessment shown for each station record was based on an assessment matrix which considers the number and quality of discharge measurements made during the year, the quality and extent of the stage-discharge rating curve, and the record completeness.

Data quality for the 2011 WY was generally good (34 of 39 locations) with wildlife, wildfire, and equipment attrition affecting the 2011 WY hydrometric record at 11 stations as described below:

- The pressure transducer at McClelland Lake (Station L1) was encased in ice on January 23 due to extreme cold conditions, which affected water level measurements until the ice around the pressure transducer thawed on May 12.
- A faulty voltage regulator caused Station S10, Wapasu Creek at Canterra Road, to lose power on December 13, 2010. The voltage regulator was replaced on the next station visit on January 15, 2011 and station function was reinstated.
- The pressure transducer at Station S14A, Ells River near the CNRL Bridge, failed on July 24, 2011. A new pressure transducer and datalogger were installed on August 12 to reinstate the station.
- Station S15A, Tar River near the mouth, was damaged by wildfire on June 23, 2011. The station was reinstalled and became fully operational on August 12.
- Station S16A, Calumet River near the mouth, was damaged by wildfire in spring 2011 (the exact date is unknown given the datalogger melted from the fire). The station was replaced with a new datalogger and pressure transducer on July 27 when field crews were able to access the area.
- The datalogger malfunctioned at Station S19, Tar River Lowland Tributary near the mouth, after installation on April 19, 2011. Data recording was reinstated on June 24 when a replacement datalogger was installed at the station.
- A wildfire damaged the pressure transducer at Station S24, Athabasca River below Eymundson Creek, on June 2, 2011. Station function was reinstated during the following station visit on June 18.

- The pressure transducer at Station S31, Hangingstone Creek at Northstar Road, malfunctioned shortly after installation in late April and was replaced with a newly-calibrated pressure transducer on June 20.
- Station S36, McClelland Lake outlet, was damaged on May 8, 2011 by wildfire. The station was repaired on July 27 when field crews were able to access the area.
- The pressure transducer at Station S45, Ells River above Joslyn Creek Diversion, was damaged by wildlife on September 27, 2011. Station function was reinstated on October 28.
- The pressure transducer wiring at Station S48, Big Creek, was damaged on June 1, 2011 by an unknown source. The pressure transducer was rewired on July 28 to reinstate the full function of the station.

Data quality at the following six stations was compromised due to backwater effects caused by beaver activity:

- S09, Kearl Lake Outlet;
- S10, Wapasu Creek at Canterra Road;
- S19, Tar River Lowland Tributary;
- S20, Muskeg River Upland;
- S36, McClelland Lake Outlet above Firebag River; and
- S50, Red Clay Creek.

Table C.3-1 Summary of RAMP hydrometric monitoring during the 2011 WY.

Watershed and Station	Catchment Area (km ²)	Monitored Period 2011 WY	Percent of Open Water Period Record Available 2011 WY	Maximum Daily Discharge (Water Year: Nov 1 2010 - Oct 31 2011)		Minimum Daily Discharge (Open Water Season: May 1 - Oct 31 2011)		Runoff Volume (Open Water Season: May 1 - Oct 31 2011)	
				2011 WY (m ³ /s)	Historic Mean (m ³ /s)	2011 WY (m ³ /s)	Historic Mean (m ³ /s)	2011 WY (mm)	Historic Mean (mm)
<i>Athabasca River</i>									
S46 - Athabasca River near Embarras Airport	162,000	Aug 16 – Oct 31	42	1,101	2,700	363	570	-	-
S24 - Athabasca River below Eymundson Creek	146,000	Nov 1 - Oct 31	92	4,438	1,986	374	361	11.3	9.3
Athabasca River at Fort McMurray (07DA001)	133,000	Nov 1 - Oct 31	100	4,410	2,478	323	428	14.0	11.7
<i>Muskeg River Watershed</i>									
S2 - Jackpine Creek at Canterra Road	358	Nov 1 - Oct 31	100	4.1	8.0	0.01	0.30	2.1	9.0
S3 - Iyininim Creek above Kearl Lake	32.2	Apr 22 - Oct 29	100	0.6	-	0.00	0.03	3.7	11.2
S5 - Muskeg River above Stanley Creek	395	Nov 1 - Oct 31	100	3.1	8.7	0.03	0.20	2.3	7.1
S5A - Muskeg River above Muskeg Creek	552	Nov 1 - Oct 31	100	3.6	8.5	0.03	0.37	2.1	6.1
S7 - Muskeg River near Fort McKay (07DA008)	1,457	Nov 1 - Oct 31	100	9.2	22.3	0.29	1.09	2.0	7.1
S9 - Kearl Lake Outlet	73.6	Apr 26 - Oct 31	100	0.1	0.5	0.00	0.03	0.2	3.3
S10 - Wapasu Creek at Canterra Road	90.7	Jan 15 - Oct 31	100	0.6	3.6	0.02	0.06	1.0	8.7
S20 - Muskeg River Upland	157	Apr 21 - Oct 31	100	0.5	-	0.00	0.07	1.3	6.2
S22 - Muskeg Creek near the mouth	369	Apr 26 - Oct 31	100	1.8	-	0.03	0.17	1.3	5.5
S33 - Muskeg River at Aurora/Shell Boundary	728	Nov 1 - Oct 31	100	4.6	14.7	0.09	0.48	2.2	6.9
S37 - East Jackpine Creek near the 1,300m Contour	33	Apr 22 - Oct 29	100	0.5	-	0.01	0.01	3.7	14.5
<i>Athabasca River Tributaries Upstream of Fort McMurray</i>									
S29 - Christina River near Chard (07CE002)	4,860	Nov 1 - Oct 31	100	107.0	92.2	5.84	6.49	9.6	7.6
S31 - Hangingstone Creek at North Star Road	160	Jun 20 - Oct 31	73	4.0	-	0.13	0.18	-	8.7
S32 - Surmount Creek at Highway 881	158	Apr 25 - Oct 31	100	10.3	-	0.00	0.15	9.1	10.3
S42 - Clearwater River above Christina River (07CD005)	17,017	Nov 1 - Oct 31	100	104.0	194.3	45.00	59.71	6.1	8.6
S47 - Christina River near the mouth	13,455	Jul 28 - Oct 31	52	112.5	-	16.25	-	-	-

* See Section C.2.1.1 for details of missing data.

Means were calculated from years with greater than 85% of data for the required period.

Volumes presented to three significant figures.

Table C.3-1 (Cont'd.)

Watershed and Station	Catchment Area (km ²)	Monitored Period 2011 WY	Percent of Open Water Period Record Available 2011 WY	Maximum Daily Discharge (Water Year: Nov 1 2010 - Oct 31 2011)		Minimum Daily Discharge (Open Water Season: May 1 - Oct 31 2011)		Runoff Volume (Open Water Season: May 1 - Oct 31 2011)	
				2011 WY	Historic Mean	2011 WY	Historic Mean	2011 WY	Historic Mean
				(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(mm)	(mm)
Athabasca River Tributaries Downstream of Fort McMurray									
S6 - Mills Creek at Highway 63	9	Nov 1 - Oct 31	100	0.1	0.1	0.01	0.02	2.4	8.2
S11 - Poplar Creek at Highway 63 (07DA007)	151	Apr 5 - Oct 31	100	3.5	9.8	0.06	0.06	8.0	14.3
S12 - Fort Creek at Highway 63	32	Apr 20 - Oct 31	100	0.2	-	0.03	0.02	3.4	4.7
S14A - Ells River at CNRL Bridge	2,450	Nov 1 - Oct 31	90	36.3	57.6	1.91	2.37	5.6	6.9
S15A - Tar River near the mouth	333	Apr 18 - Oct 31	71	5.3	2.8	0.15	0.19	-	3.6
S16A / S16A / CR-1 - Calumet River	174	Apr 24 - Oct 29	61	2.2	2.2	0.04	0.02	-	1.7
S19 - Tar River Lowland Tributary near the mouth	11.5	Jun 24 - Oct 31	71	0.033	-	0.000	0.002	-	2.0
S25 - Susan Lake Outlet	13.6	Jun 18 - Oct 25	74	0.1	-	0.01	0.01	-	6.1
S26 - MacKay River near Fort McKay (07DB001)	5,569.3	Nov 1 - Oct 31	100	50	111.1	3.57	3.65	4.7	6.7
S27 - Firebag River near the mouth (07DC001)	5,687.6	Nov 1 - Oct 31	100	54	119.7	13.80	15.50	5.8	10.5
S34 - Tar River above CNRL Lake	134	Nov 1 - Oct 31	100	4.4	5.3	0.10	0.11	8.4	8.4
S36 - McClelland Lake Outlet above Firebag River	330	Apr 22 - Oct 29	57	0.8	-	0.25	0.32	-	2.2
S38 - Steepbank River near Fort McMurray (07DA006)	1,320	Nov 1 - Oct 31	100	13.5	33.9	0.80	1.68	3.6	10.3
S39 - Beaver River above Syncrude (07DA018)	165	Nov 1 - Oct 31	100	2.5	9.1	0.01	0.13	3.4	8.0
S40 - MacKay River at Petro-Canada Bridge	5,290	Nov 1 - Oct 31	100	38	38.4	2.39	2.83	3.6	4.7
S43 - Firebag River above Suncor Firebag	2,437	Nov 1 - Oct 31	100	18.7	-	3.23	5.80	4.4	9.6
S44 - Pierre River near Fort McKay (07DA013)	123	Apr 24 - Oct 29	100	2.6	1.4	0.05	0.05	4.5	3.5
S45 - Ells River above Joslyn Creek Diversion	2,450	Nov 1 - Oct 31	84	33.8	30.1	2.89	3.03	6.4	5.4
S48 - Big Creek near the mouth	304	Apr 23 - Oct 29	71	2.0	-	0.02	-	-	-
S49 - Eymundson Creek near the mouth	243	Jul 27 - Oct 29	53	2.5	-	0.17	-	-	-
S50 - Red Clay Creek	187	Apr 23 - Oct 29	100	0.5	-	0.00	-	0.8	-
				Maximum Water Level		Minimum Water Level			
Water Level Stations				2011 WY	Historic Mean	2011 WY	Historic Mean		
L1 - McClelland Lake	191	Nov 1 - Oct 31	94	294.652	294.621	294.449	294.379		
L2 - Kearl Lake	72.6	Nov 1 - Oct 31	100	331.981	332.120	331.785	331.759		
L3 - Isadore`s Lake	28	Nov 1 - Oct 31	100	233.901	233.940	233.733	233.672		

* See Section C.2.1.1 for details of missing data.

Means were calculated from years with greater than 85% of data for the required period.

Volumes presented to 3 significant figures.

C.3.1.2 Suspended Sediment

Suspended sediment samples were collected at 34 RAMP stream flow stations for a total of 112 measurements in the 2011 WY. The total suspended sediment (TSS) data are provided in Table C.3-2. Discharge (Q) shown in the table is the manual discharge measurement at the time the sample was collected where available.

Table C.3-2 Suspended sediment data collected at RAMP hydrometric stations during the 2011 WY.

Station	June 15 to 24	July 26	Aug 8 to 18	Sept 12 to 26	Oct 25 to Nov 5	
S02	TSS (mg/L)	4.0	*	4.0	7.0	<3.0
	Q (m ³ /s)	0.223	*	0.034	0.057	0.115
S03	TSS (mg/L)	*	*	<3.0	5.0	4.0
	Q (m ³ /s)	*	*	0.026	0.042	0.018
S5	TSS (mg/L)	*	*	10	10.0	<3.0
	Q (m ³ /s)	*	*	0.167	0.068	0.174
S5A	TSS (mg/L)	10.0	*	6.0	4.0	8.0
	Q (m ³ /s)	0.556	*	0.181	0.143	0.283
S6	TSS (mg/L)	6.0	*	6.0	13.0	<3.0
	Q (m ³ /s)	0.012	*	0.012	0.007	0.012
S7	TSS (mg/L)	<3.0	*	7.0	3.0	<3.0
	Q (m ³ /s)	1.111	*	0.406	0.446	0.555
S9	TSS (mg/L)	4.0	*	3.0	5.0	9.0
	Q (m ³ /s)	0.0	*	0.001	0.0	0.0
S10	TSS (mg/L)	*	*	7.0	6.0	4.0
	Q (m ³ /s)	*	*	0.018	0.024	0.017
S11	TSS (mg/L)	*	*	<3.0	*	7.0
	Q (m ³ /s)	*	*	0.333	*	0.224
S12	TSS (mg/L)	*	*	5.0	6.0	5.0
	Q (m ³ /s)	*	*	0.044	0.071	0.067
S14 A	TSS (mg/L)	19.0	*	10.0	<3.0	4.0
	Q (m ³ /s)	6.383	*	8.677	3.415	2.408
S15 A	TSS (mg/L)	12.0	*	23.0	8.0	4.0
	Q (m ³ /s)	0.6	*	0.839	0.218	0.189
S16 A	TSS (mg/L)	*	3.0	4.0	19.0	22.0
	Q (m ³ /s)	*	0.515	0.231	0.028	0.071
S19	TSS (mg/L)	5.0	*	7.0	16.0	<3.0
	Q (m ³ /s)	0.033	*	0.005	0.003	0.009
S20	TSS (mg/L)	<3.0	*	4.0	6.0	5.0
	Q (m ³ /s)	0.102	*	0.036	0.002	0.010
S22	TSS (mg/L)	<3.0	*	12.0	6.0	8.0
	Q (m ³ /s)	0.122	*	0.059	0.007	0.047
S24	TSS (mg/L)	104	*	65.0	18.0	7.0
	Q (m ³ /s)	1001.1	*	859.1	522.096	404.795

* Not measured.

Table C.3-2 (Cont'd.)

Station		June 15 to 24	July 26	Aug 8 to 18	Sept 12 to 26	Oct 25 to Nov 5
S25	TSS (mg/L)	<3.0	*	7.0	*	*
	Q (m ³ /s)	0.032	*	0.019	*	*
S31	TSS (mg/L)	6.0	*	8.0	3.0	14.0
	Q (m ³ /s)	0.272	*	1.06	0.116	0.110
S32	TSS (mg/L)	50.0	*	11.0	10.0	7.0
	Q (m ³ /s)	1.247	*	0.839	0.109	0.133
S33	TSS (mg/L)	3.0	*	3.0	7.0	<3.0
	Q (m ³ /s)	0.788	*	0.243	0.147	0.603
S34	TSS (mg/L)	*	89.0	42.0	17.0	5
	Q (m ³ /s)	*	1.590	0.814	0.192	0.103
S36	TSS (mg/L)	*	4.0	7.0	5.0	<3.0
	Q (m ³ /s)	*	0.0	0.356	0.355	0.384
S37	TSS (mg/L)	*	*	*	3	3
	Q (m ³ /s)	*	*	*	0.004	0.013
S40	TSS (mg/L)	7.0	*	13.0	7.0	<3.0
	Q (m ³ /s)	3.53	*	15.089	2.811	2.053
S43	TSS (mg/L)	*	*	22.0	3.0	<3.0
	Q (m ³ /s)	*	*	5.492	4.025	3.865
S44	TSS (mg/L)	*	*	*	7.0	<3.0
	Q (m ³ /s)	*	*	*	0.038	0.086
S45	TSS (mg/L)	*	48.0	8.0	6.0	<3.0
	Q (m ³ /s)	*	0.0	8.433	3.003	3.062
S46	TSS (mg/L)	*	*	*	19.0	*
	Q (m ³ /s)	*	*	*	537.12	*
S47	TSS (mg/L)	*	*	*	17.0	7.0
	Q (m ³ /s)	*	*	*	26.244	17.195
S48	TSS (mg/L)	*	25.0	68.0	11.0	<3.0
	Q (m ³ /s)	*	0.910	0.389	0.154	0.194
S49	TSS (mg/L)	*	322	132.0	*	23.0
	Q (m ³ /s)	*	1.702	0.768	*	0.284
S50	TSS (mg/L)	*	10.0	5.0	*	8.0
	Q (m ³ /s)	*	0.355	0.290	*	0.001

* Not measured.

C.3.2 Hydrometric Data from Focal Projects

Several oil sands operators provided stream flow and operational water withdrawal and release data to RAMP, as summarized in Table C.3-3.

C.3.3 Hydrometric Data from Government Agencies

Daily discharge data are published by Environment Canada, including data for WSC hydrometric stations that are within the RAMP study area. In some cases, RAMP provides winter monitoring at seasonal WSC stations to extend the record to cover the

full year. For stations where RAMP monitors to supplement the Environment Canada data record, the full period of record including both RAMP and WSC data have been incorporated into the RAMP database. Data flagging protocols are used in the database to identify data sources. An inventory of the data obtained for the stations is provided in Section C.5.

Table C.3-3 Hydrometric information for 2011 WY received from oil sands operators and incorporated into the water balance analyses.

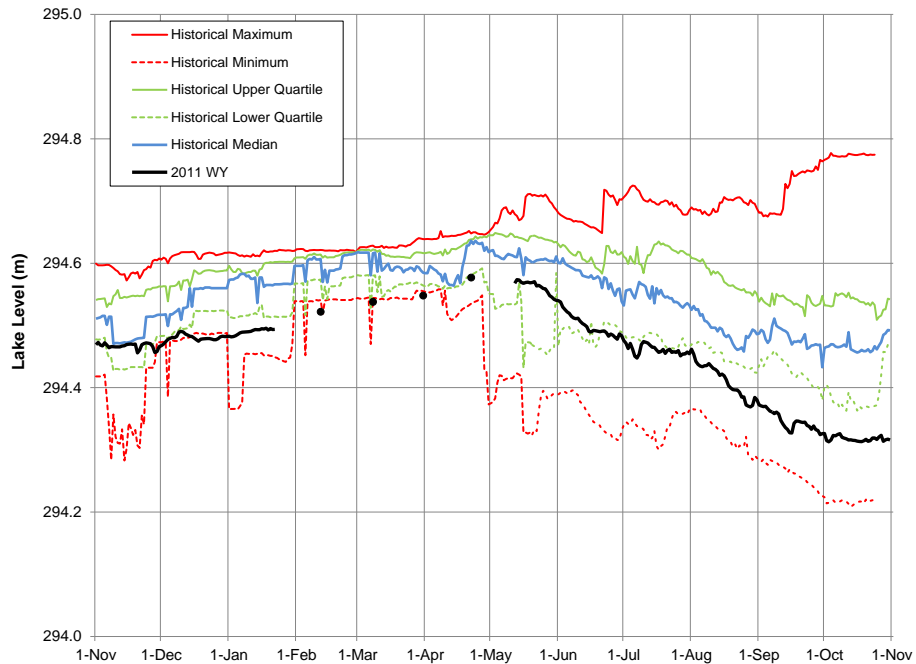
Operator	Watershed	Activity	Annual Volume (dam ³)	Location (if provided)	Time-step
CNRL - Horizon	Athabasca	Withdrawals from Athabasca River	10,300	SW14-96 W4M	Daily
Cenovus	Christina	Water withdrawals	69	Various	Daily
Nexen	Christina	Water withdrawals	33	Various	Daily
Total E&P Canada Ltd.	Ells	Water withdrawals from various sites	6	Various	Daily
	Athabasca	Water withdrawals	5	NE-26-095-11	
Synchrude	Muskeg	Aurora Clean Water Diversion to Stanley Creek	8,900	21-096-09-W4M	Daily
	Athabasca	Treated Sewage Releases to Athabasca River	310	02-093-10-W4M	Monthly
		Withdrawals from Athabasca River	36,300	35-096-09-W4M	
	Poplar Creek	Diversion from Beaver Creek into Poplar Creek	1,100		Daily
Shell – Jackpine Mine	Athabasca	Withdrawals from Athabasca River	11,700	476508E, 6347999N	Daily
Shell – Muskeg River Mine	Athabasca	Withdrawals from Athabasca River	12,100	461422.87E , 6346082.31N	Daily
	Muskeg	Water withdrawals	120		Daily
Suncor Energy Ltd.	Athabasca	Withdrawals from the Athabasca River	28,100	Various	Daily
		Releases to the Athabasca River	3,400		
	Steepbank	Water withdrawals	6	Various	Daily
		Water releases	110		
	Muskeg	Water withdrawals	11	Various	Daily
		Water releases	1		
	Firebag	Water Releases	98	Various	Daily
		Water withdrawals	<1		
MacKay	Water withdrawals	3	SE-18-093-12-W4	Daily	
Imperial Oil Resources	Athabasca	Withdrawals from Fort Hills	23	461020E, 6356390N	Daily
	Firebag	Withdraw from Moose Creek	2	490126E, 6374068	

Note: The above data were used in the water balance calculations described in Section 5. Further information was received from industry but not included within the water balance calculations. This includes: (i) data classified as muskeg dewatering, groundwater extraction or other processes not affecting natural surface watercourses and waterbodies; (ii) operator withdrawal and discharge data located downstream of the corresponding observed *test* monitoring location; and (iii) focal project withdrawal and discharges occurring on days when observed *test* monitoring did not occur (e.g., during winter months for open-water monitoring stations, or when data collection was prevented due to forest fires or other reasons). Values are presented to the nearest dam³ for values under 100 dam³, to the nearest 10 dam³ for values between 100-1000 dam³, and to the nearest 100 dam³ for values above 1000 dam³.

C.3.4 2011 WY Hydrographs in Historical Context

Discharge and water level hydrographs for the 2011 WY, for each RAMP station, are presented in Figure C.3-1 to Figure C.3-42. Historical maximum, minimum, and median daily values are also provided to assist with interpretation. Stations S43, S44, S45, S46, S47, S48, S49, and S50 do not contain more than two open-water seasons of historical data, and historical data are; therefore, not shown for these stations. In all cases, the current year was excluded from the calculation of the historical context, so that the current year is compared to the previous years.

Figure C.3-1 2011 WY water level hydrograph and historical context for Station L1, McClelland Lake.



Note: Missing continuous data occurred from January 23 to May 11, 2011 because the pressure transducer was encased in ice. Available manual measurements are presented during this period.

Figure C.3-2 2011 WY water level hydrograph and historical context for Station L2, Kearl Lake.

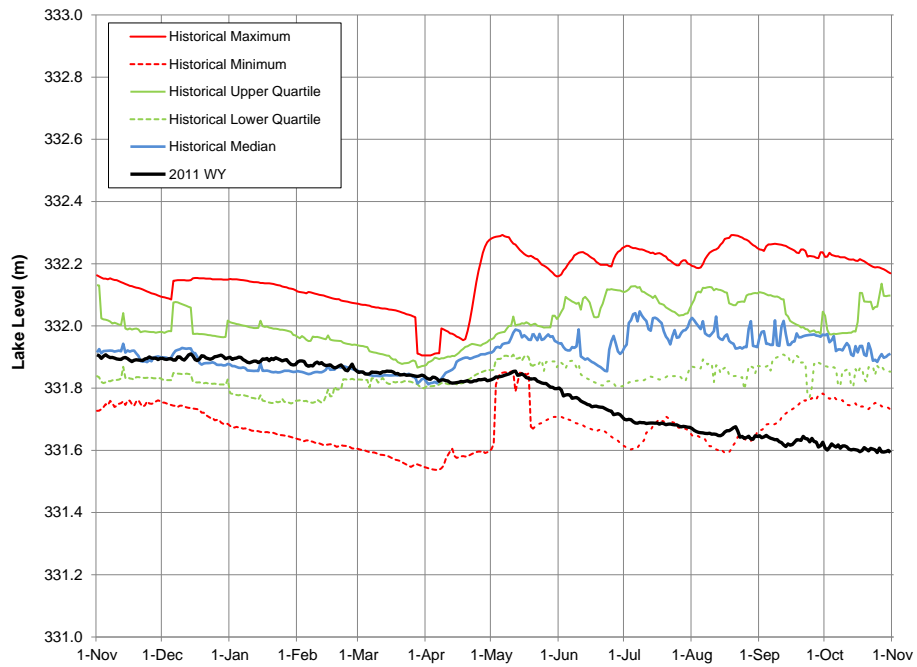


Figure C.3-3 2011 WY water level hydrograph and historical context for Station L3, Isadore's lake.

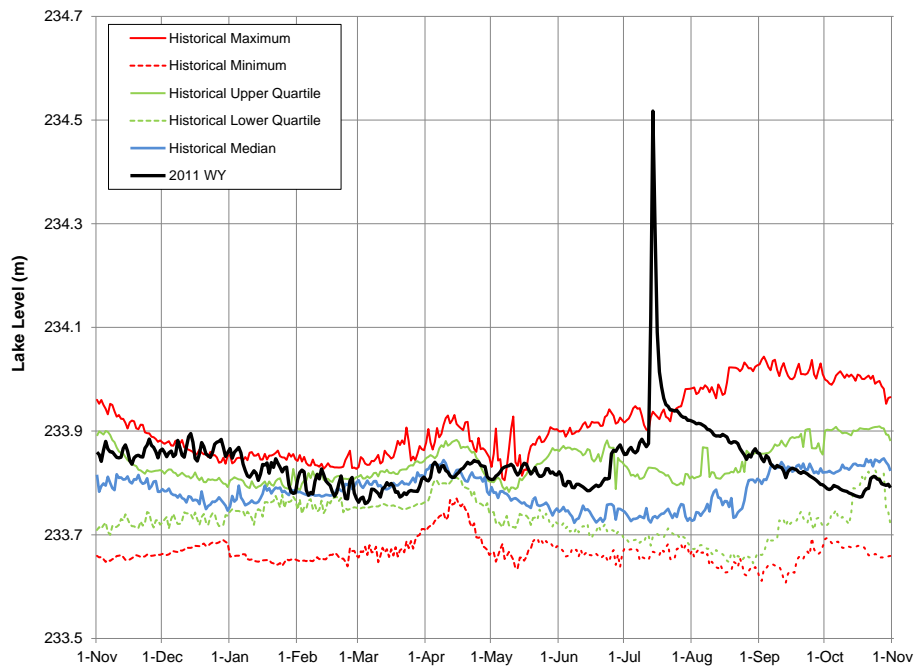


Figure C.3-4 2011 WY discharge hydrograph and historical context for Station S2, Jackpine Creek at Canterra Road.

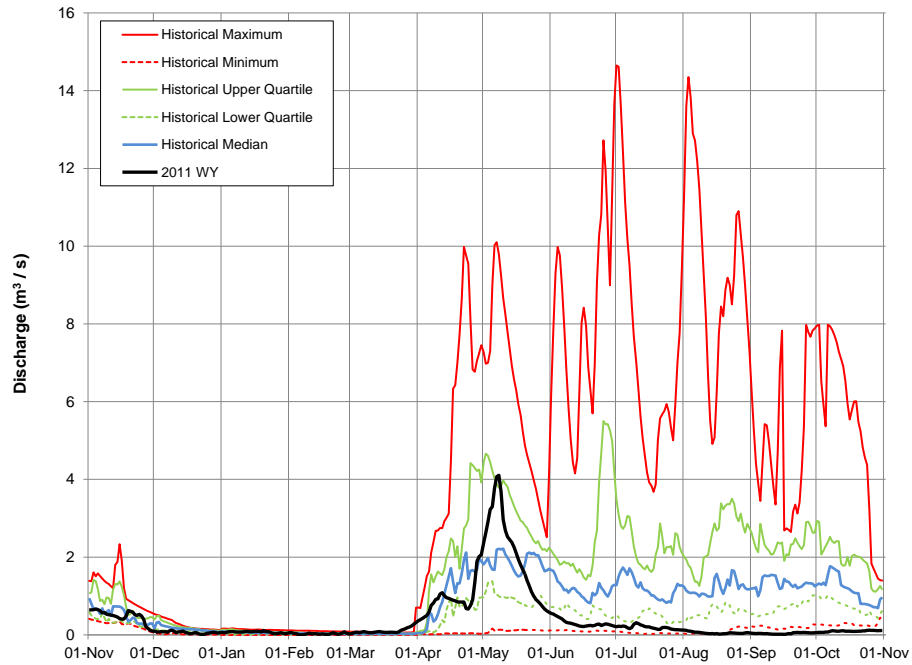


Figure C.3-5 2011 WY discharge hydrograph and historical context for Station S3, Iynimin Creek above Kearn Lake.

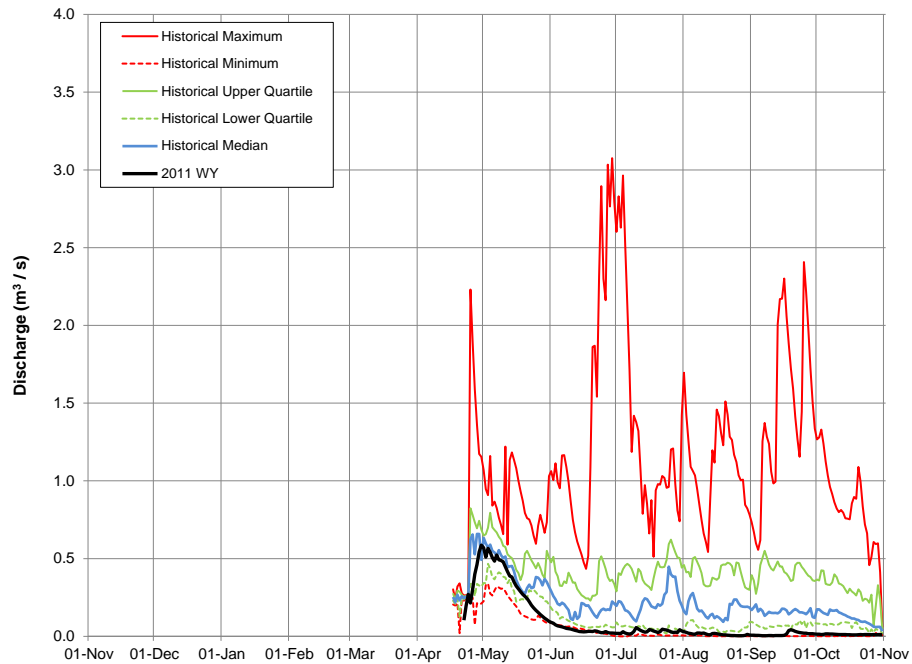


Figure C.3-6 2011 WY discharge hydrograph and historical context for Station S5, Muskeg River above Stanley Creek.

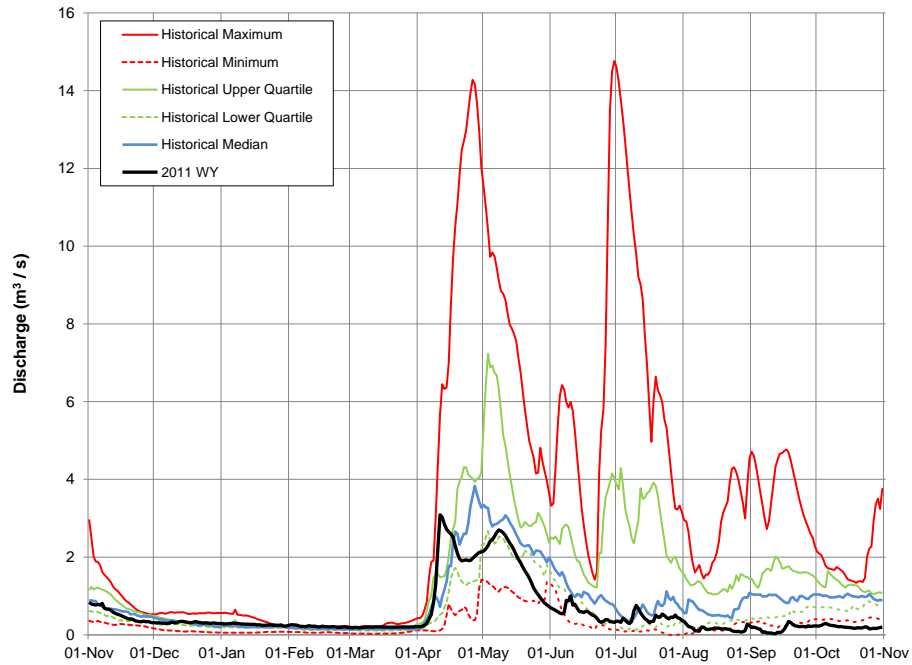


Figure C.3-7 2011 WY discharge hydrograph and historical context for Station S5A, Muskeg River above Muskeg Creek.

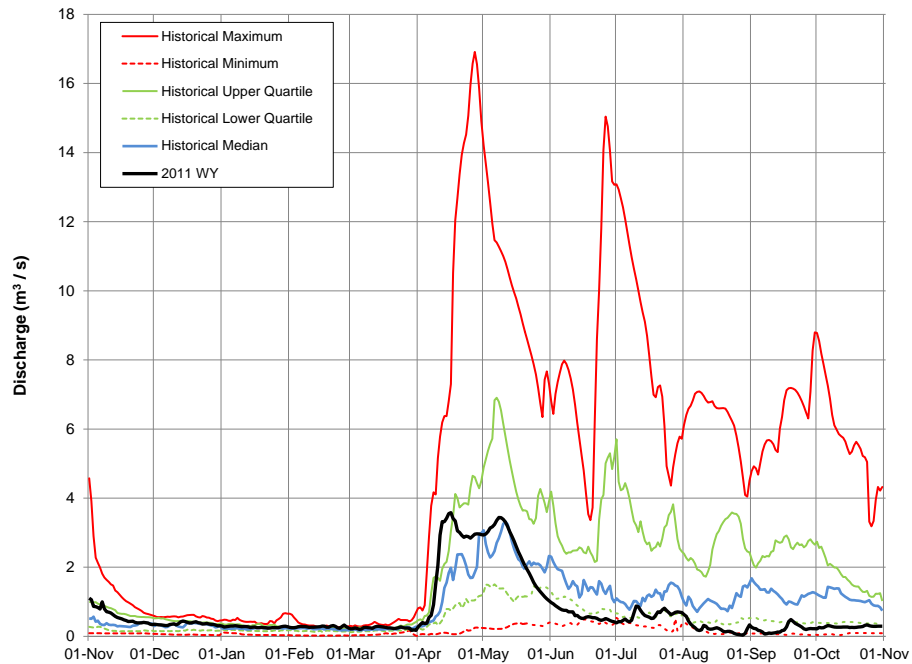


Figure C.3-8 2011 WY discharge hydrograph and historical context for Station S6, Mills Creek at Highway 63.

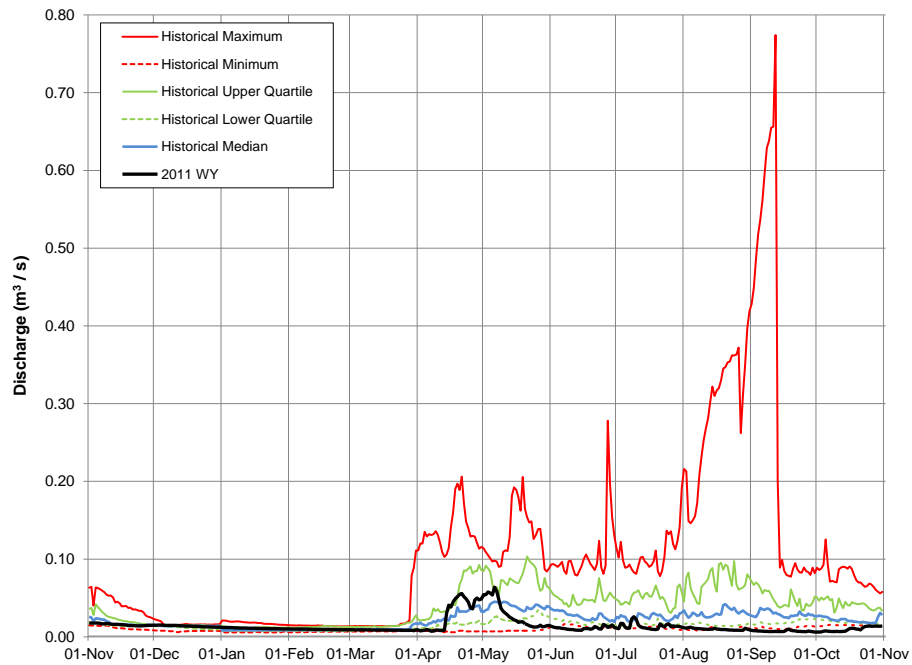
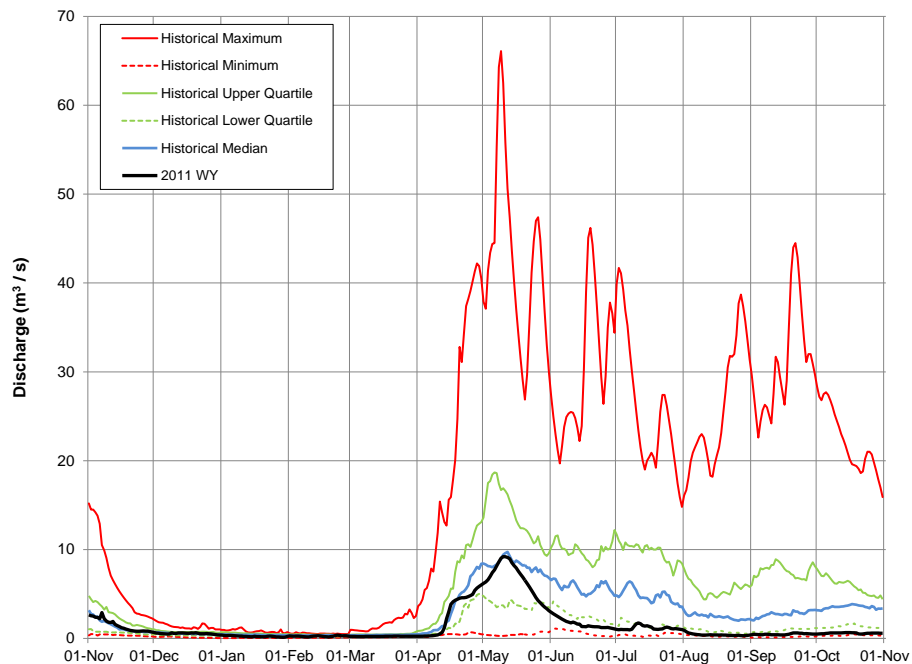
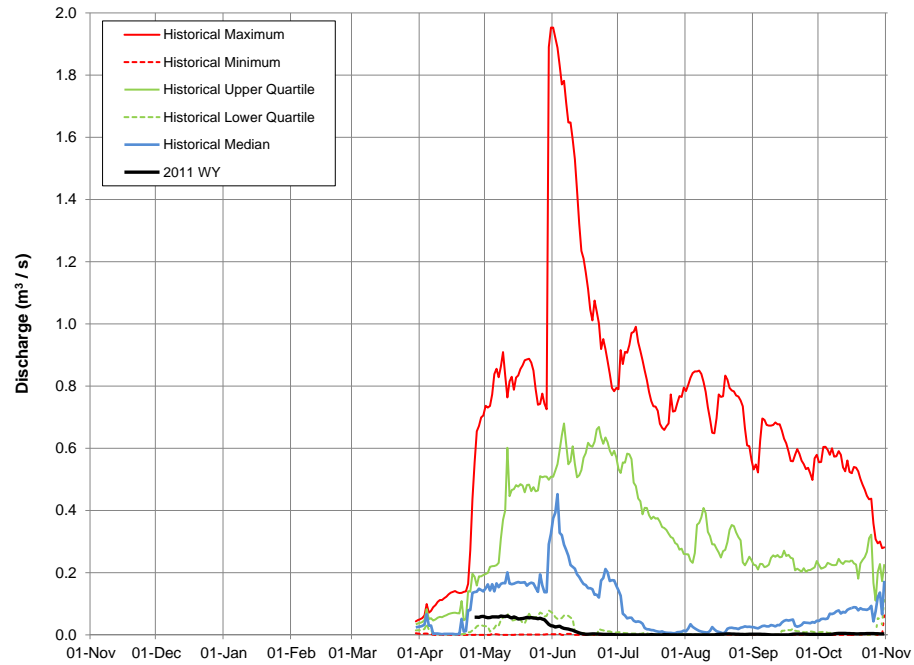


Figure C.3-9 2011 WY discharge hydrograph and historical context for Station S7, Muskeg River near Fort McKay (07DA008).



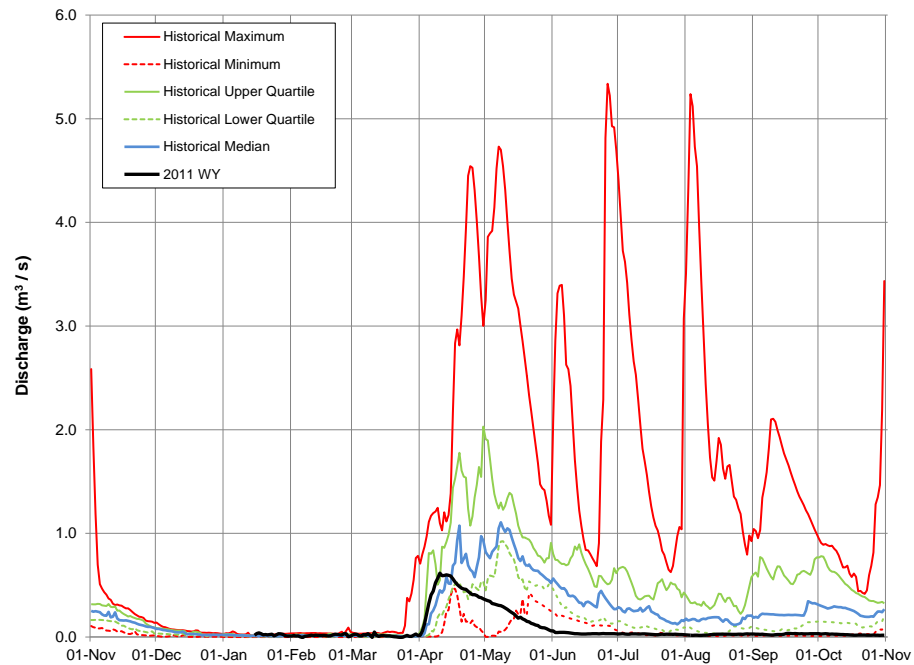
Note: Hydrograph is composed of WSC data from station 07DA008 from March 1 to October 31, 2011, and RAMP Station S7 data from November 1, 2010 to February 28, 2011.

Figure C.3-10 2011 WY discharge hydrograph and historical context for Station S9, Kearl Lake Outlet.



Note: Data at this site is impacted by beaver activity and data should be considered of poor quality.

Figure C.3-11 2011 WY discharge hydrograph and historical context for Station S10, Wapasu Creek at Canterra Road.



Note: Data at this site is impacted by beaver activity and is presented for reference purposes only.

Figure C.3-12 2011 WY discharge hydrograph and historical context for Station S11, Poplar Creek at Highway 63 (07DA007).

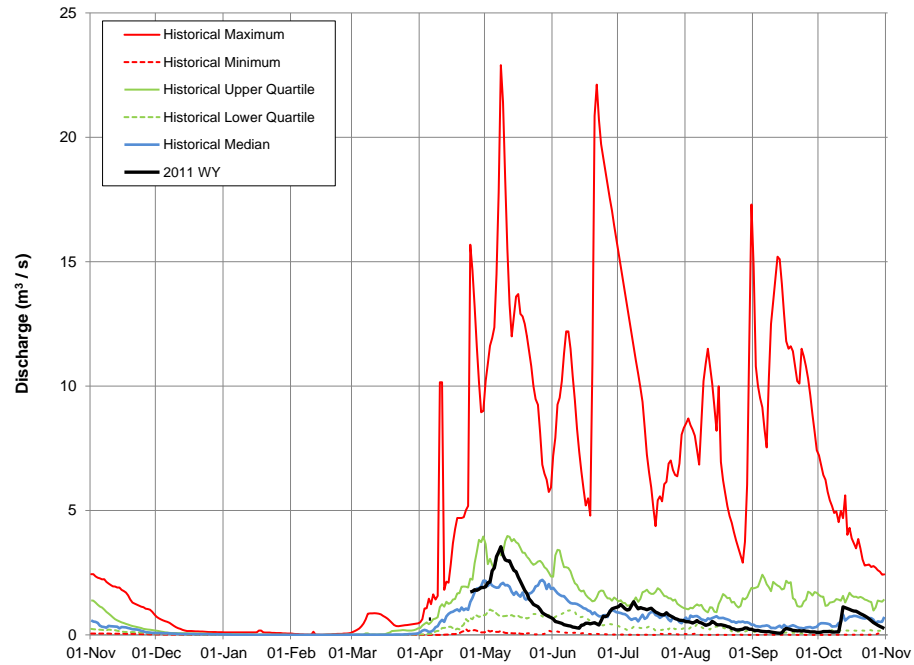


Figure C.3-13 2011 WY discharge hydrograph and historical context for Station S12, Fort Creek at Highway 63.

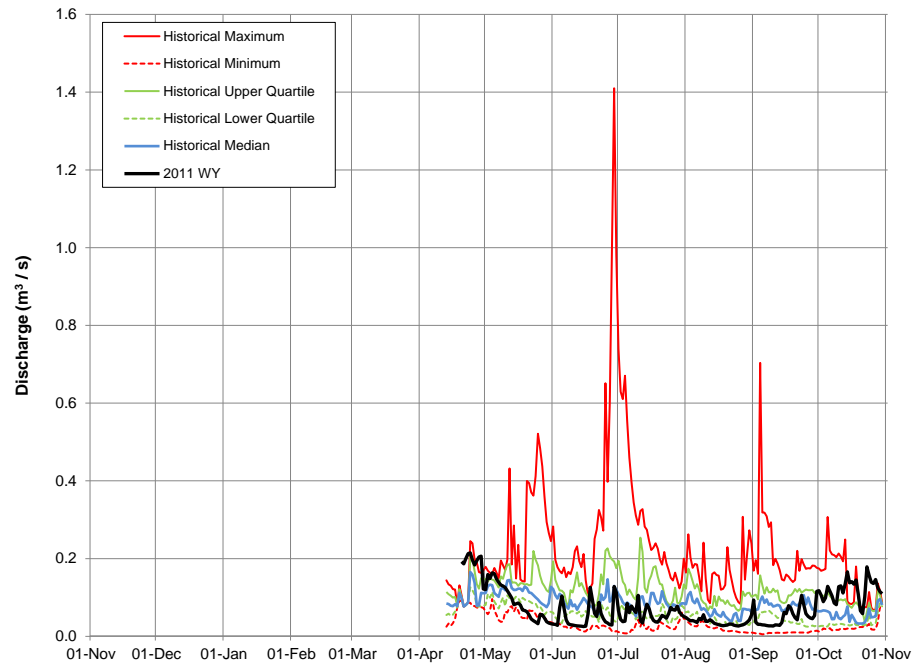
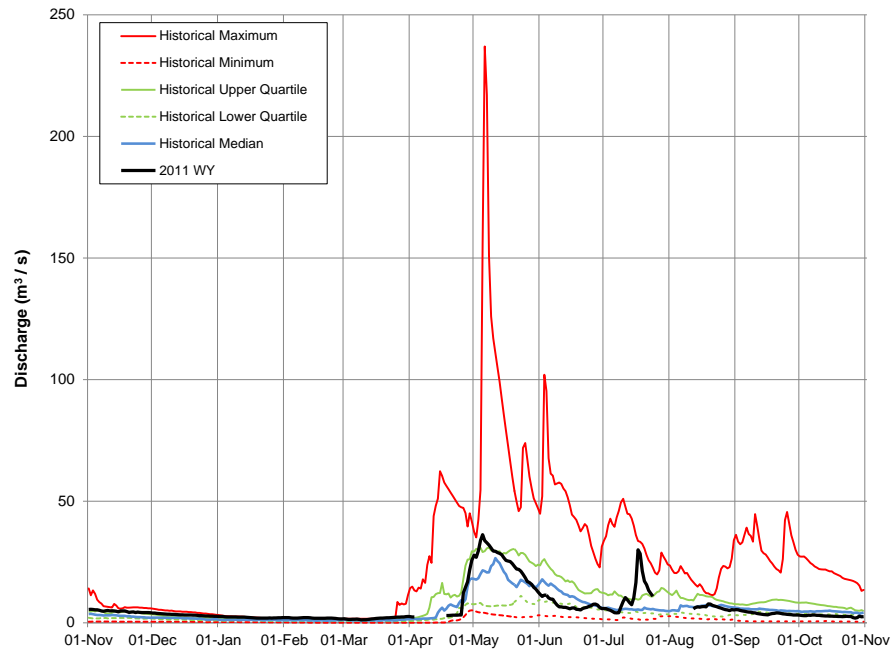
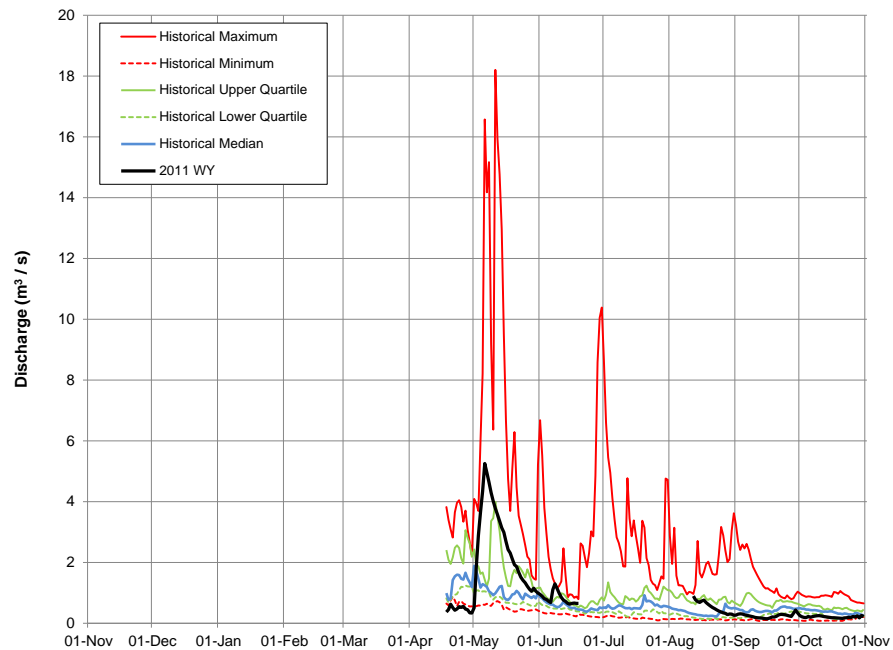


Figure C.3-14 2011 WY discharge hydrograph and historical context for Station S14A, Ells River at the CNRL Bridge.



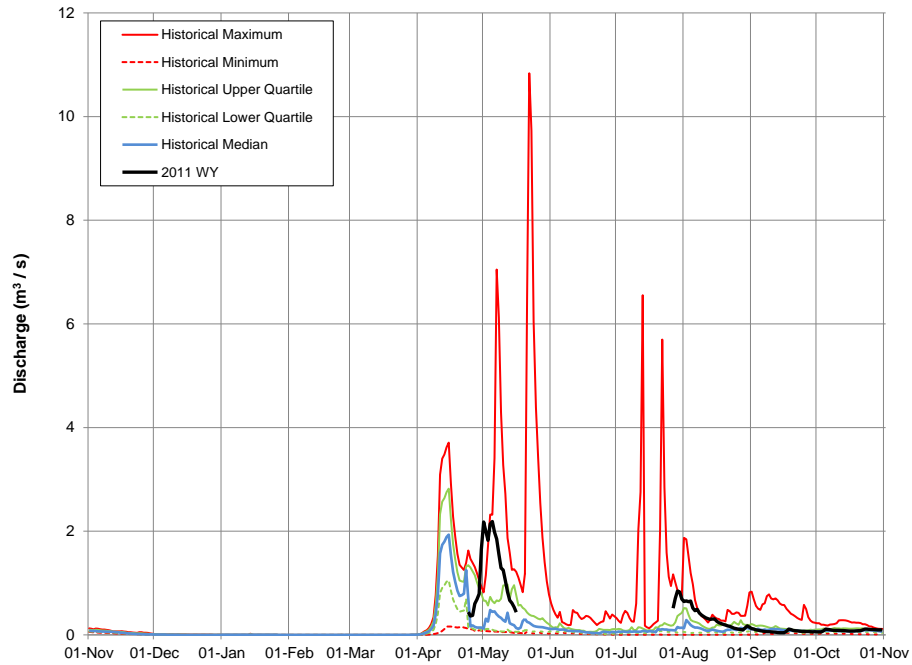
Note: Historic statistics are based on data from WSC Station 07DA017 (1975 to 1986) and RAMP Station S14A (2004-2010).

Figure C.3-15 2011 WY discharge hydrograph and historical context for Station S15A, Tar River near the mouth.



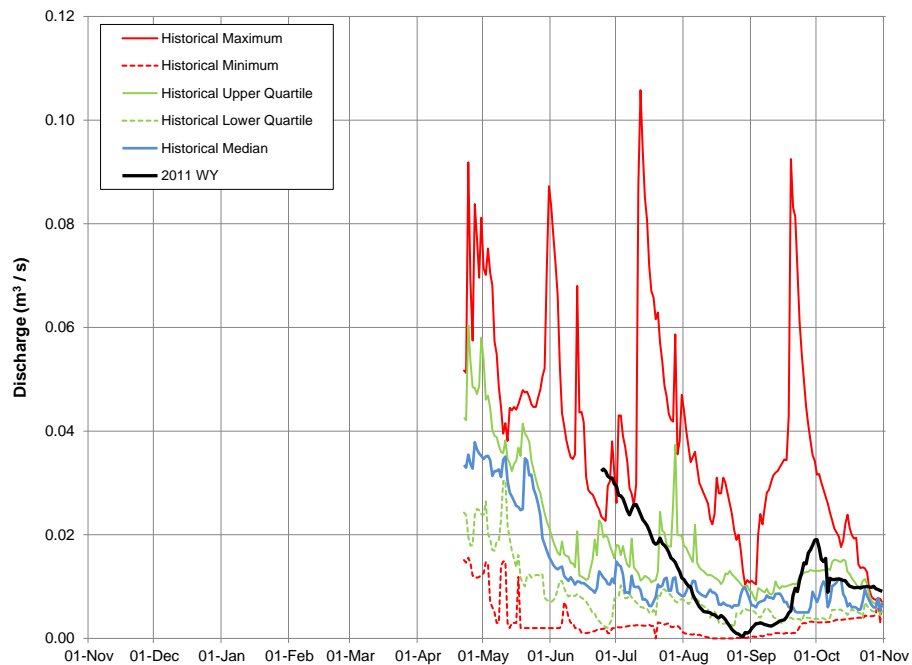
Note: Historic statistics are based on data from WSC Station 07DA015 (1975 to 1977), RAMP Station S15 (2001-2006), and RAMP Station S15A (2007 to 2010).

Figure C.3-16 2011 WY discharge hydrograph and historical context for Station S16A, Calumet River Upland Tributary.



Note: Historic statistics are based on data from WSC Station 07DA014 (1975 to 1977), RAMP Station S16 (2001-2005), CNRL Station CR1 (2006-2009), and RAMP Station S16A (20010).

Figure C.3-17 2011 WY discharge hydrograph and historical context for Station S19, Tar River Lowland Tributary near the mouth.



Note: Data at this site is impacted by beaver activity and data should be considered of poor quality.

Figure C.3-18 2011 WY discharge hydrograph and historical context for Station S20, Muskeg River Upland.

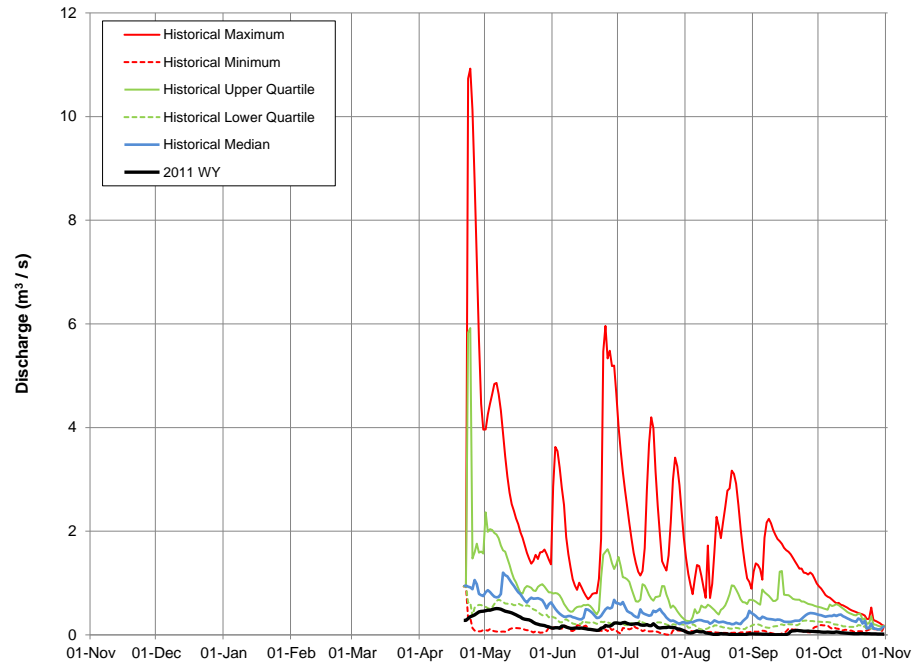


Figure C.3-19 2011 WY discharge hydrograph and historical context for Station S22, Muskeg Creek near the mouth.

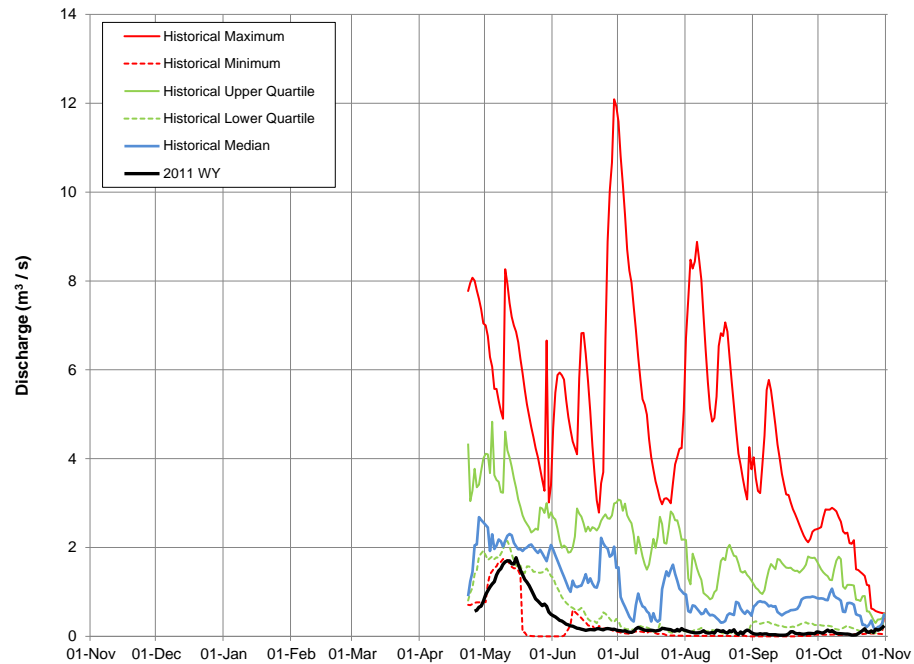


Figure C.3-20 2011 WY discharge hydrograph and historical context for Station S24, Athabasca River below Eymundson Creek.

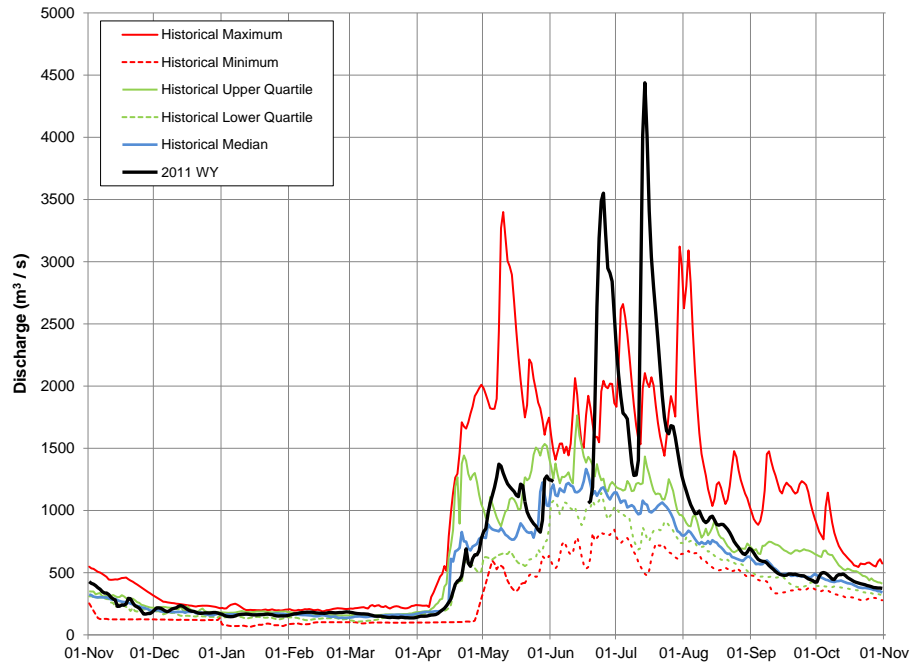


Figure C.3-21 2011 WY discharge hydrograph for Station S25, Susan Lake Outlet.

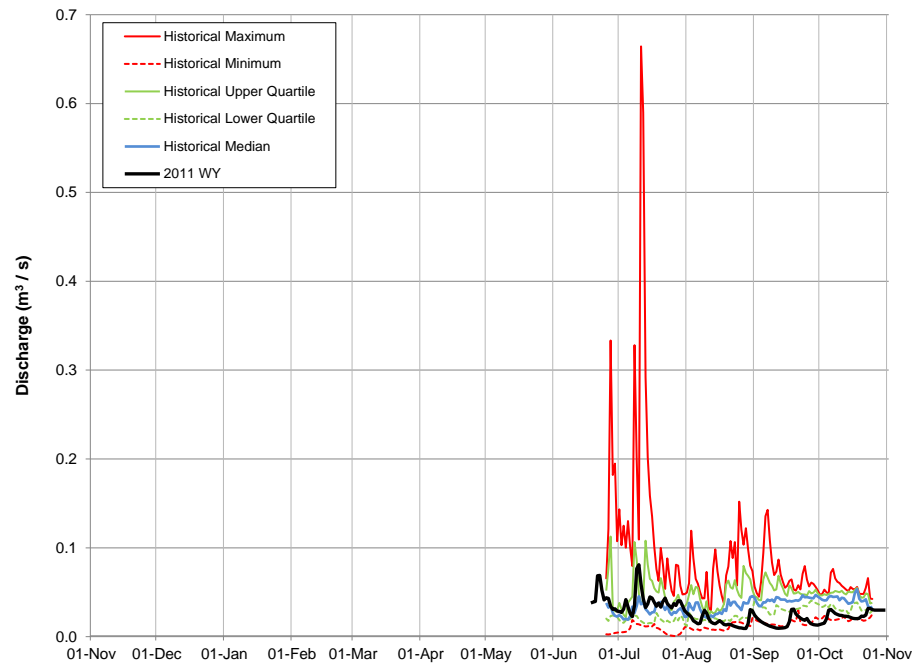
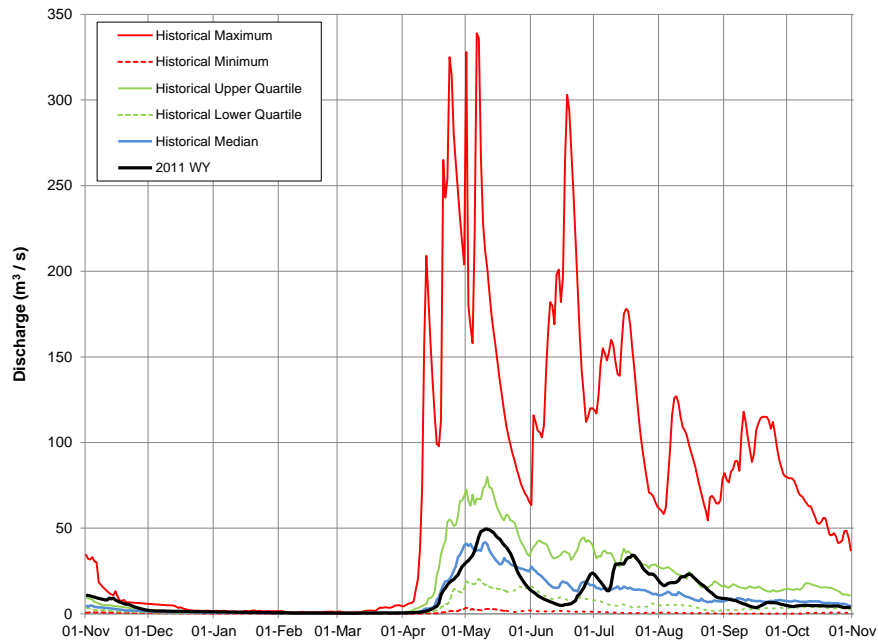
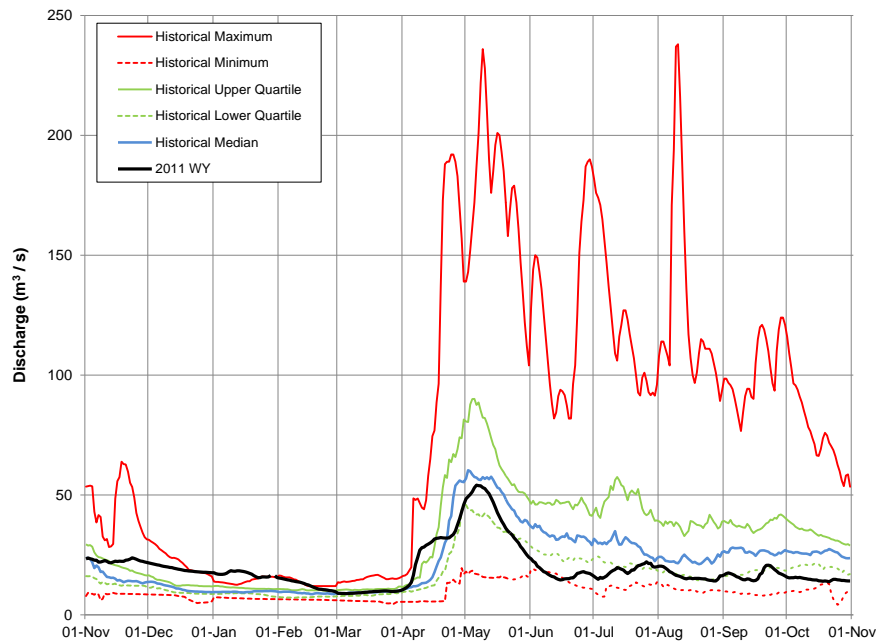


Figure C.3-22 2011 WY discharge hydrograph and historical context for Station S26, MacKay River near Fort McKay (07DB001).



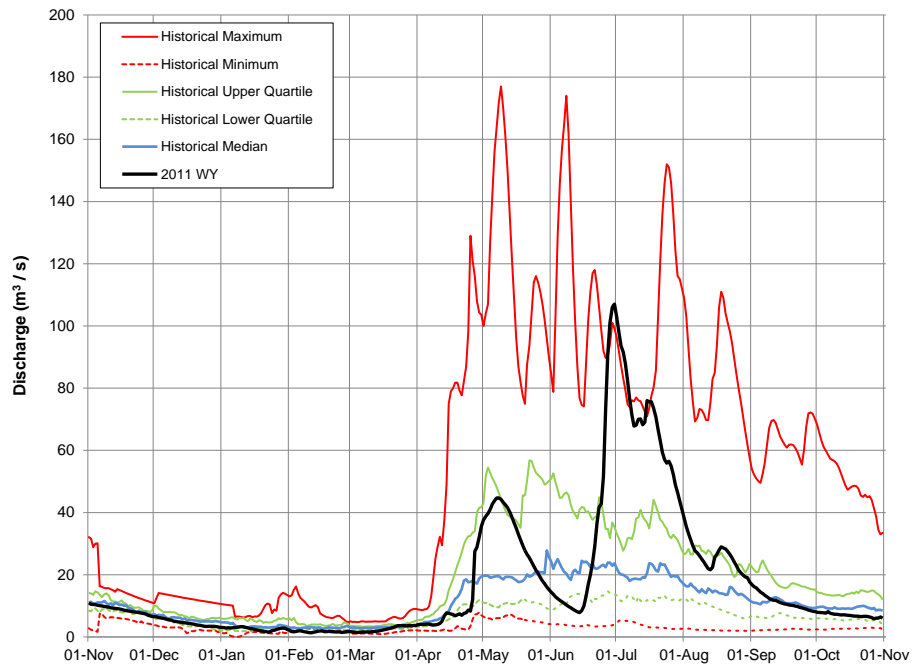
Note: Hydrograph is composed of WSC data from station 07DB001 from March 1 to October 31, 2011 WY, and RAMP Station S26 data from November 1, 2010 to February 28, 2011.

Figure C.3-23 2011 WY discharge hydrograph and historical context for Station S27, Firebag River near the mouth (07DC001).



Note: Hydrograph is composed of WSC data from station 07DB001 from March 1 to October 31, 2011, and RAMP Station S27 data from November 1, 2010 to February 28, 2011.

Figure C.3-24 2011 WY discharge hydrograph and historical context for Station S29, Christina River near Chard (07CE002).



Note: Hydrograph is composed of WSC data from Station 07CE002 from March 1 to October 31, 2011, and RAMP Station S29 data from November 1, 2010 to February 28, 2011.

Figure C.3-25 2011 WY discharge hydrograph and historical context for Station S31, Hangingstone Creek at North Star Road.

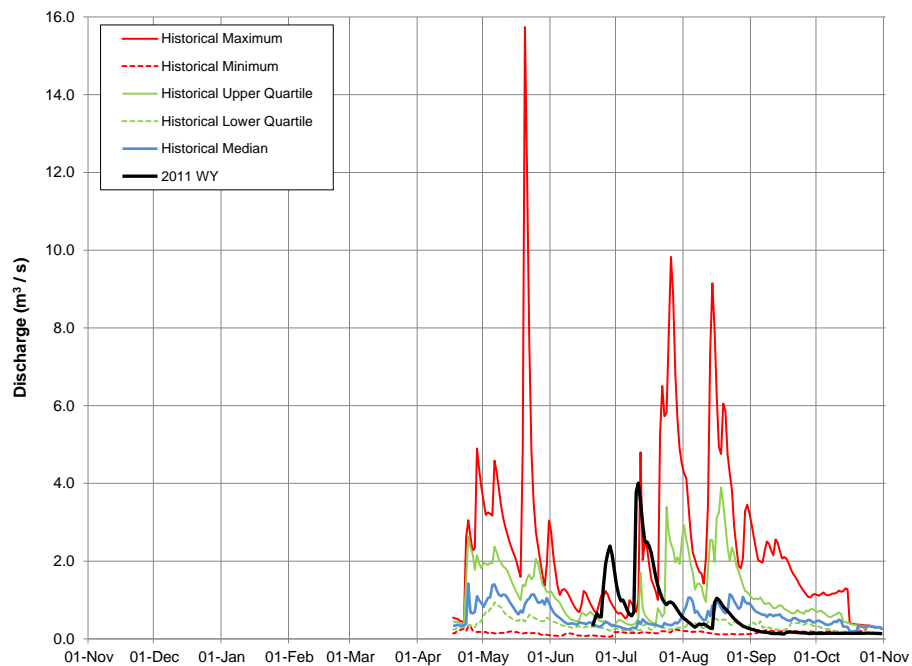


Figure C.3-26 2011 WY discharge hydrograph and historical context for Station S32, Surmont Creek at Highway 881.

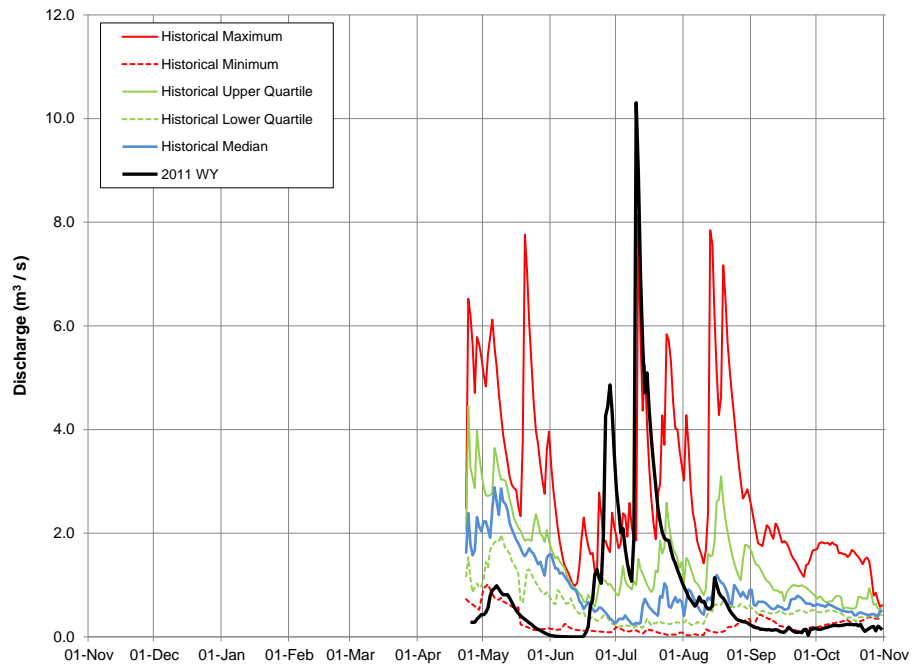


Figure C.3-27 2011 WY discharge hydrograph and historical context for Station S33, Muskeg River at the Aurora/Albian Boundary.

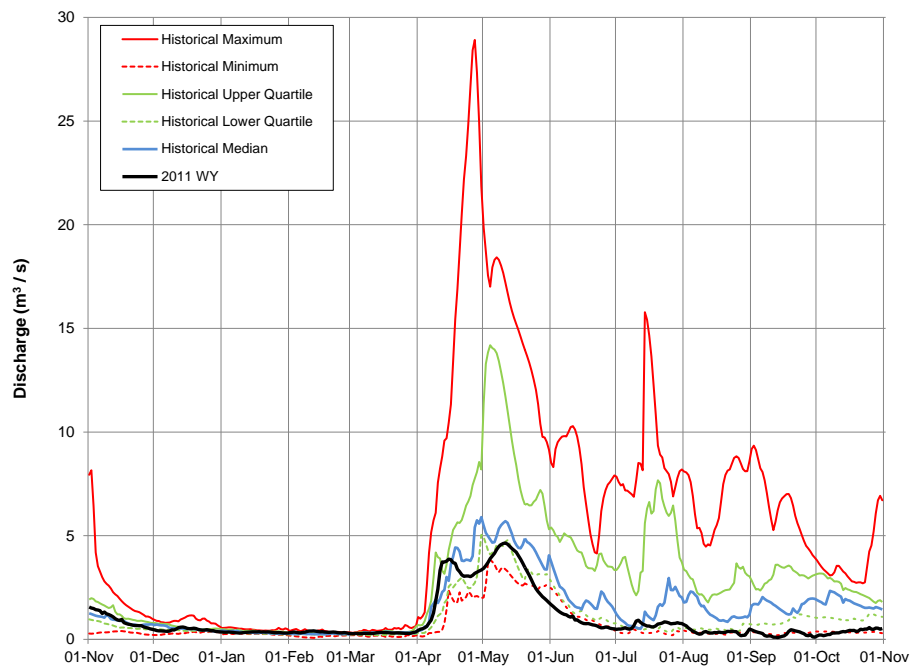


Figure C.3-28 2011 WY discharge hydrograph and historical context for Station S34, Tar River above CNRL Lake.

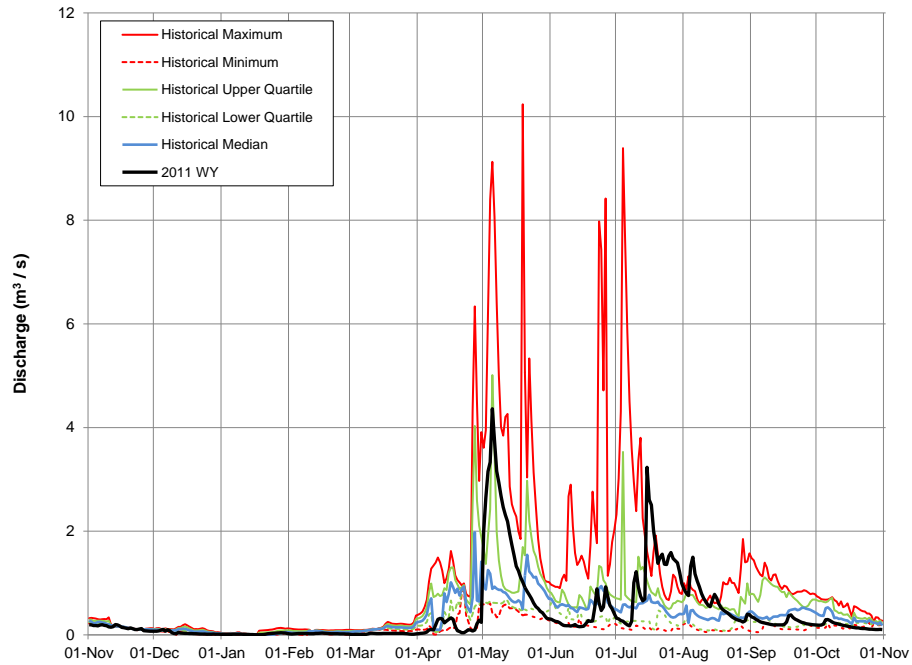
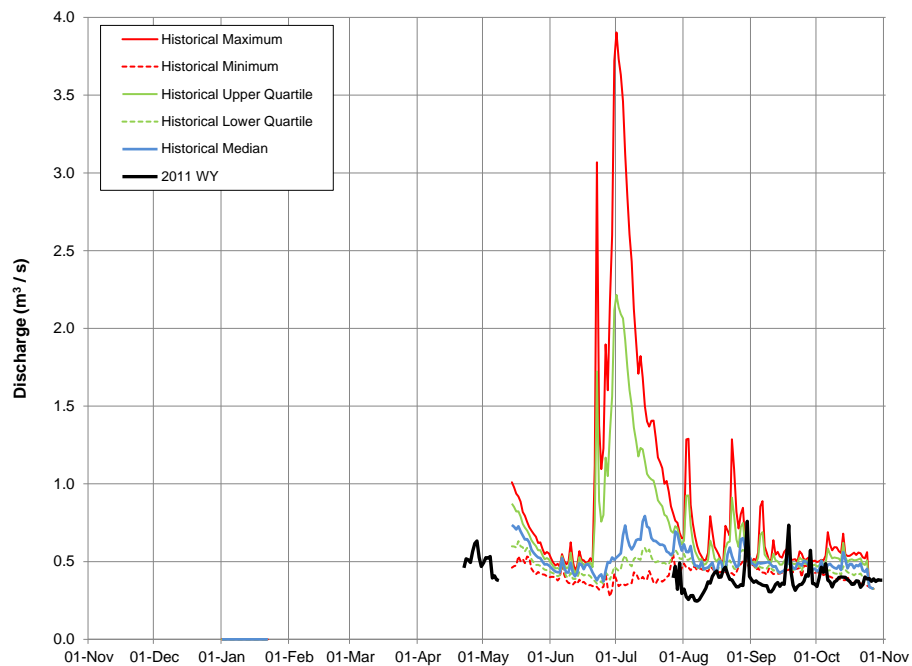


Figure C.3-29 2011 WY discharge hydrograph for Station S36, McClelland Lake Outlet above Firebag River.



Note: The 2011 WY hydrograph is an estimate and for reference purposes only. There was substantial backwater during the 2011 open water period resulting in a poor stage-discharge relationship.

Figure C.3-30 2011 WY discharge hydrograph and historical context for Station S37, East Jackpine Creek near the 1300 m contour.

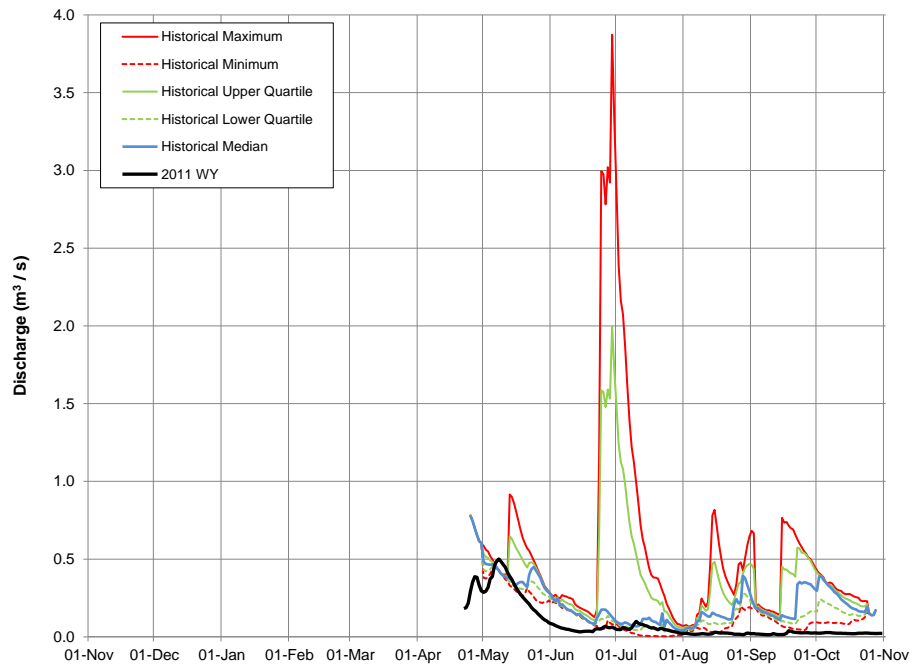
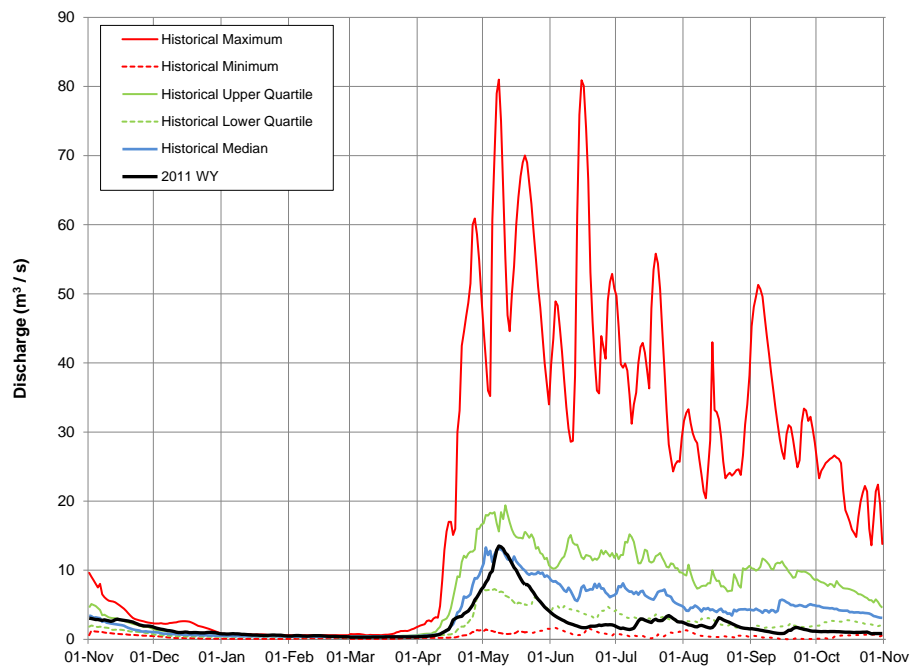
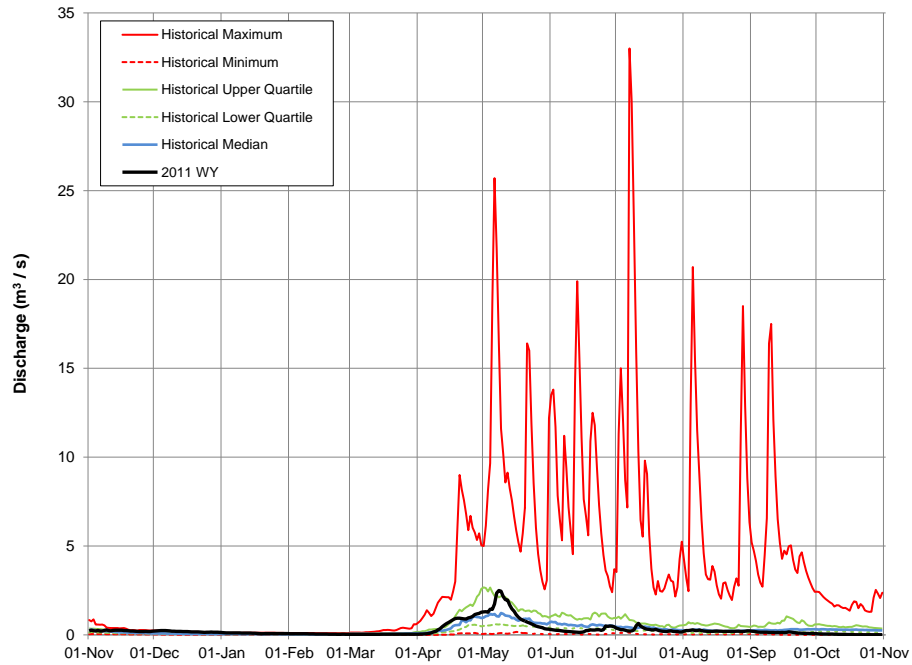


Figure C.3-31 2011 WY discharge hydrograph and historical context for Station S38, Steepbank River near Fort McMurray (07DA006).



Note: Hydrograph is composed of WSC data from station 07DA006 from March 1 to October 31, 2011, and RAMP Station S38 data from November 1, 2010 to February 28, 2011.

Figure C.3-32 2011 WY discharge hydrograph and historical context for Station S39, Beaver River above Syncrude (07DA018).



Note: Hydrograph is composed of WSC data from station 07DA018 from March 1 to October 31, 2011, and RAMP Station S39 data from November 1, 2010 to February 28, 2011.

Figure C.3-33 2011 WY discharge hydrograph and historical context for Station S40, Mackay River at Petro-Canada Bridge.

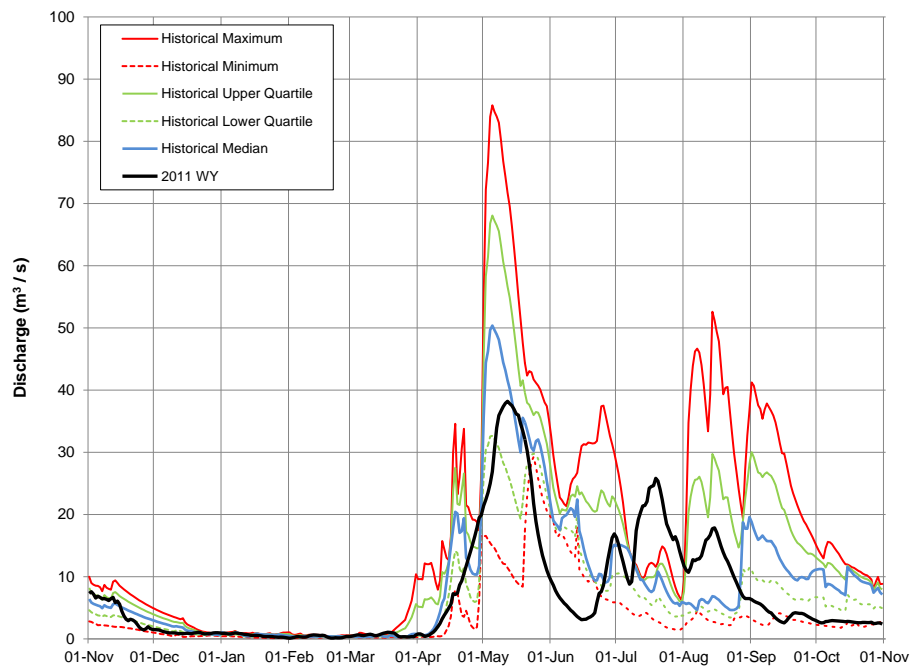
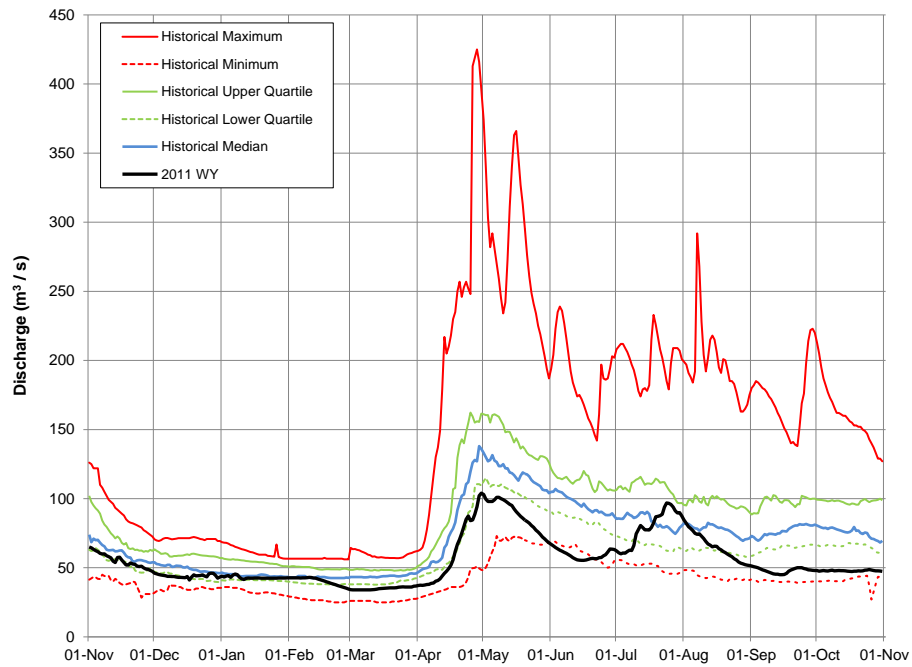


Figure C.3-34 2011 WY discharge hydrograph and historical context for Station S42, Clearwater River above Christina River (07CD005).



Note: Hydrograph is composed of WSC data from station 07CD005 from March 1 to October 31, 2011, and RAMP Station S42 data from November 1, 2010 to February 28, 2011.

Figure C.3-35 2011 WY discharge hydrograph and historical context for Station S43, Firebag River above Suncor Firebag.

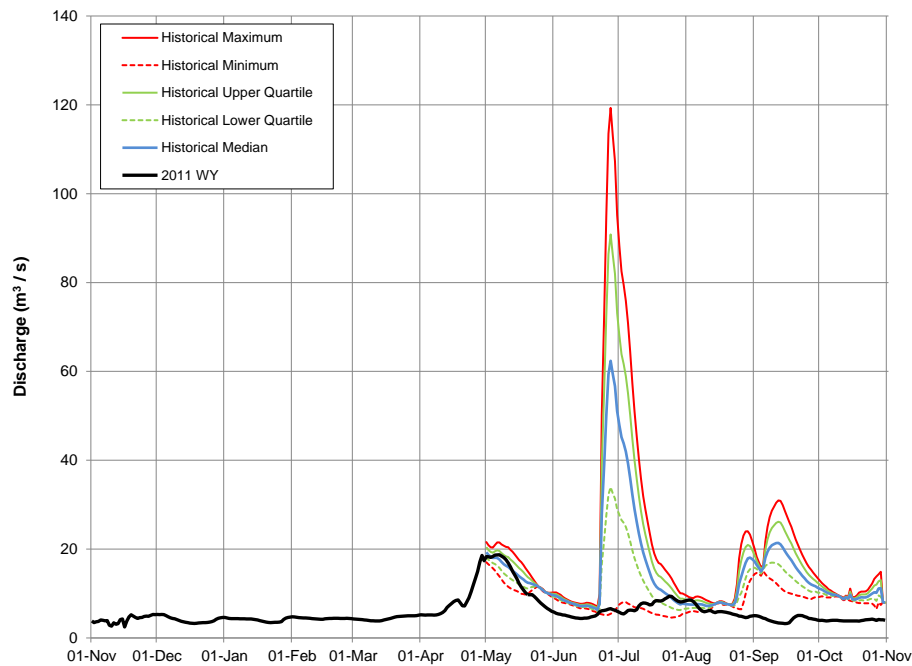
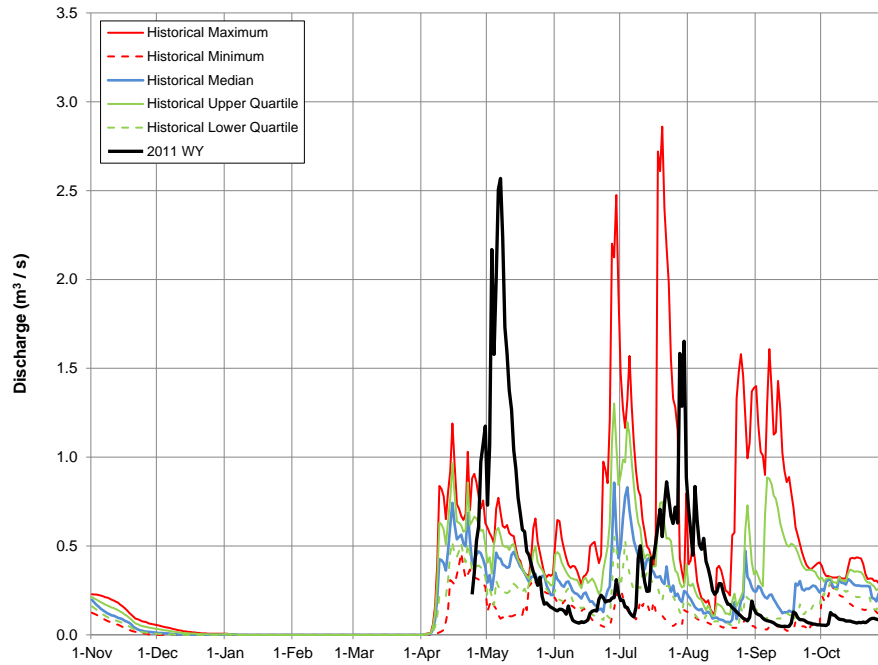


Figure C.3-36 2011 WY discharge hydrograph and historical context for Station S44, Pierre River near Fort McKay (07DA013).



Note: Historic statistics are based on data from WSC Station 07DA013 (1975 to 1977) and RAMP Station S44 (2009-2010).

Figure C.3-37 2011 WY discharge hydrograph for Station S45, Ells River above Joslyn Creek Diversion.

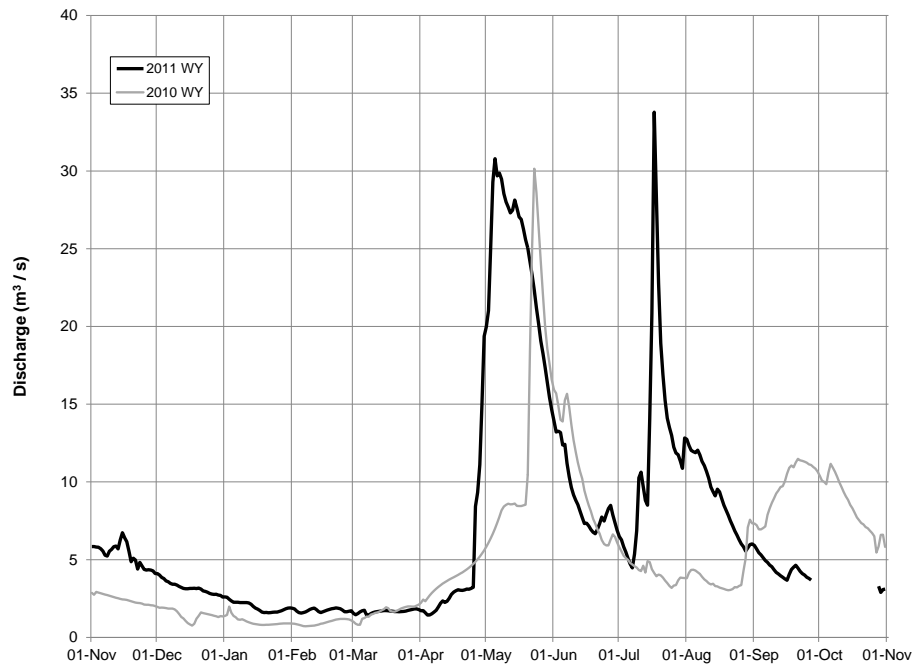
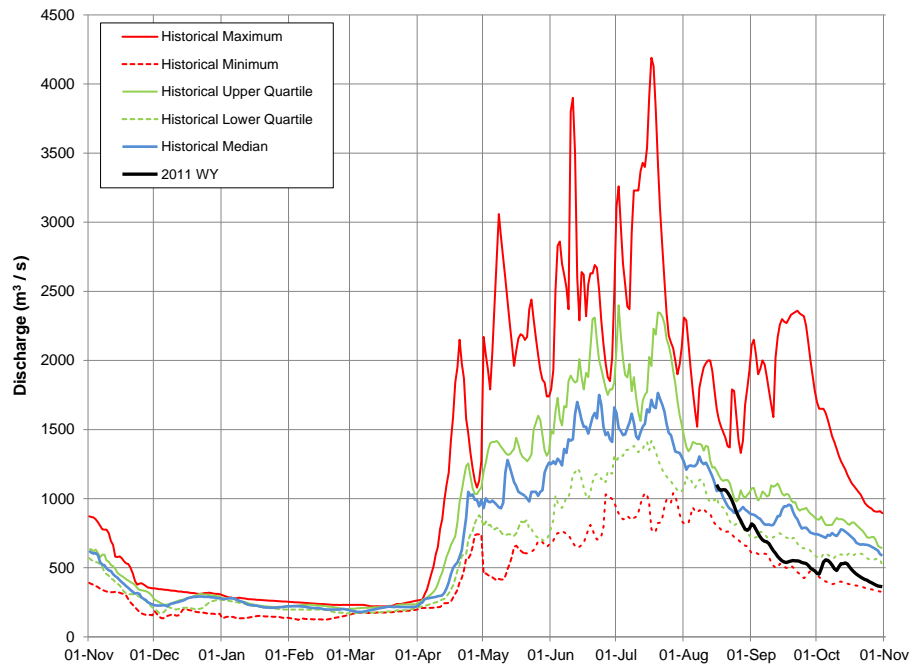


Figure C.3-38 2011 WY discharge hydrograph and historical context for Station S46, Athabasca River near Embarras Airport.



Note: Historic statistics are based on data from WSC Station 07DD001 (1971 to 1984).

Figure C.3-39 2011 WY discharge hydrograph for Station S47, Christina River near the mouth.



Figure C.3-40 2011 WY discharge hydrograph for Station S48, Big Creek.

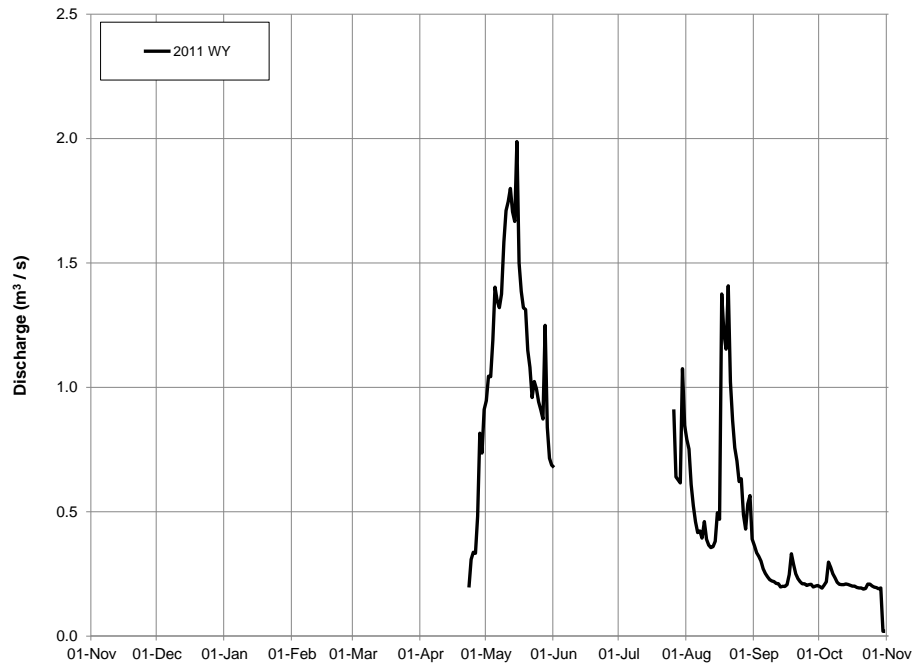


Figure C.3-41 2011 WY discharge hydrograph for Station S49, Eymundson Creek near the mouth.

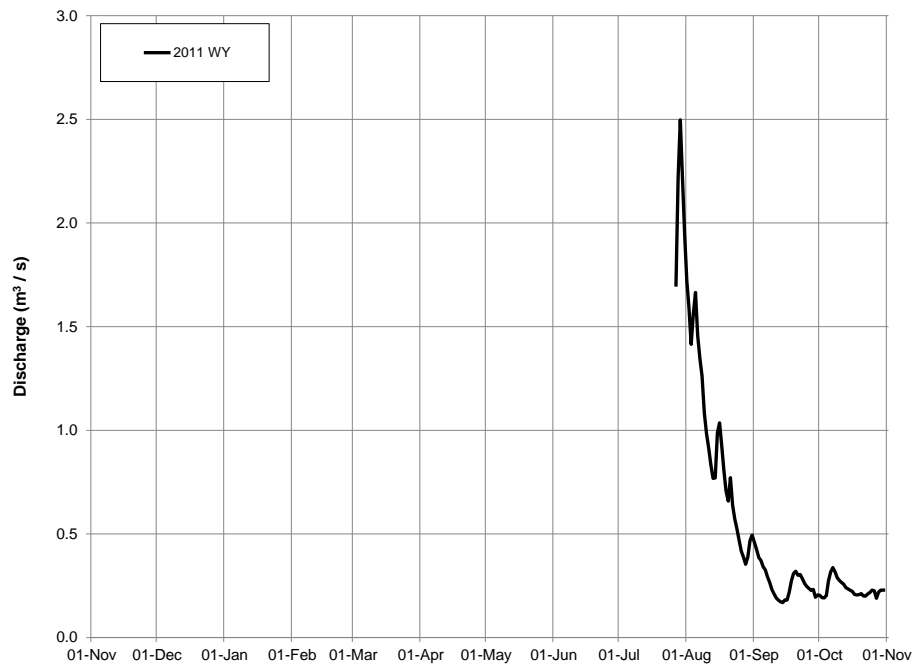
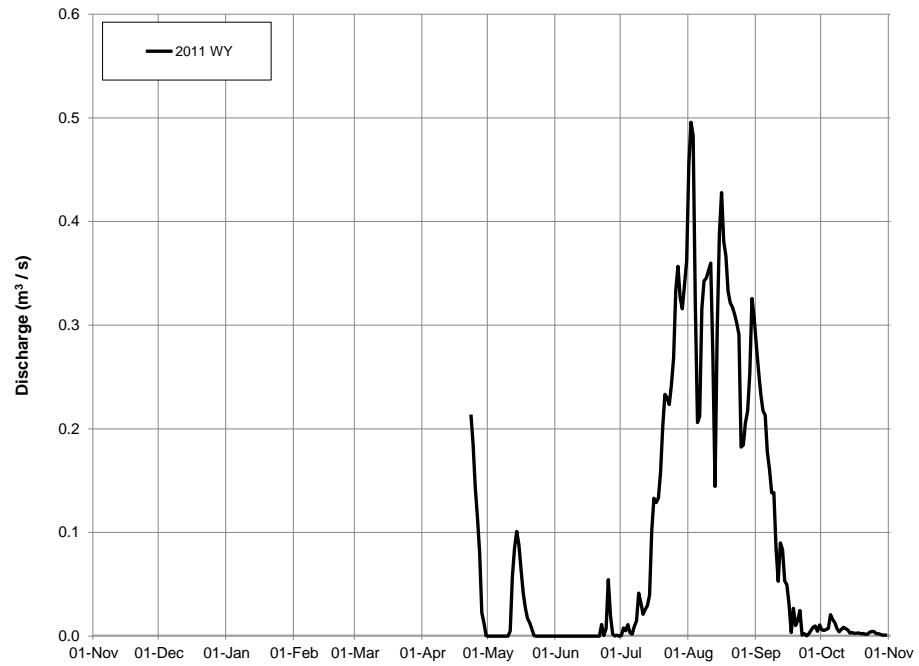


Figure C.3-42 2011 WY discharge hydrograph for Station S50, Red Clay Creek.

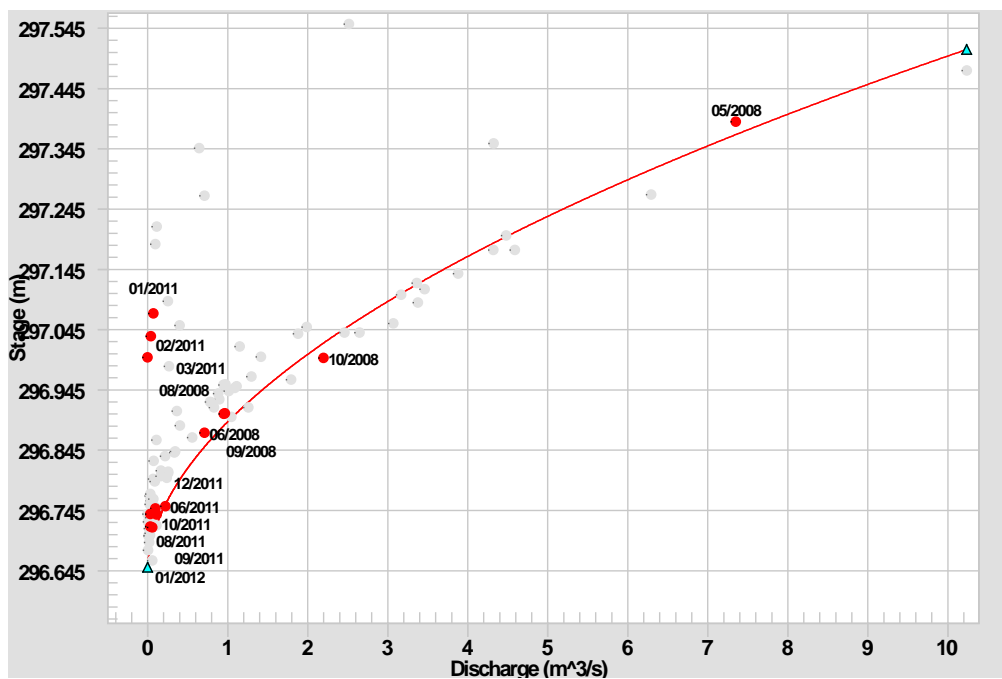


Note: The 2011 WY hydrograph is an estimate and for reference purposes only. There was substantial backwater during the 2011 open water period resulting in a poor stage-discharge relationship.

C.3.5 Stage-Discharge Rating Curves

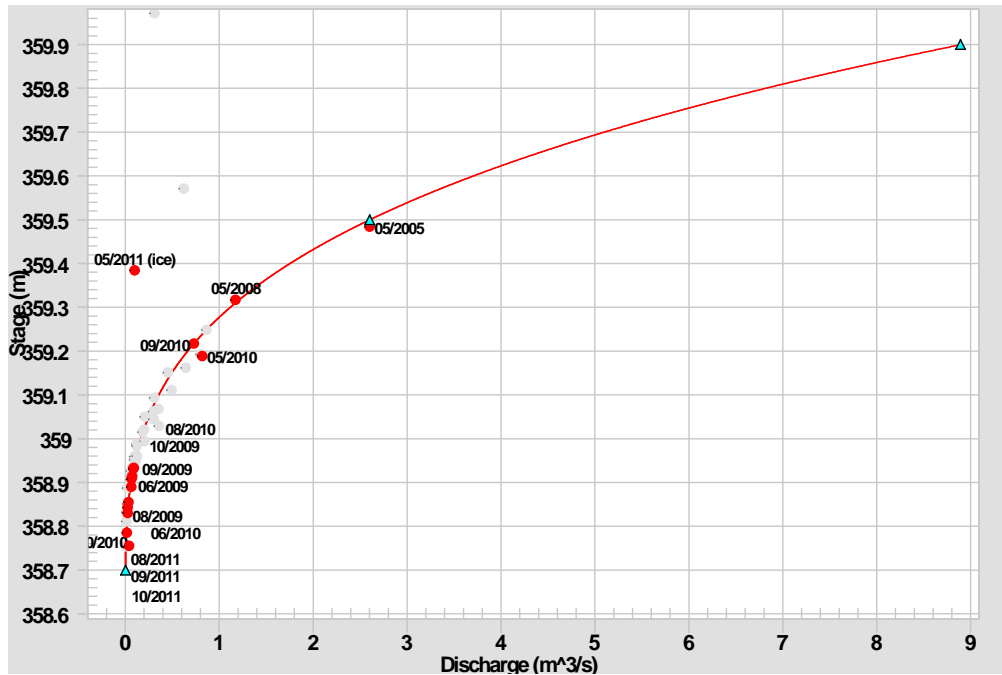
Water level and discharge measurements were used to derive and/or update stage-discharge rating curves. The derived rating curves are shown graphically for each station in Figure C.3-43 to Figure C.3-81. In each graph, the red line denotes the most current stage-discharge rating curve; green line denotes the previous stage-discharge rating curve; grey circles denote historical manual discharge measurements; red circles denote manual discharge measurements used to develop the current stage-discharge rating curve; and the green triangles denote rating points that define the stage-discharge rating curve. In cases where there is no green line, the current stage-discharge rating curve has not changed from the previous sampling year.

Figure C.3-43 Stage-discharge rating curve for RAMP Station S2, Jackpine Creek at Canterra Road.



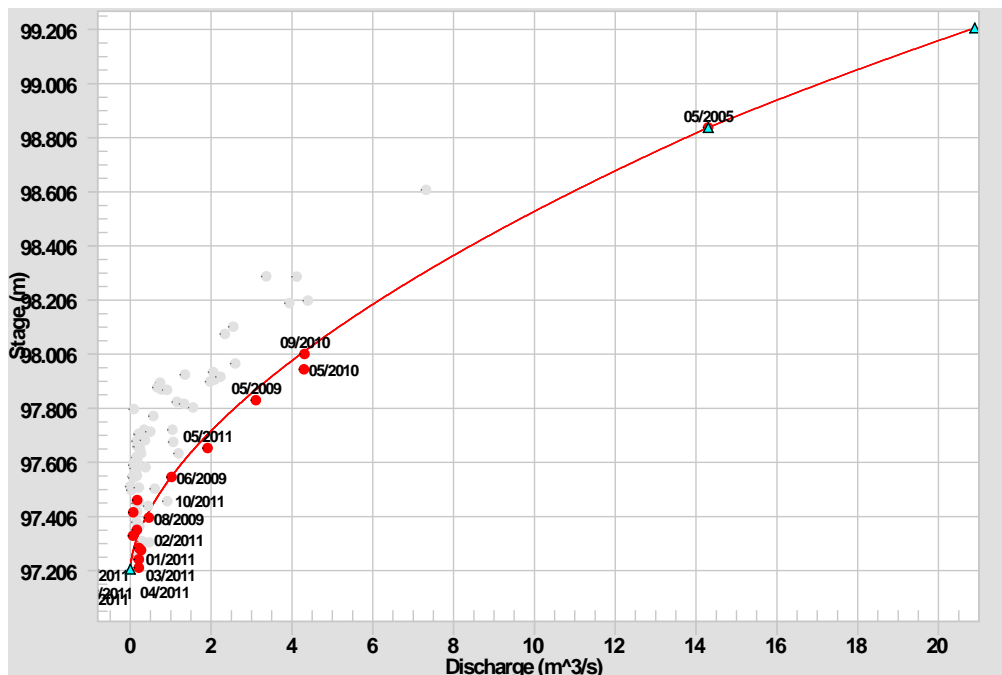
Period of Use: November 1, 2010 Open ended

Figure C.3-44 Stage-discharge rating curve for RAMP Station S3, Iyininin Creek above Kearl Lake.



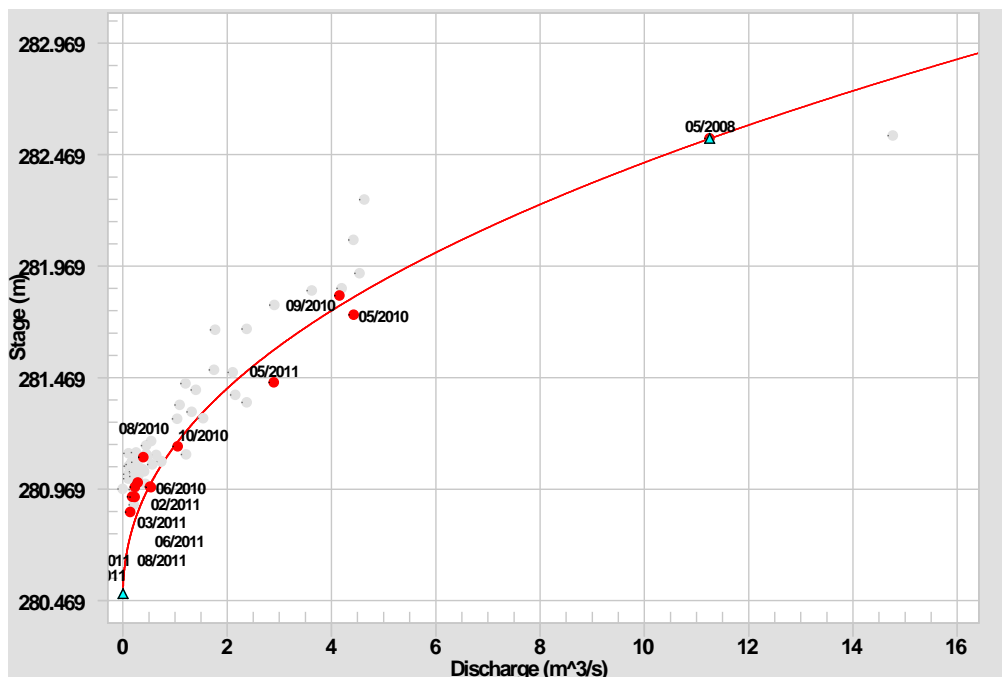
Period of Use: January 1, 2005 Open ended

Figure C.3-45 Stage-discharge rating curve for RAMP Station S5, Muskeg River above Stanley Creek.



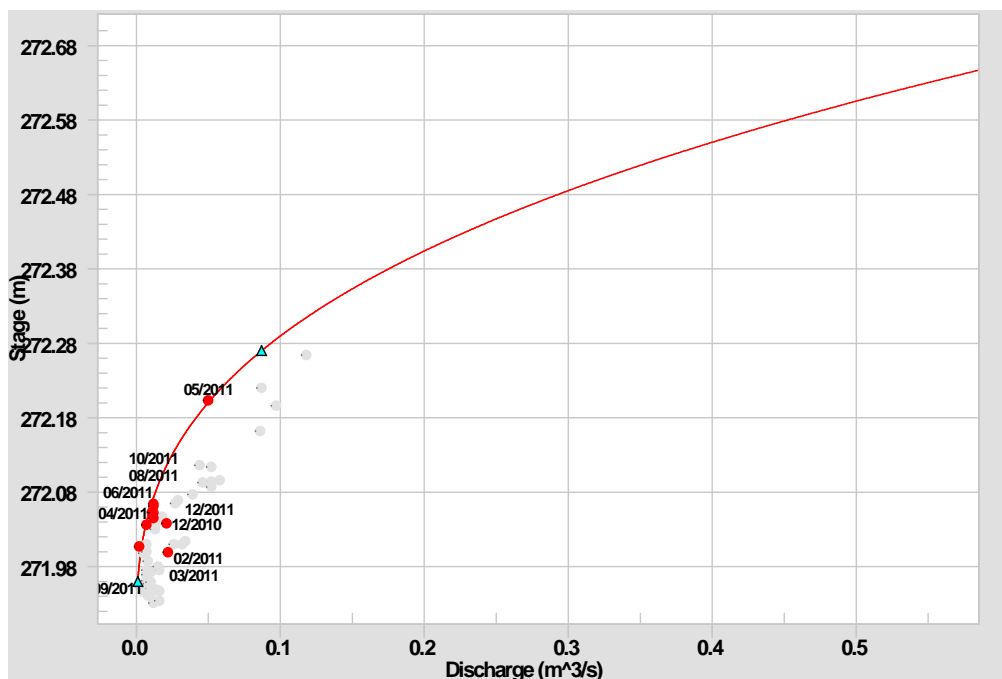
Period of Use: January 1, 2009 Open ended

Figure C.3-46 Stage-discharge rating curve for RAMP Station S5A, Muskeg River above Muskeg Creek.



Period of Use: February 1, 2008 Open ended

Figure C.3-47 Stage-discharge rating curve for RAMP Station S6, Mills Creek at Highway 63.



Period of Use: November 1, 2010 Open ended

Figure C.3-48 Stage-discharge rating curve for WSC Station 07DA008, RAMP Station S7, Muskeg River near Fort McKay.

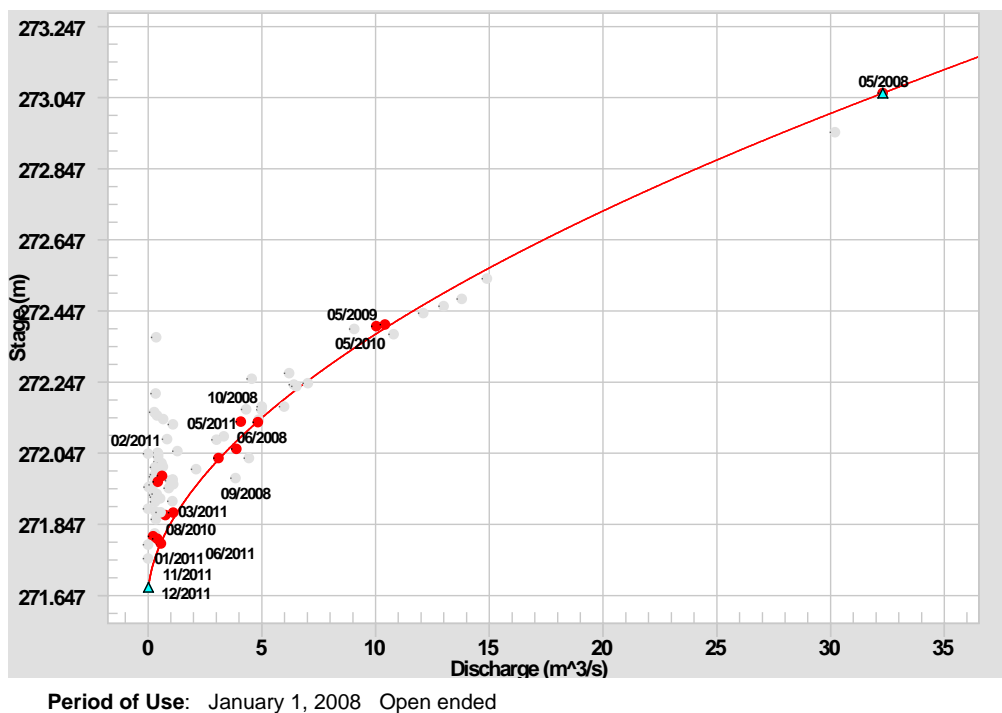
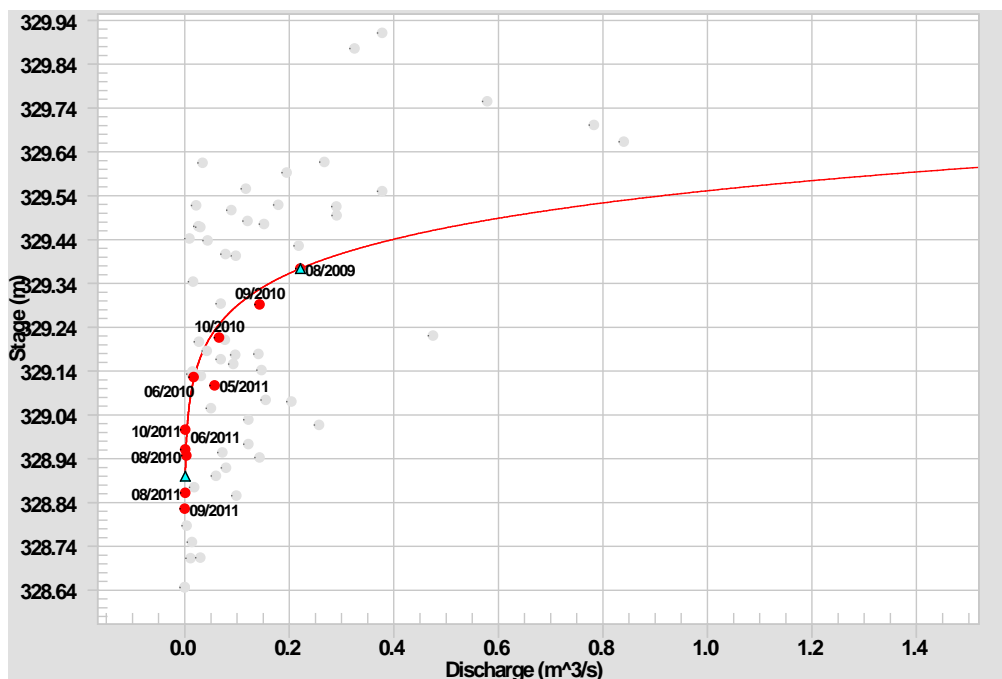
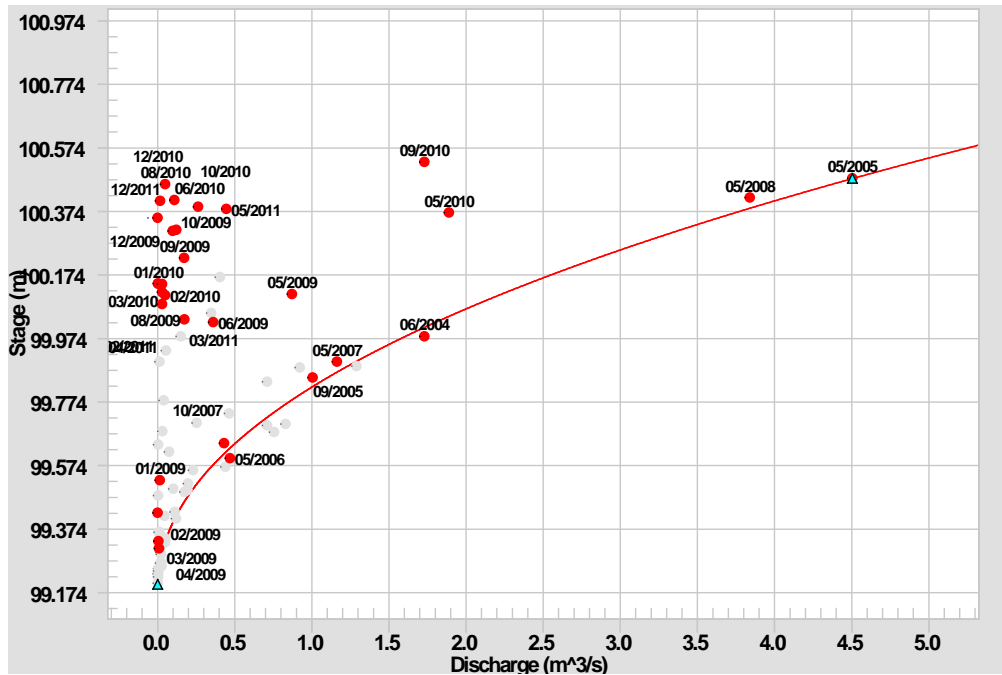


Figure C.3-49 Stage-discharge rating curve for RAMP Station S9, Kearl Lake Outlet.



Note: The data quality at this station was compromised in the 2011 WY due to backwater effects caused by beaver activity.

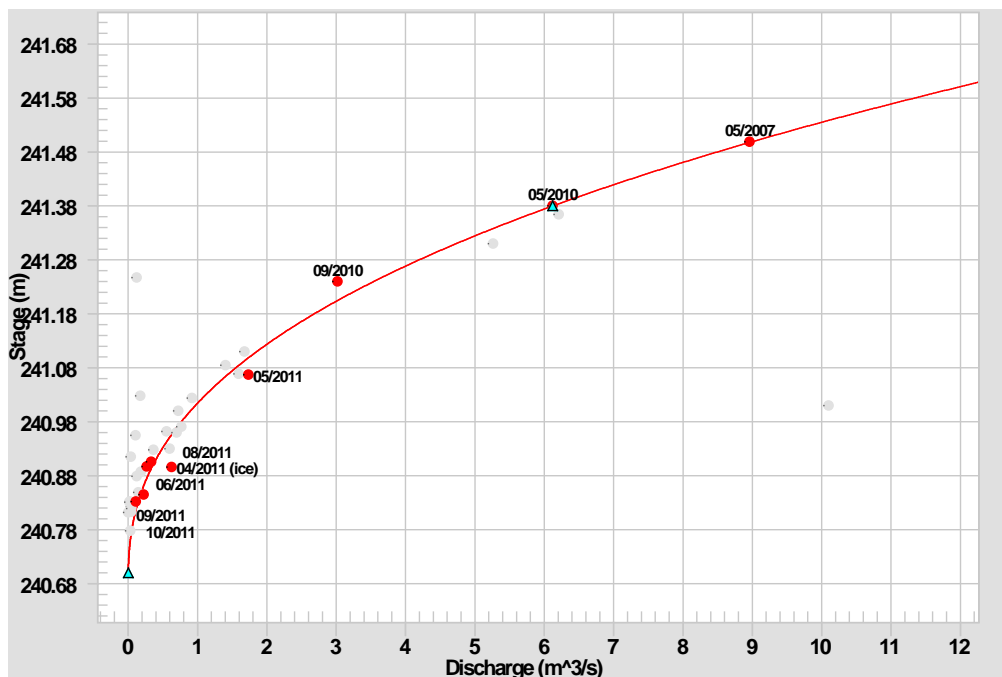
Figure C.3-50 Stage-discharge rating curve for RAMP Station S10, Wapasu Creek at Canterra Road.



Period of Use: April 26, 2007 Open ended

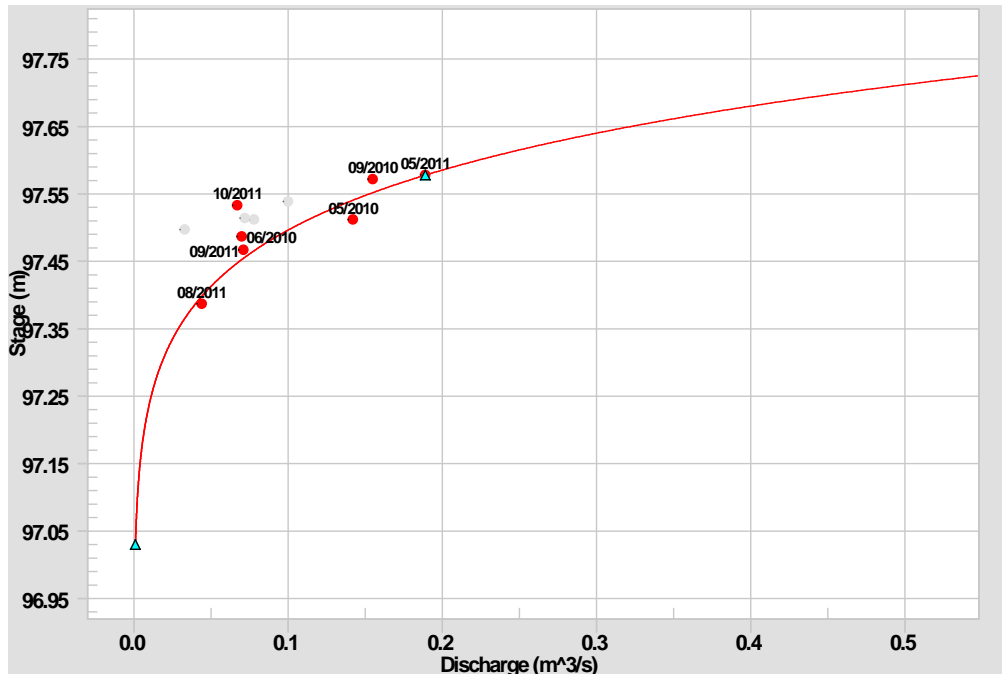
Note: The data quality at this station was compromised in the 2011 WY due to backwater effects caused by beaver activity.

Figure C.3-51 Stage-discharge rating curve for WSC Station 07DA007, RAMP Station S11, Poplar Creek at Highway 63.



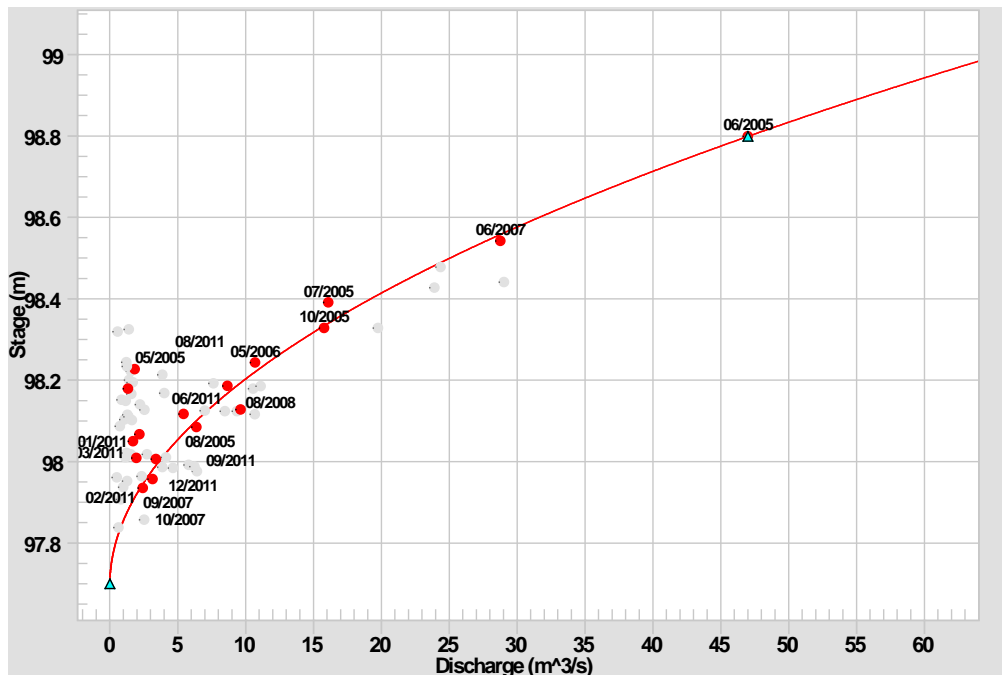
Period of Use: November 1, 2009 Open ended

Figure C.3-52 Stage-discharge rating curve for RAMP Station S12, Fort Creek at Highway 63.



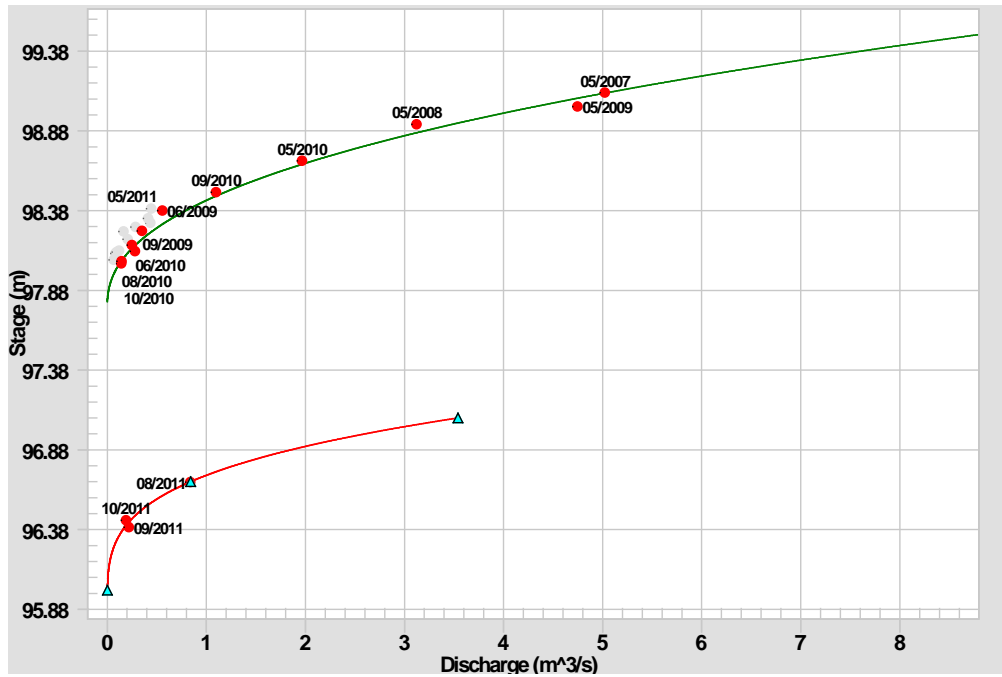
Period of Use: April 15, 2011 Open ended

Figure C.3-53 Stage-discharge rating curve for RAMP Station S14A, Ells River at the CNRL Bridge.



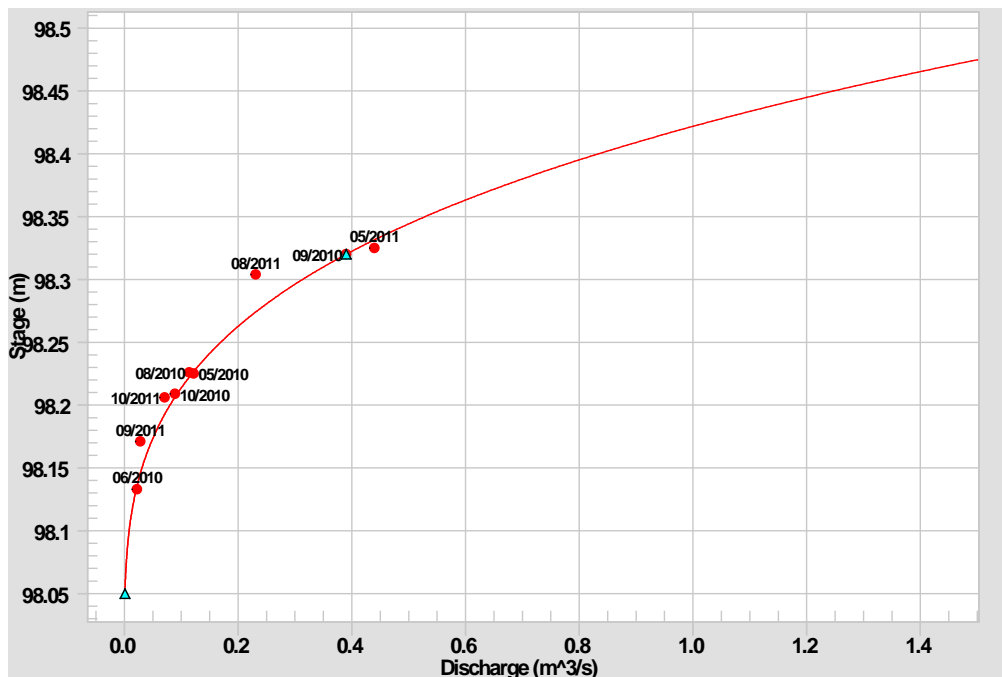
Period of Use: November 1, 2010 Open ended

Figure C.3-54 Stage-discharge rating curve for RAMP Station S15A, Tar River near the mouth.



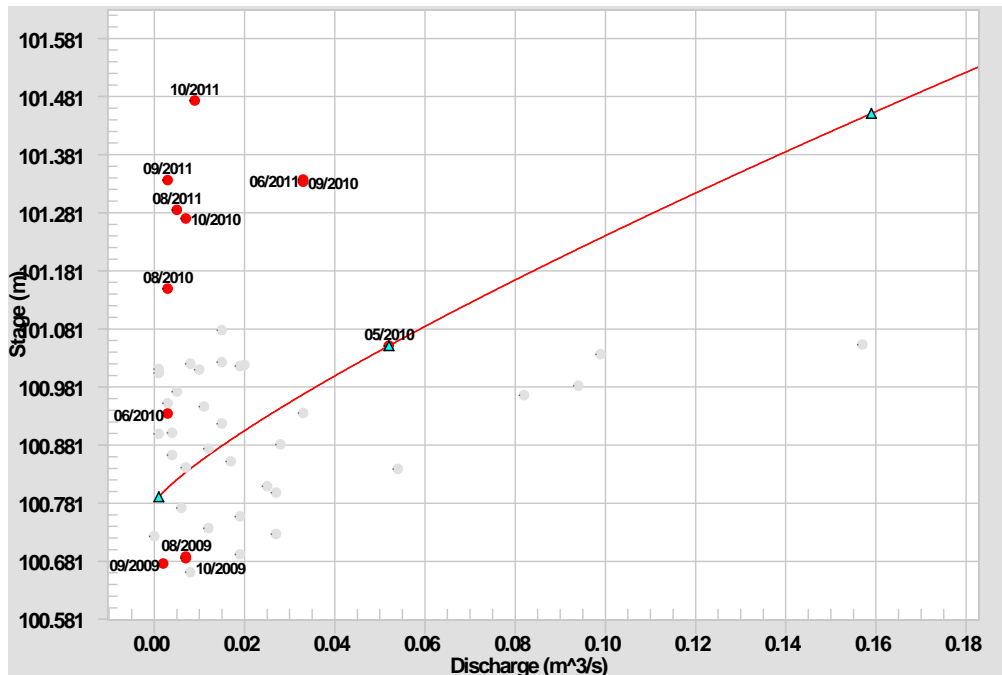
Period of Use: Green Curve April 1, 2010 to June 24, 2011; Red Curve August 12, 2011 Open ended, Station was destroyed in wildfire and relocated on August 12, 2011.

Figure C.3-55 Stage-discharge rating curve for RAMP Station S16A, Calumet River near the mouth.



Period of Use: April 1, 2010 Open ended

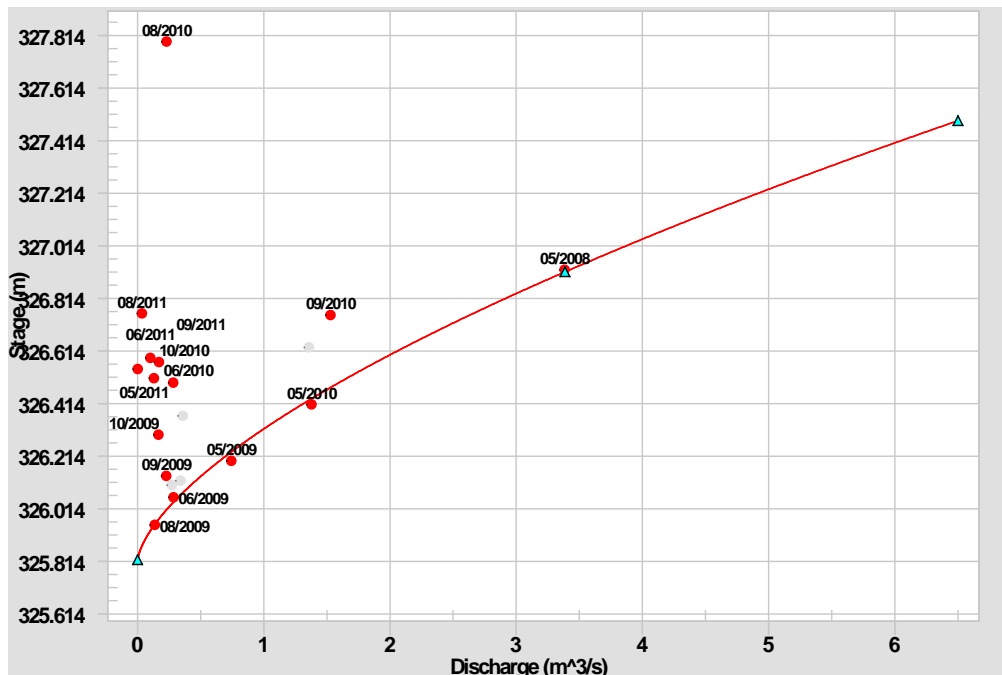
Figure C.3-56 Stage-discharge rating curve for RAMP Station S19, Tar River Lowland Tributary near the mouth.



Period of Use: April 1, 2010 Open ended

Note: The data quality at this station was compromised in the 2010 WY due to backwater effects caused by beaver activity.

Figure C.3-57 Stage-discharge rating curve for RAMP Station S20, Muskeg River Upland.



Period of Use: January 1, 2008 Open ended

Note: The data quality at this station was compromised in the 2010 WY due to backwater effects caused by beaver activity.

Figure C.3-58 Stage-discharge rating curve for RAMP Station S22, Muskeg Creek near the mouth.

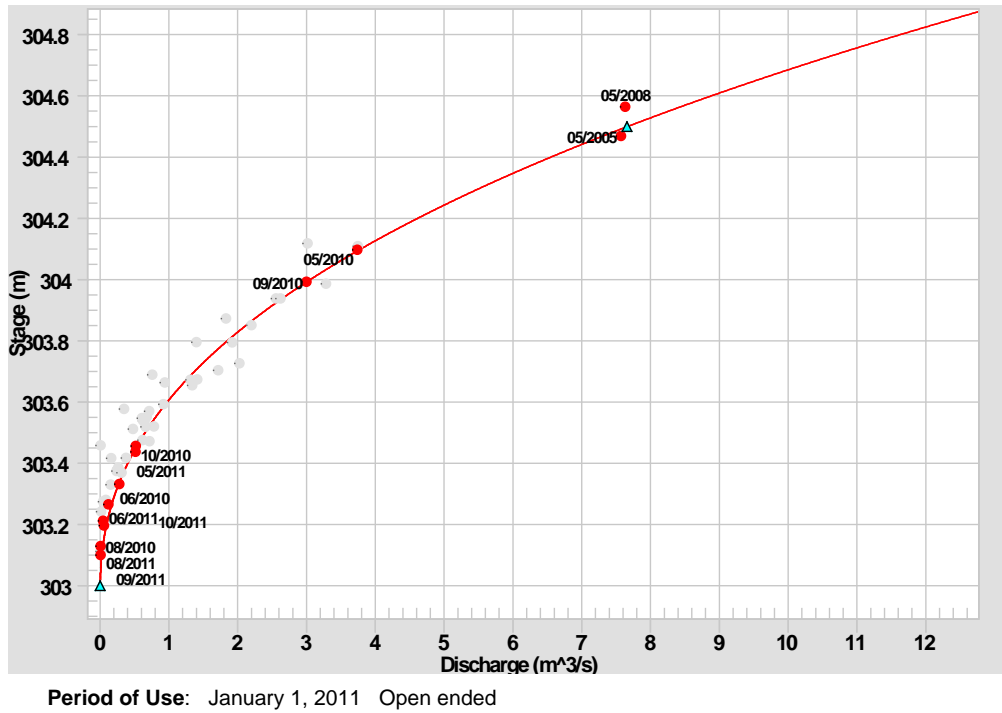


Figure C.3-59 Stage-discharge rating curve for RAMP Station S24, Athabasca River below Eymundson Creek.

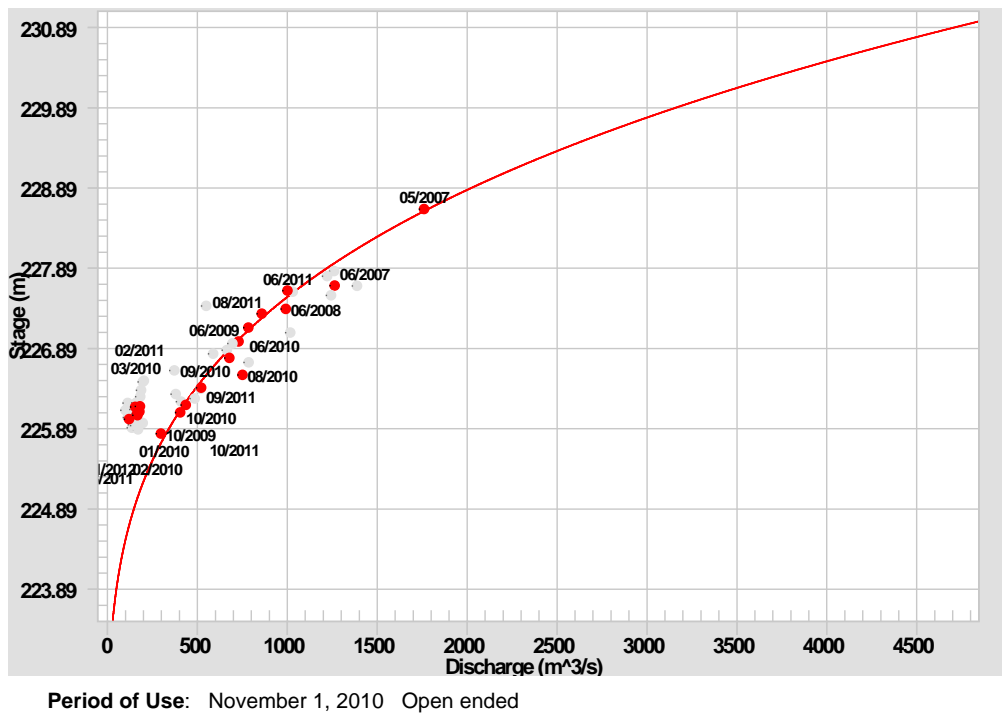
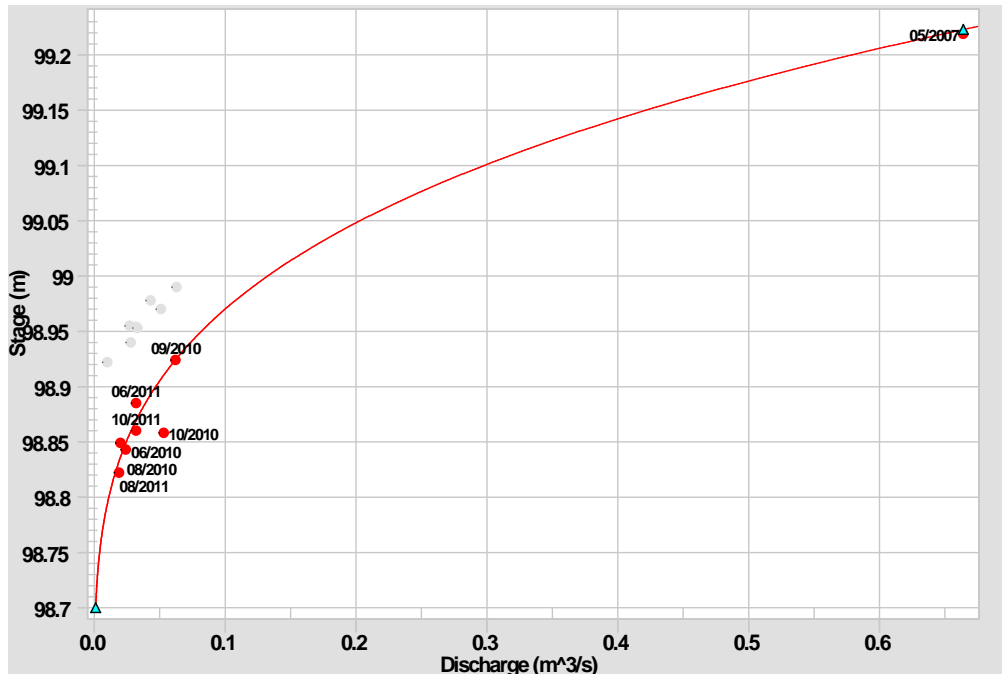
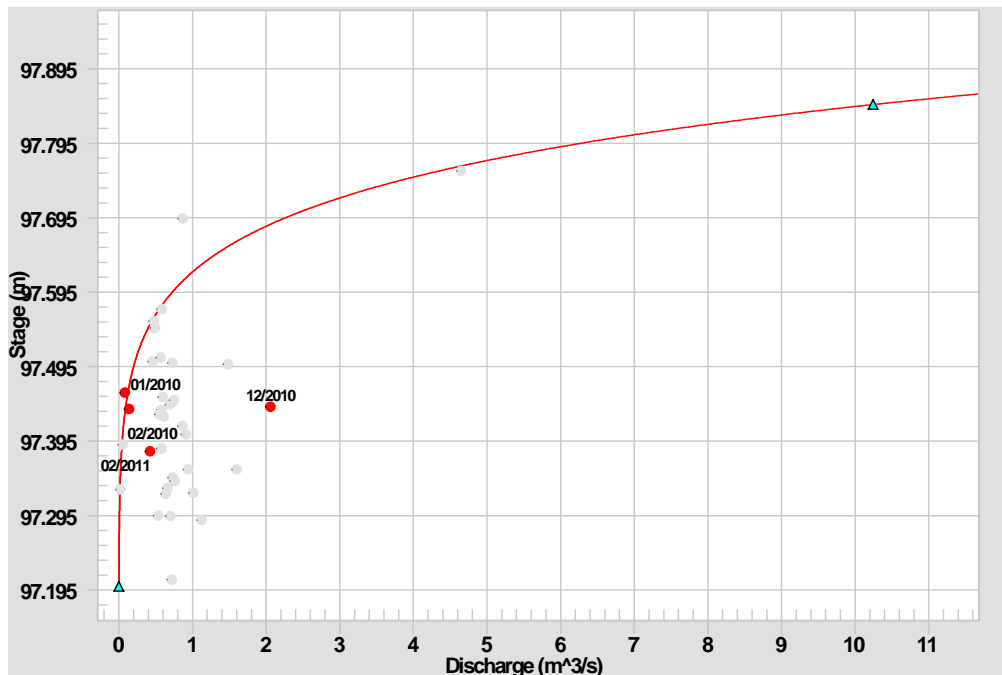


Figure C.3-60 Stage-discharge rating curve for RAMP Station S25, Susan Lake Outlet.



Period of Use: May 1, 2010 Open ended

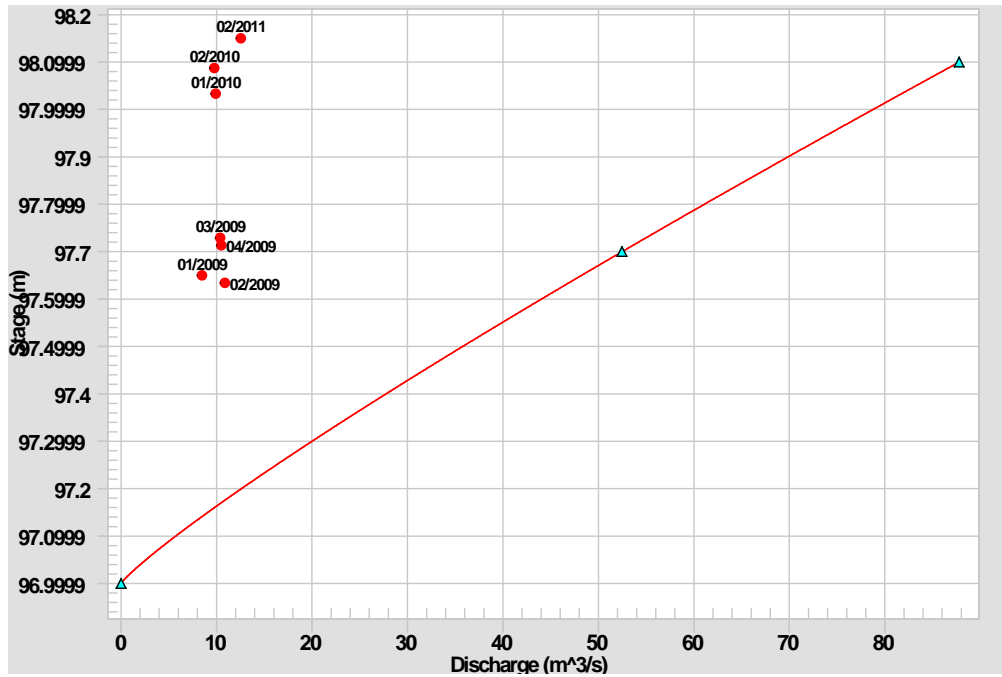
Figure C.3-61 Stage-discharge rating curve for WSC Station 07DB001, RAMP Station S26, MacKay River near Fort McKay.



Period of Use: March 1, 2004 Open ended

Note: Winter manual measurements collected by RAMP; rating curve developed by Water Survey of Canada based on open-water flows.

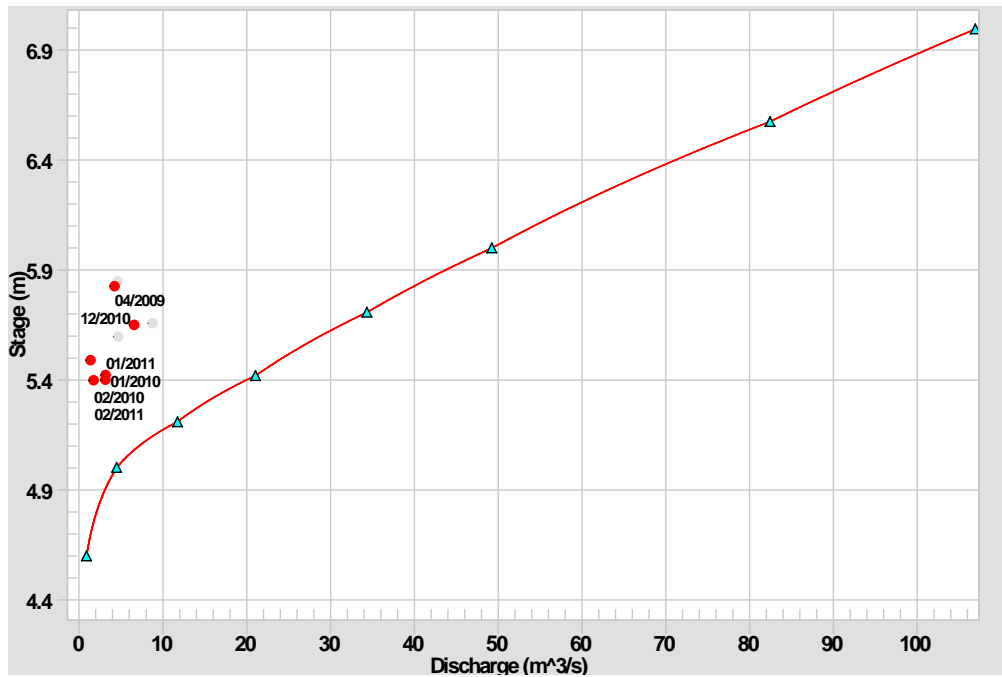
Figure C.3-62 Stage-discharge rating curve for WSC Station 07DC001, RAMP Station S27, Firebag River near the mouth.



Period of Use: 01/01/2008 Open ended

Note: Winter manual measurements collected by RAMP; rating curve developed by Water Survey of Canada based on open-water flows.

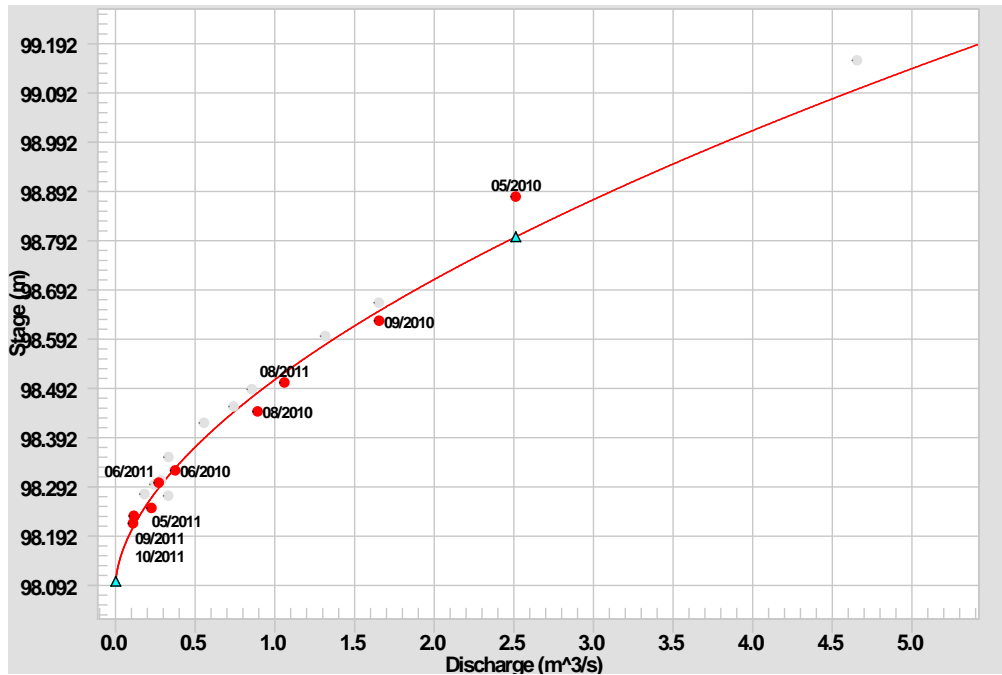
Figure C.3-63 Stage-discharge rating curve for WSC Station 07CE002, RAMP Station S29, Christina River near Chard.



Period of Use: 01/01/2009 Open ended

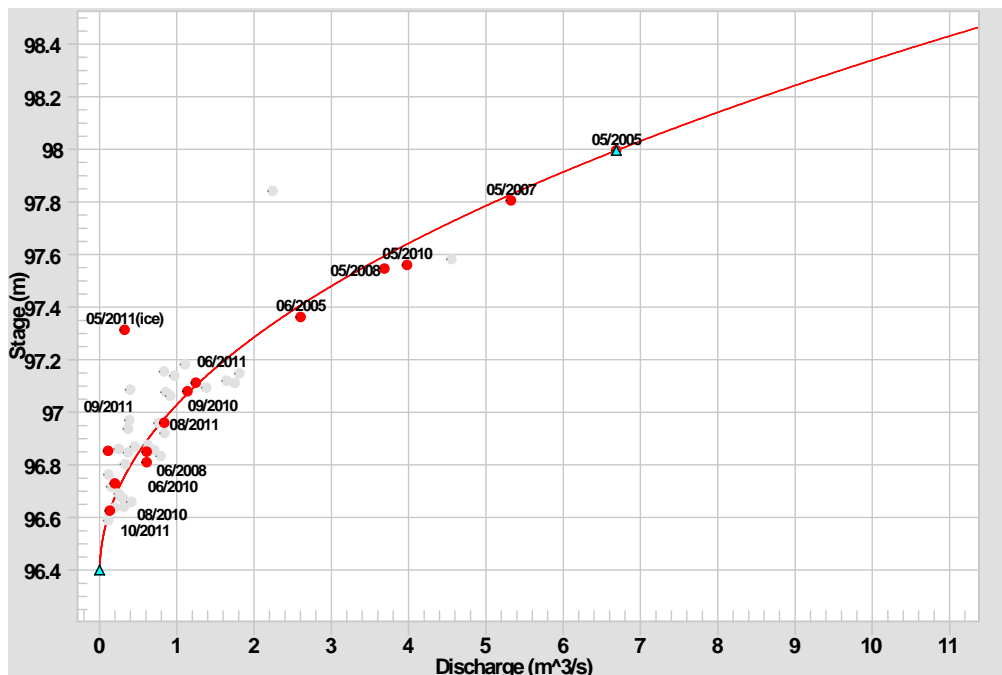
Note: Winter manual measurements collected by RAMP; rating curve developed by Water Survey of Canada based on open-water flows.

Figure C.3-64 Stage-discharge rating curve for RAMP Station S31, Hangingstone Creek at North Star Road.



Period of Use: April 14, 2011 Open ended

Figure C.3-65 Stage-discharge rating curve for RAMP Station S32, Surmont Creek at Highway 881.



Period of Use: April 1, 2011 Open ended

Figure C.3-66 Stage-discharge rating curve for RAMP Station S33, Muskeg River at the Aurora/Shell Boundary.

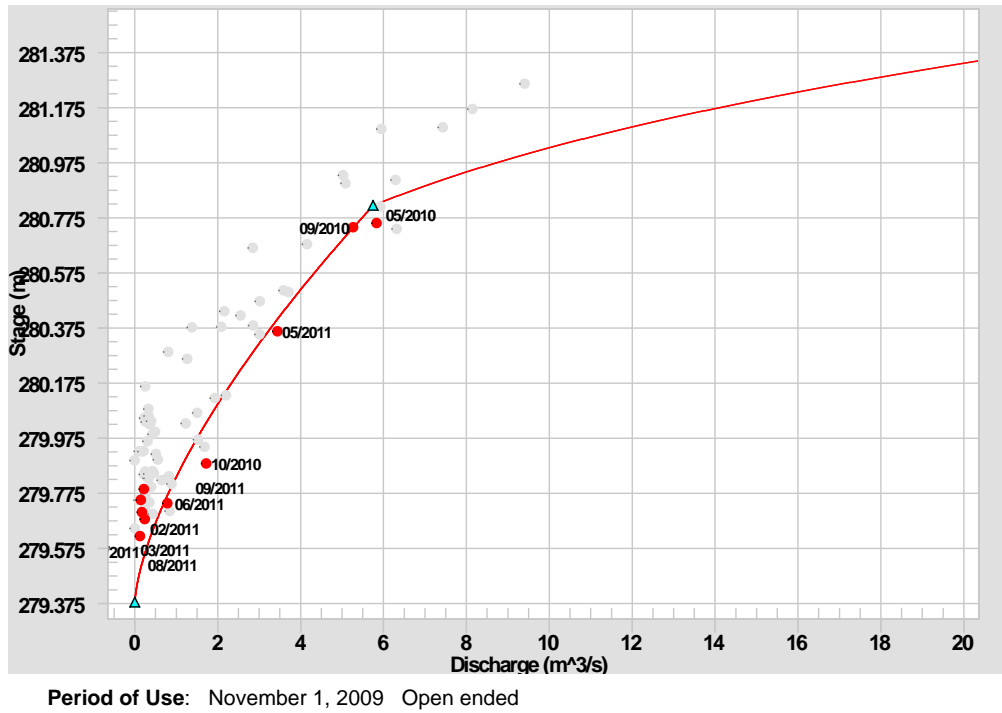


Figure C.3-67 Stage-discharge rating curve for RAMP Station S34, Tar River above CNRL Lake.

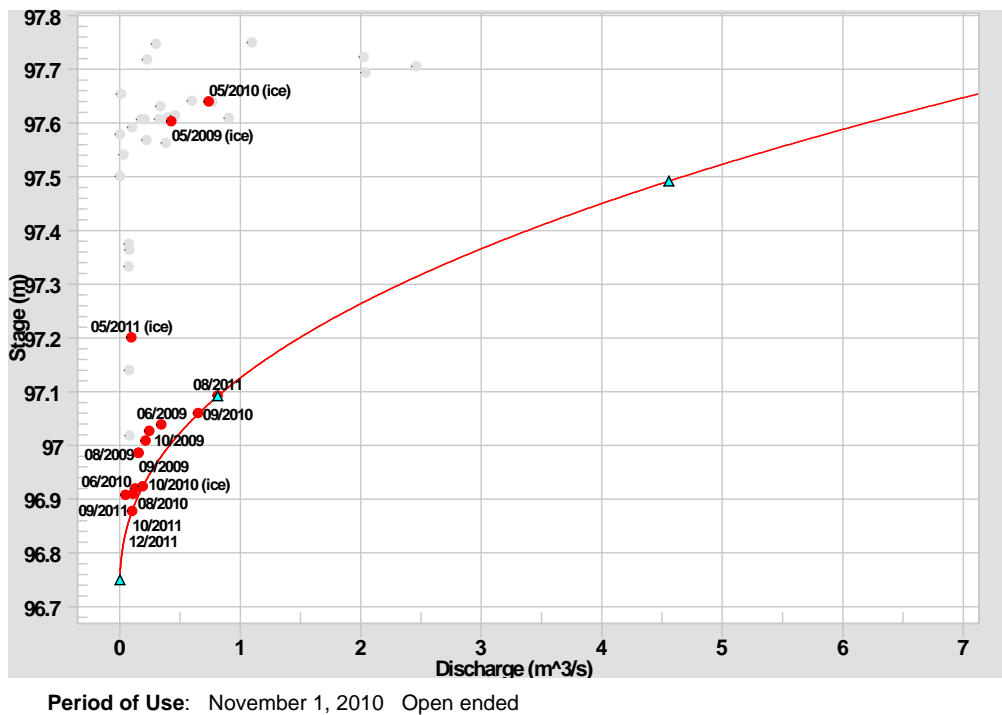
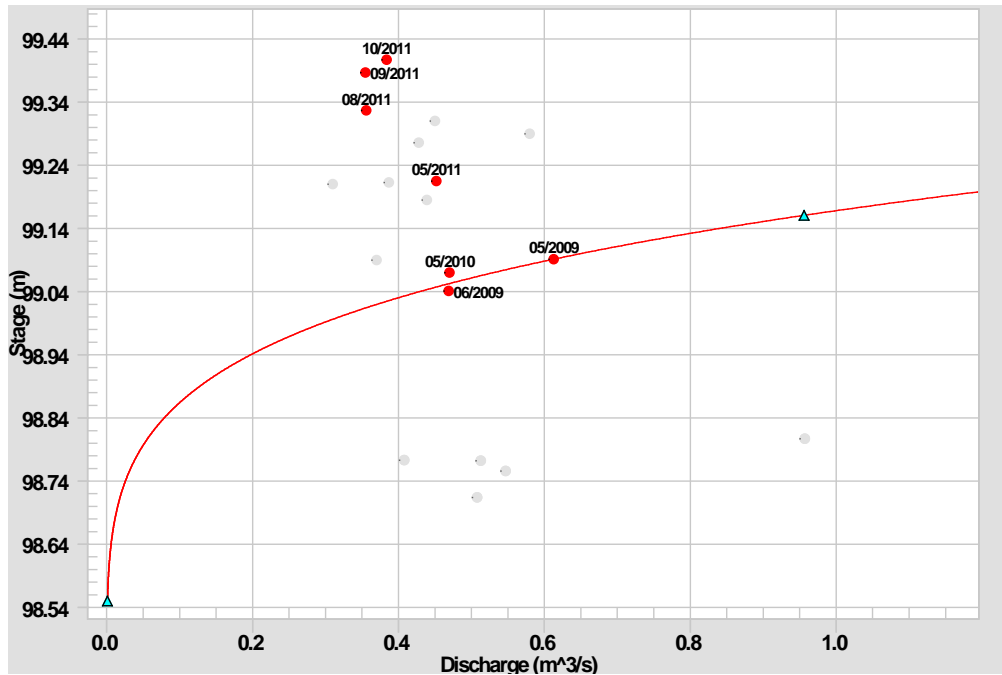


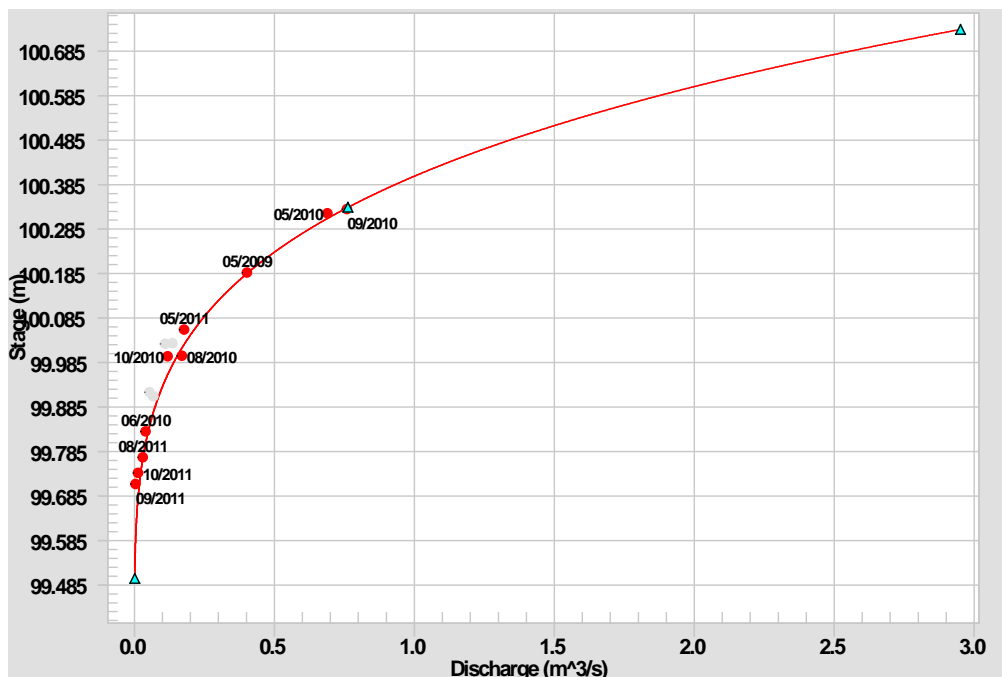
Figure C.3-68 Stage-discharge rating curve for RAMP Station S36, McClelland Lake Outlet above Firebag River.



Period of Use: May 1, 2009 Open ended

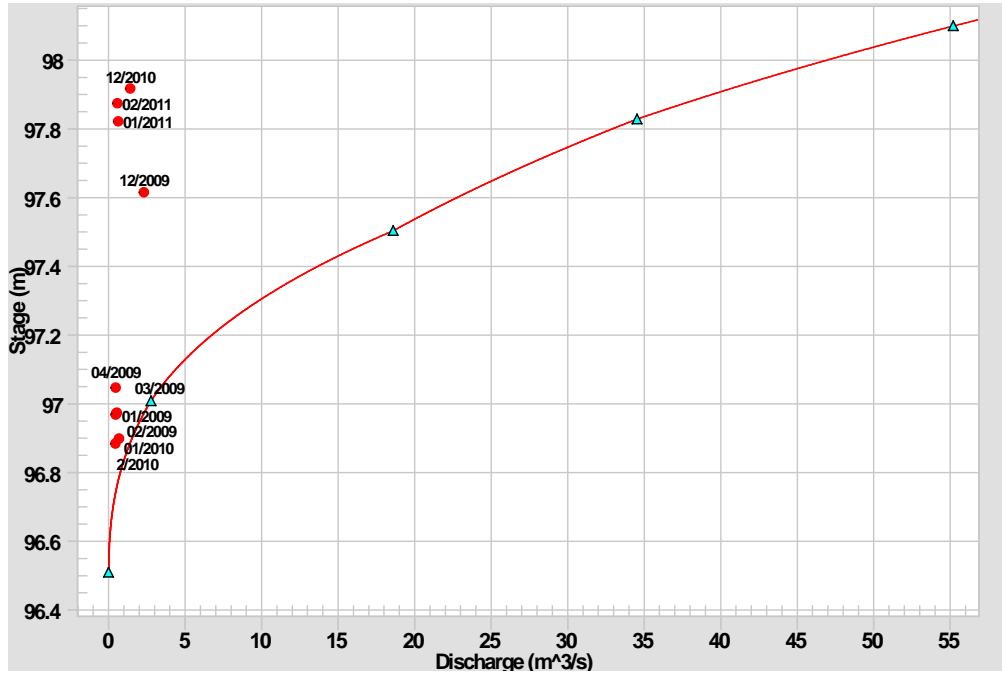
Note: The data quality at this station was compromised in the 2011 WY due to backwater effects caused by beaver activity.

Figure C.3-69 Stage-discharge rating curve for RAMP Station S37, East Jackpine Creek near the 1,300 m contour.



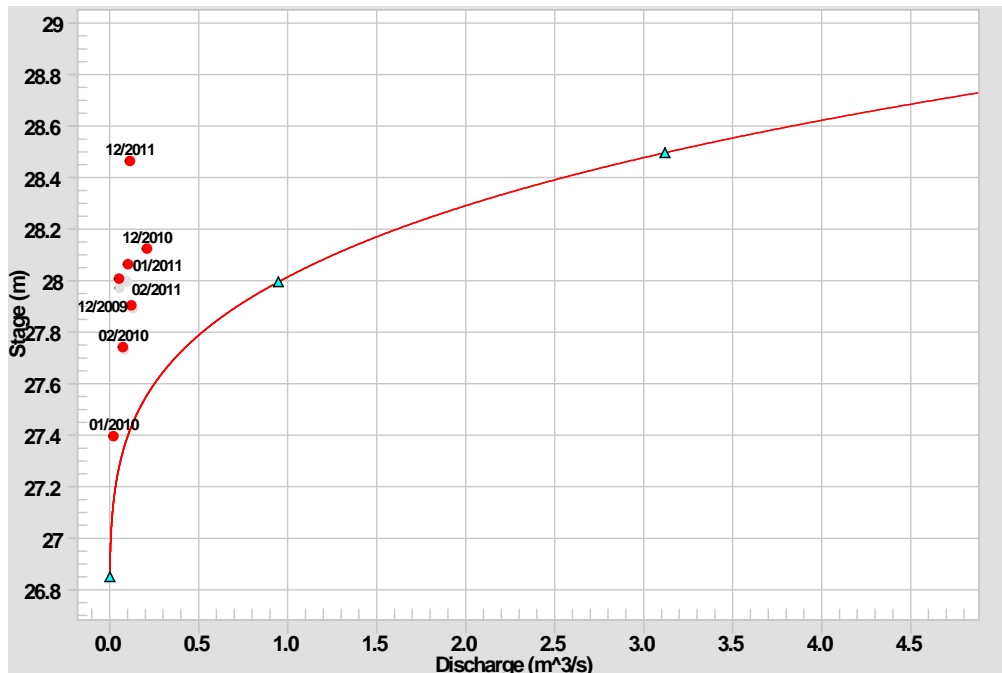
Period of Use: April 25, 2010 Open ended

Figure C.3-70 Stage-discharge rating curve for WSC Station 07DA006, RAMP Station S38, Steepbank River.



Period of Use: October 31, 2009 Open ended
 Note: Winter manual measurements collected by RAMP; rating curve developed by Water Survey of Canada based on open-water flows.

Figure C.3-71 Stage-discharge rating curve for WSC Station 07DA018, RAMP Station S39, Beaver River above Syncrude.



Period of Use: October 31, 2009 Open ended
 Note: Winter manual measurements collected by RAMP; rating curve developed by Water Survey of Canada based on open-water flows.

Figure C.3-72 Stage-discharge rating curve for RAMP Station S40, MacKay River at the Petro-Canada Bridge.

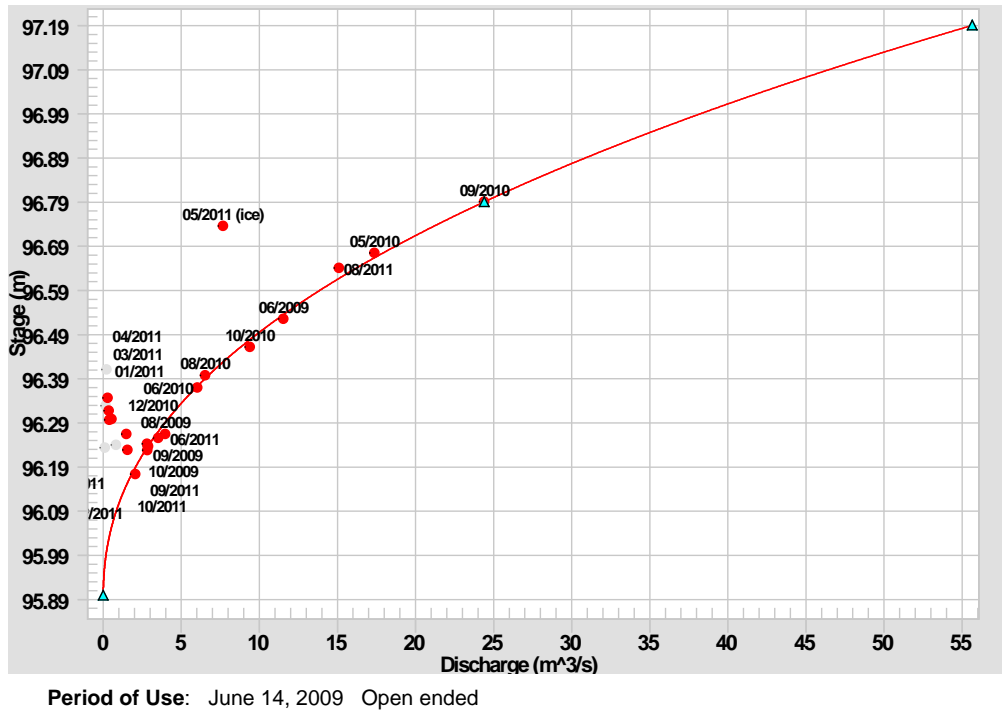
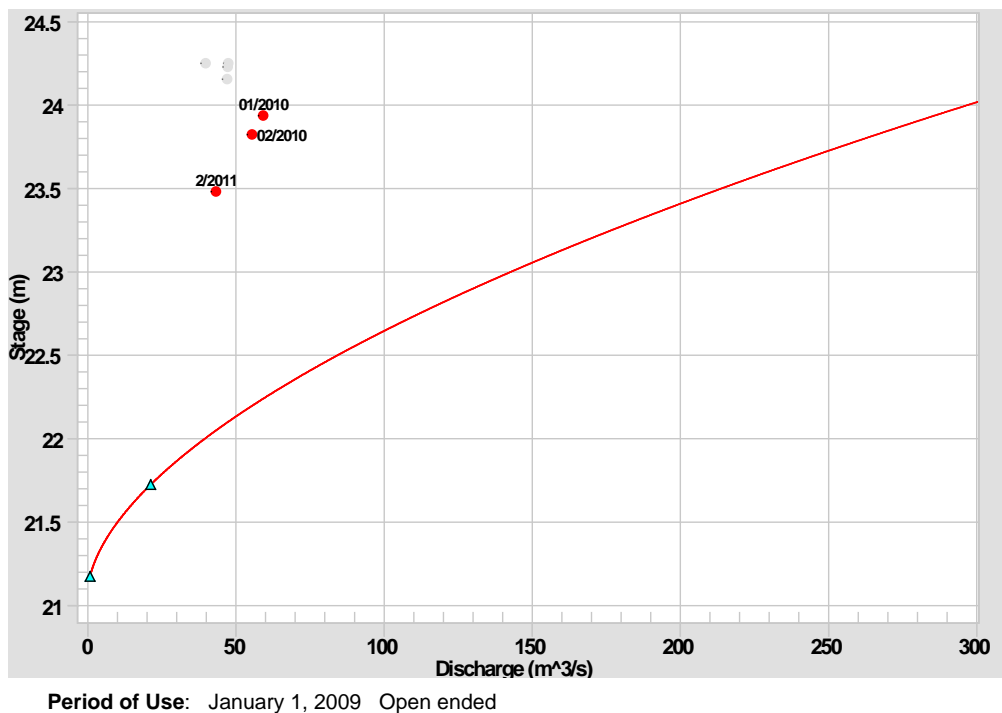


Figure C.3-73 Stage-discharge rating curve for RAMP Station S42, Clearwater River above the Christina River.



Note: Winter manual measurements collected by RAMP; rating curve developed by Water Survey of Canada based on open-water flows.

Figure C.3-74 Stage-discharge rating curve for RAMP Station S43, Firebag River above Suncor Firebag.

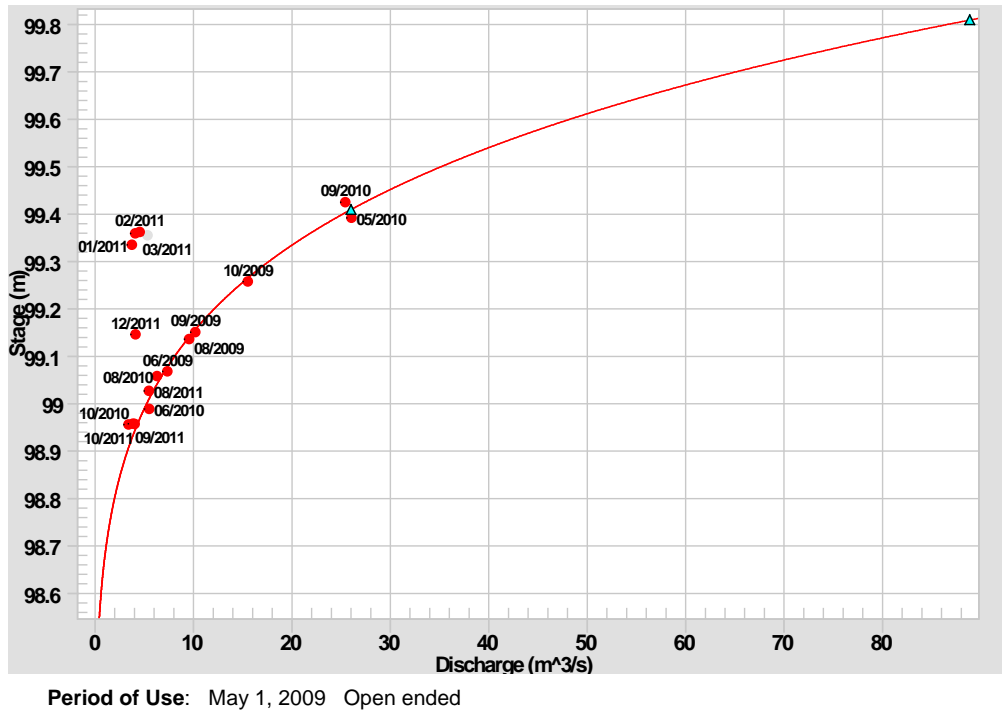


Figure C.3-75 Stage-discharge rating curve for WSC Station 07DA013, RAMP Station S44, Pierre River near Fort McKay.

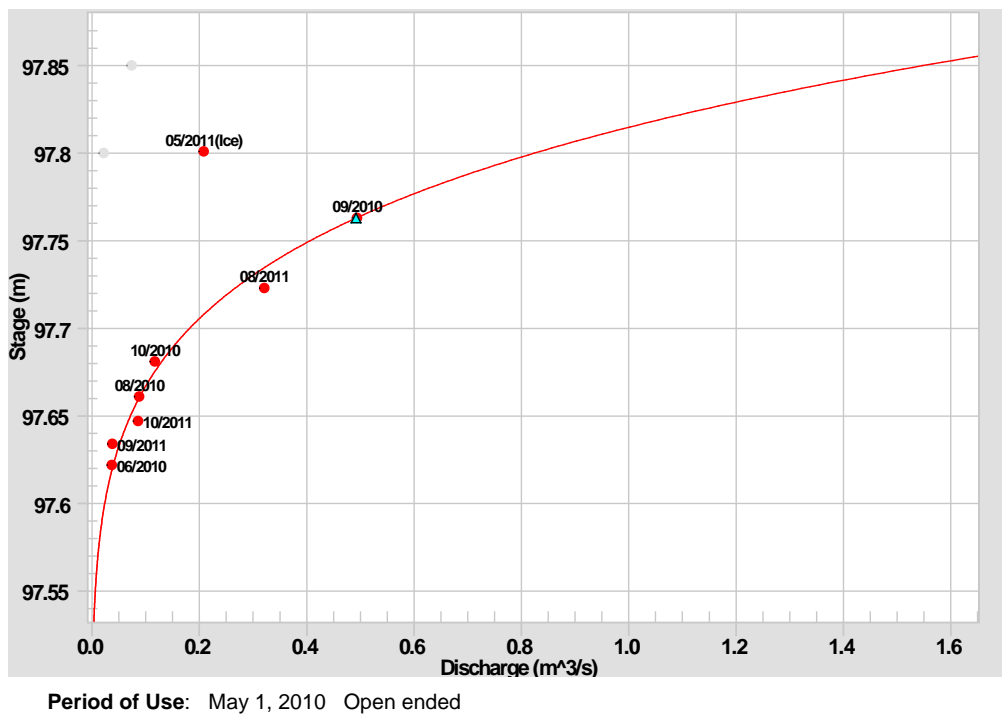


Figure C.3-76 Stage-discharge rating curve for RAMP Station S45, Ells River above the Jocelyn Creek Diversion.

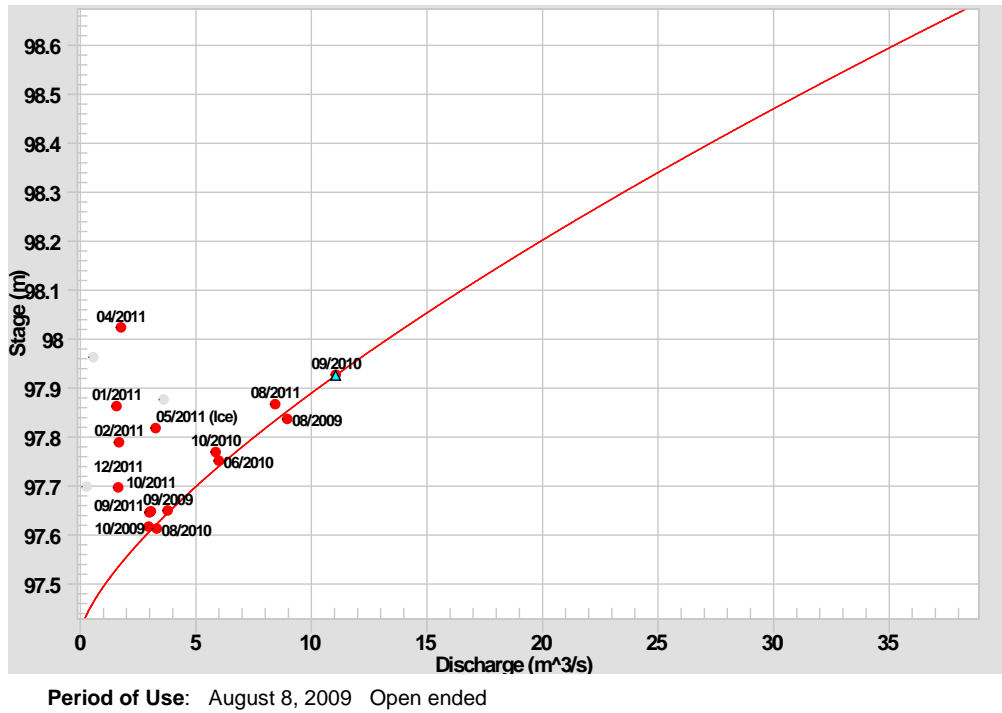


Figure C.3-77 Stage-discharge rating curve for RAMP Station S46, Athabasca River near Embarras Airport.

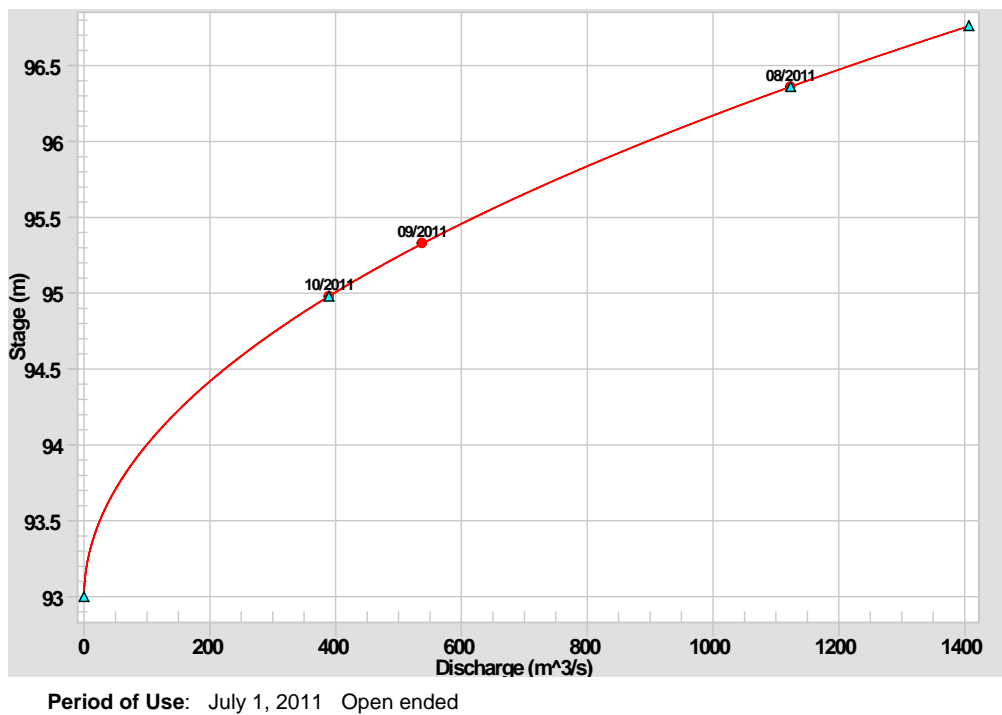


Figure C.3-78 Stage-discharge rating curve for RAMP Station S47, Christina River near the mouth.

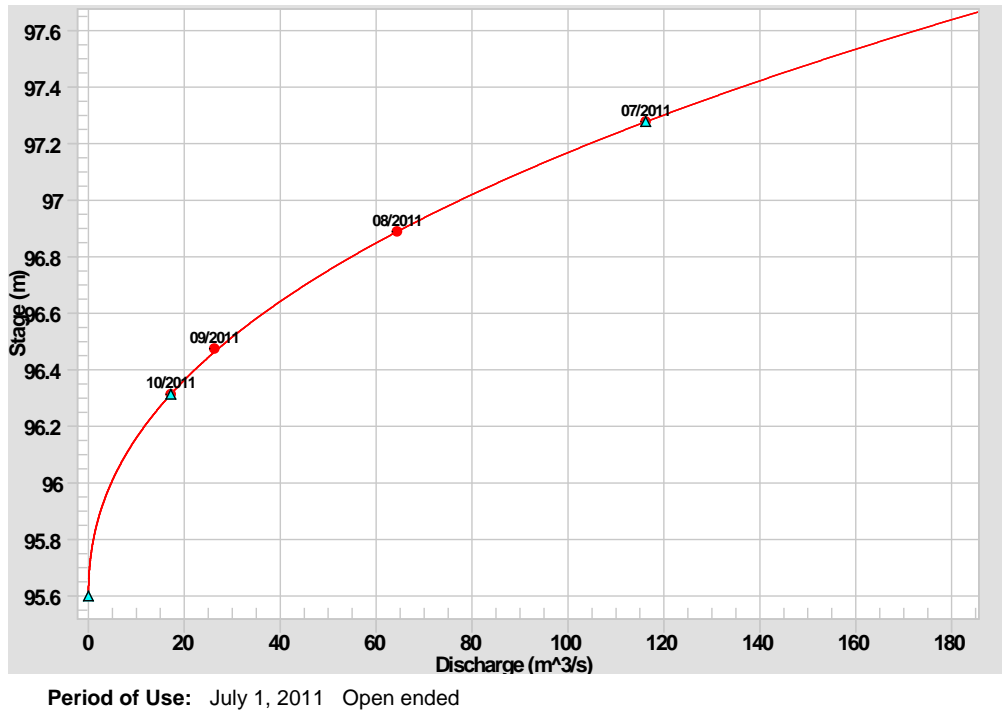


Figure C.3-79 Stage-discharge rating curve for RAMP Station S48, Big Creek near the mouth.

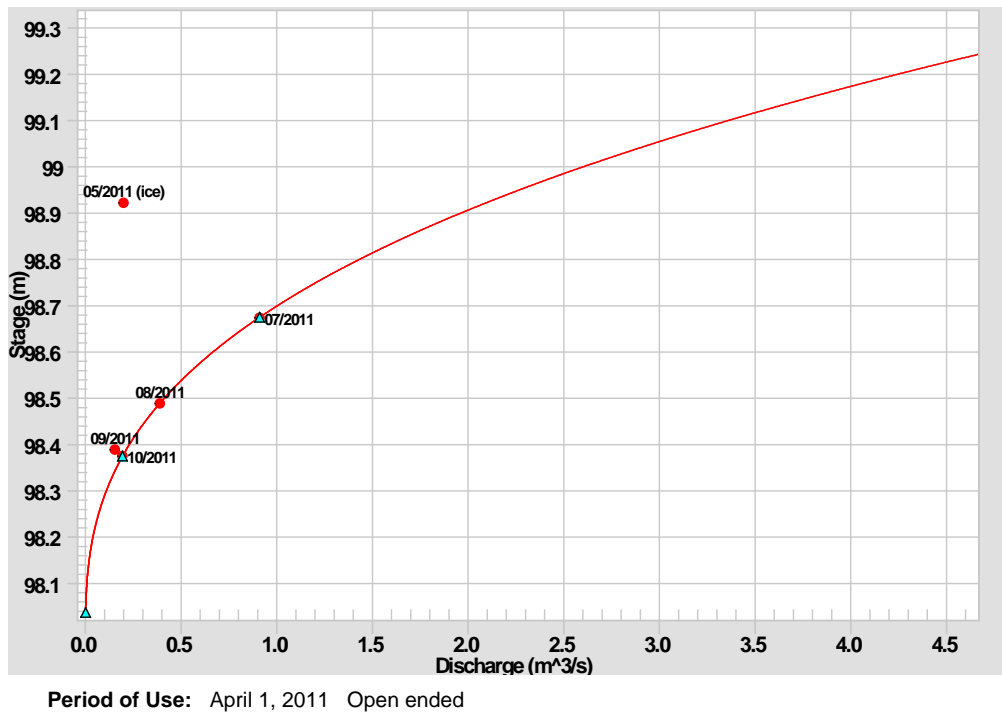


Figure C.3-80 Stage-discharge rating curve for RAMP Station S49, Eymundson Creek near the mouth.

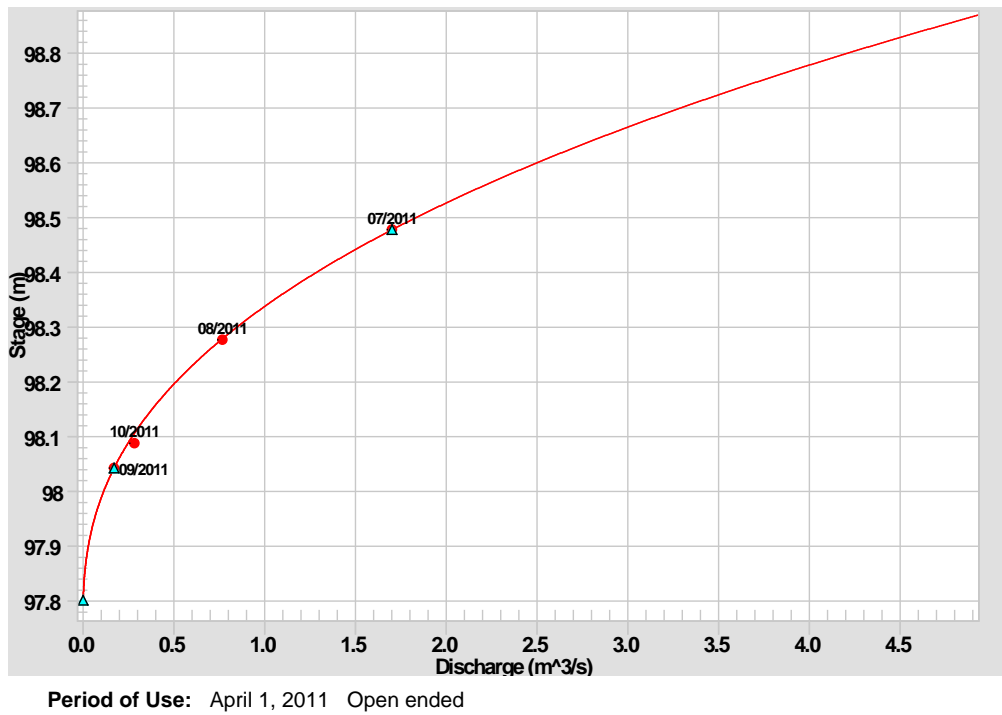
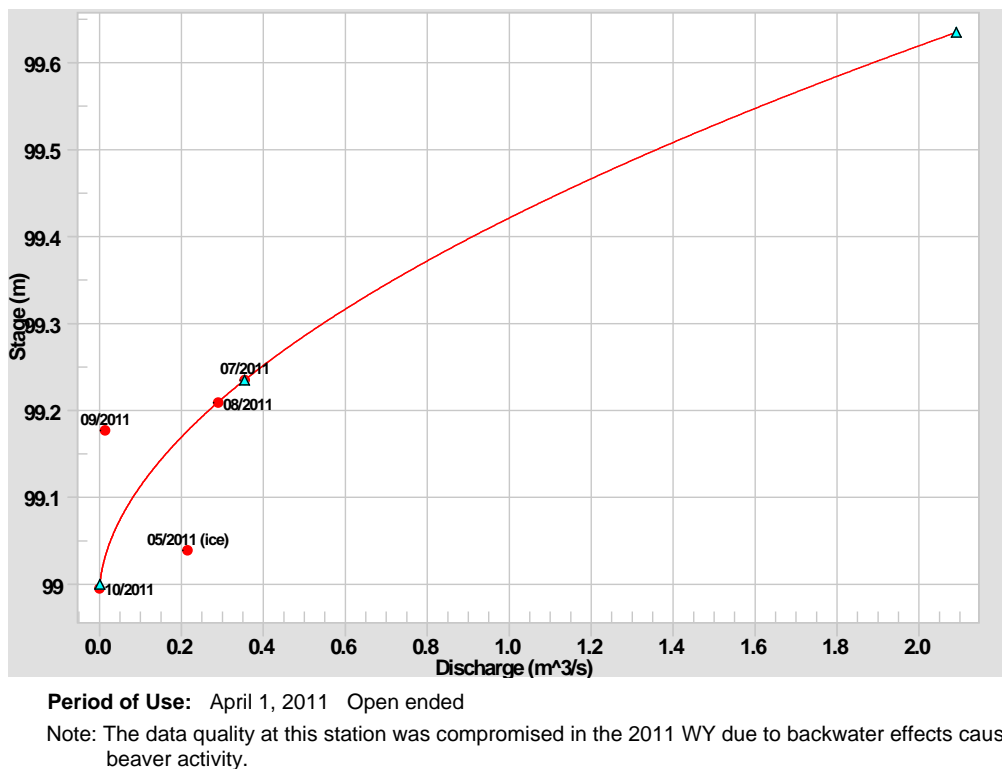


Figure C.3-81 Stage-discharge rating curve for RAMP Station S50, Red Clay Creek.



C.4 NATURALIZED FLOW CALCULATION

C.4.1 Introduction

A water balance approach was used to assess hydrologic impacts on the flow regime experienced at the mouth of major tributaries of the Athabasca River within the oil sands region. This analytical approach is considered useful in that the difference between observed and naturalized flows can be calculated using recorded and calculated flow inputs and outputs.

The water balance approach involved the calculation of a naturalized hydrograph by accounting for flow inputs and outputs that have affected the observed hydrograph at a particular location. By adding back into the observed hydrograph flows that would have occurred under natural conditions, and by subtracting flows that would not have occurred naturally, but have been added to the system through human intervention (flows added as a result of industrial activity such as industrial flow releases and land-use changes), a naturalized hydrograph for the location was calculated. The observed hydrograph and the naturalized hydrograph were compared to assess the impacts to the flow regime at the specified location.

Details of the procedure are provided below.

C.4.2 Rationale

C.4.2.1 Water Balance

In general, the water balance for a partially-developed catchment (that is, a catchment that has been affected by land clearing, hydrologic isolation, and water withdrawals and releases from watercourses) may be considered as follows:

$$Hyd_B = Hyd_O + I_w - I_r + R_n - R_i \quad (1)$$

where:

Hyd_B is the *baseline* hydrograph;

Hyd_O is the *test* hydrograph which was observed;

I_w are the focal project withdrawals from the watershed;

I_r are the focal project releases to the watershed;

R_n is the natural runoff that would have occurred in the watershed, but was intercepted or closed-circuited by focal projects; and

R_i is the incremental increase in runoff caused by land cleared within the watershed.

For catchments monitored as part of the RAMP program, the observed discharge was the discharge measured at streamflow stations near the catchment outlet. Most streamflow stations were operated by RAMP, but some were operated by government, or by a combination of government and RAMP.

Water withdrawals and releases were obtained from industry reports. In most cases, daily discharges were reported. In other cases the withdrawal or release discharge was reported as a monthly or annual volume, and the corresponding daily discharges were estimated by RAMP.

The effects of clearing and of hydrologic isolation were estimated as discussed in the following sections.

The natural flow, Hyd_B was initially unknown and estimated by solving Equation 1 using information on the other components of the water balance. Because some of the other components were not known precisely, and because the water balance equation omits factors such as changes in surface water discharge in response to groundwater extraction, Hyd_B was referred to as “naturalized”, rather than “natural”.

C.4.2.2 Effect of Clearing

The effect of clearing was estimated by assuming a 20% increase in average runoff depth in cleared areas. This assumption provided an approximate estimate of increased runoff. A more precise assessment would require consideration of the following factors:

- The effect of clearing on runoff is not well defined and may vary significantly depending on the soil type, initial vegetation, and other factors; and
- When land is cleared, the runoff is frequently treated in settling ponds, which may have sufficient capacity to attenuate the runoff and appreciably affect the discharge hydrograph.

Using an assumption of a constant increase in average runoff depth was considered to be appropriate for reviewing changes in flow characteristics when evaluated at the mouth of the tributaries, because the cleared area is usually small compared to the total catchment area.

C.4.2.3 Closed-Circuited Areas

Closed-circuited (or hydrologically isolated) areas were delineated based on satellite imagery and reviewed by oil sands operators (Table C.4-1). It was assumed that zero runoff was released to the environment from closed-circuit areas.

The definition of “effective area” used in the water balance analyses was the area of the catchment remaining after removal of the closed-circuited areas. The effective area includes both cleared and natural areas that were not closed-circuited by development activities. All areas of the watershed that were not closed-circuited were included in the effective area for the purposes of the water balance analyses. The effective area as defined for this analysis may include areas that were ineffective in the classic hydrological sense of areas that do not contribute runoff to the stream during normal (up to 1:2 year) runoff events.

Table C.4-1 Area of each watershed that was cleared or hydrologically closed-circuited, 2011.

Watershed	Total Area¹ (km²)	Closed-Circuit Area (km²)	Cleared Area (km²)
Athabasca River ²	146,000	574	369
Muskeg River	1,457	118.7	69.0
Steepbank River	1,320	4.9	40.1
Tar River	326	63.6	26.3
Mackay River	5,569	5.4	12.6
Calumet River	173.5	1.9	0.4
Firebag River	5,988	2.6	42.8
Ells River	2,450	1.6	16.5
Christina River ²	13,038	6.8	53.6
Hangingstone River	962	0.5	0.1
Poplar Creek	151	3.1	1.8
Fort Creek	31.9	0.3	19.7

¹ Area is reported for the stream monitoring station.

² Values reported for all oil sands projects in these watersheds.

C.4.3 Water Balance Procedure

In order to calculate the naturalized hydrograph, the observed discharge was first adjusted to remove the effects of industrial water withdrawals and releases. The resulting discharge represented the observed runoff (R) from the contributing portion of the catchment. The observed runoff was then converted to a naturalized runoff depth (d), accounting for the effects of clearing. The naturalized runoff depth was used to calculate the naturalized discharge for the catchment (Hyd_B). The natural flow that would have occurred from industrially closed-circuited areas (R_n), and the incremental flow from cleared areas (R_i) were also calculated. This process is shown in equation form below:

$$R = Hyd_o + I_w - I_r \quad (2)$$

$$d = \frac{R}{[A_E + (A_C \times F)]} \times C \quad (3)$$

$$Hyd_B = \frac{A \times d}{C} \quad (4)$$

$$R_n = \frac{A_{HI} \times d}{C} \quad (5)$$

$$R_i = \frac{A_C \times d \times F}{C} \quad (6)$$

where:

- A is the total catchment area (km²);
- A_C is the cleared area in the catchment (km²);
- A_E is the effective area (i.e. A - A_{HI}) (km²);
- A_{HI} is the closed-circuit area (km²);
- C is the conversion factor from m³/s/km² to mm/yr;
- d is the naturalized runoff depth (mm);
- F is the adjustment factor to account for clearing (0.20);
- R is the observed runoff from the effective area adjusted for reported industrial withdrawals and releases (m³/s); and

Other symbols are as defined previously. The water balance calculation is done at a daily time step.

C.4.4 Previously Published Estimates

Naturalized flows provided in the RAMP reports in 2005–2007 were estimated using methods similar to, but slightly different than, the procedure described above. Estimates for 2005–2007 were revised to be consistent with the method used from 2008 to 2011, which reflects more accurately a naturalized water balance, and these revisions were presented in the RAMP 2008 report. The assumption of differences in runoff response between upland and lowland terrain, previously applied to closed-circuited areas, was not applied due to the lack of a reliable and consistent approach for all watersheds.

C.5 UPDATED STATION DESCRIPTION SHEETS

Updated station description sheets are provided below for all stations that were active in the 2011 WY.

Revised 26 March, 2012

Location and Purpose

Established in May 1995 to monitor climate conditions in the Muskeg River basin. Formerly Station 271 for the OSLO project - 1988 data available.

Variables Measured: Air Temperature, Relative Humidity, Wind Speed, Wind Direction, Snow Depth, Precipitation, and Solar Radiation

Period of Record: March 2006 to Present

Access: Truck Via Canterra Road and Jackpine Mine

Coordinates: 475230 E, 6344049 N (NAD 83)

Station Elevation: Geodetic elevation of station based on 2011 differential GPS program 308.5 ± 0.5m

Active: Year Round

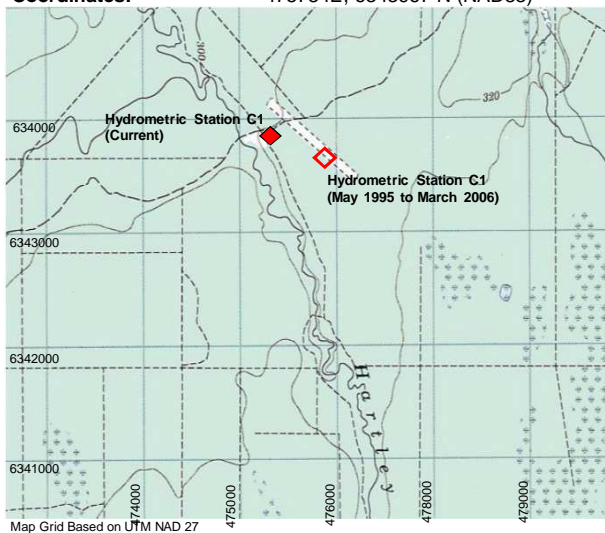
Lat/Long: 57°14'20" N, 111°24'37" W

NTS Map: 74E03

Previous Locations

Period: May 1995 to March 2006

Coordinates: 475734E, 6343967 N (NAD83)



Revised 26 March, 2012

Location and Purpose

Established in October 2008 to monitor climate conditions in the Tar River basin.

Variables Measured:	Air Temperature, Relative Humidity, Wind Speed, Wind Direction, Snow Depth, Precipitation, Solar Radiation, and Barometric Pressure		
Period of Record:	October 2008 to Present	Active:	Year Round
Access:	4WD Truck Via CNRL Horizon	Lat/Long:	57°23'02" N, 111°56'31" W
Coordinates:	12 V 443364 E, 6360515 N (NAD 83)	NTS Map:	74E05
Station Elevation:	Geodetic elevation of station based on 2011 differential GPS program 412 ±0.5m		

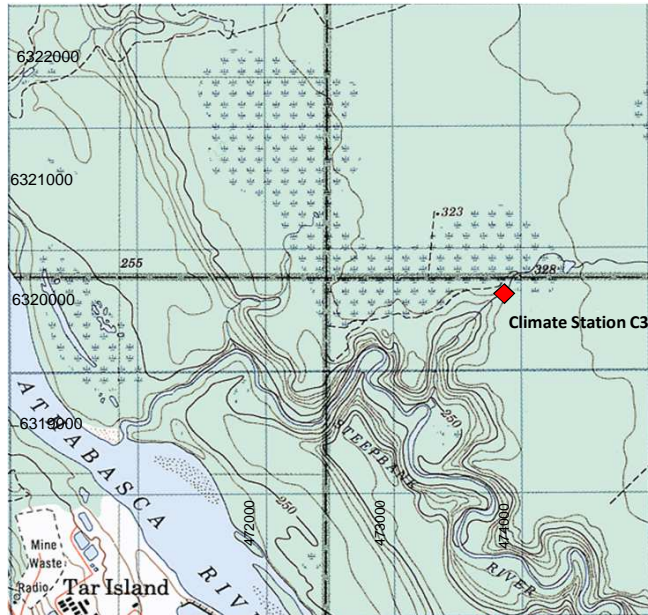


Revised 26 March, 2012

Location and Purpose

Established in August 2009 to monitor precipitation in the Steepbank River area.

Variables Measured:	Air Temperature, Relative Humidity, Wind Speed, Wind Direction, Snow Depth, Precipitation, Solar Radiation, and Barometric Pressure	Active:	Year Round
Period of Record:	August 2009 to Present	Lat/Long:	57°01'38.4" N, 111°25'45.1" W
Access:	4WD Truck Via Suncor	NTS Map:	74E03
Coordinates:	12 V 473950 E, 6320500 N (NAD 83)		
Station Elevation:	Estimated Geodetic Elevation 328 m ± 5m		

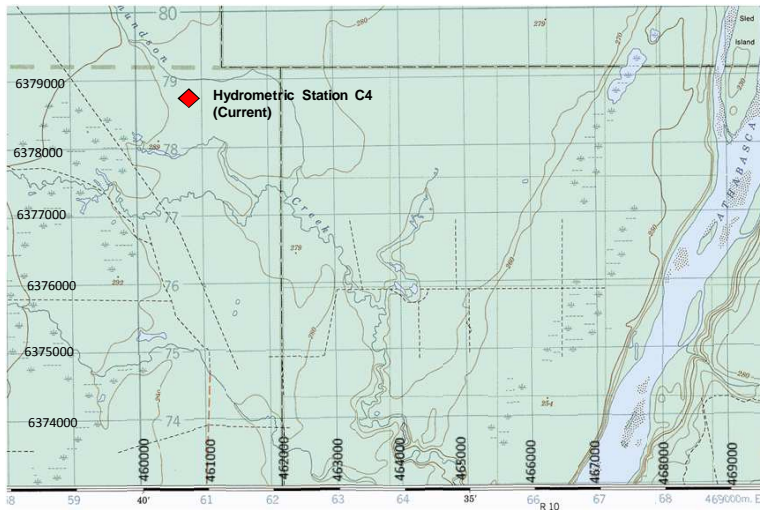


Revised 26 March, 2012

Location and Purpose

Established in July 2011 to monitor climate conditions on the west side of the Athabasca River north of all current development.

Variables Measured:	Air Temperature, Relative Humidity, Wind Speed, Wind Direction, Snow Depth, Precipitation, Solar Radiation, and Barometric Pressure
Period of Record:	July 2011 to Present
Access:	Helicopter
Coordinates:	460853 E, 6378740 N (NAD 83)
Station Elevation:	Geodetic elevation of station based on 2011 differential GPS program 291.5 ± 0.5m
	Active: Year Round
	Lat/Long: 57°32'58" N, 111°39'14" W
	NTS Map: 74E12

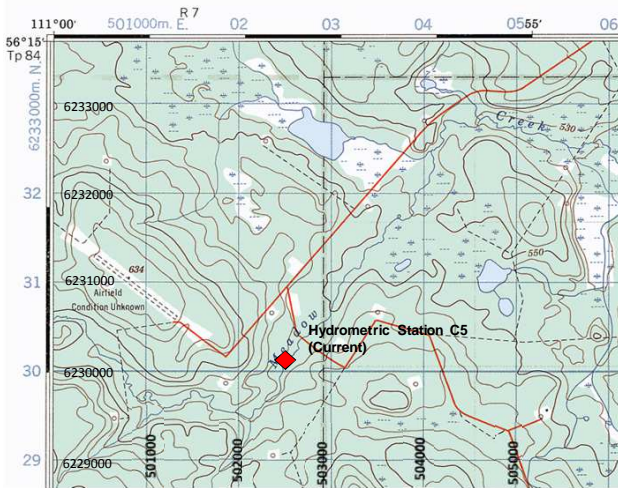


Revised 26 March, 2012

Location and Purpose

Established in October 2011 to monitor climate conditions between Fort McMurray and Christina Lake.

Variables Measured:	Air Temperature, Relative Humidity, Wind Speed, Wind Direction, Snow Depth, Precipitation, Solar Radiation, and Barometric Pressure	Active:	Year Round
Period of Record:	October 2011 to present	Lat/Long:	56°13'24" N, 110°57'32" W
Access:	Truck via Hwy 881 and Surmont Project	NTS Map:	74D02
Coordinates:	502542 E, 6230964 N (NAD 83)		
Station Elevation:	Estimated Geodetic Elevation 555 m ± 5m		

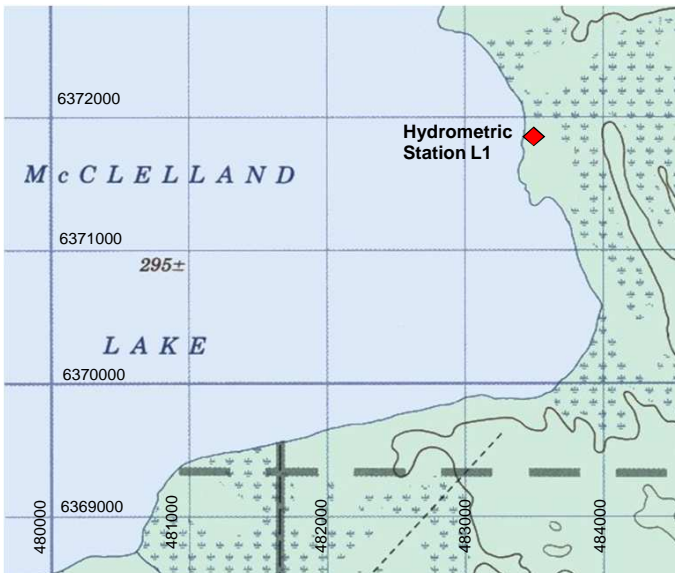


Revised 8 March, 2012

Location and Purpose:

Established on the East side of McClelland Lake to monitor Water Levels.

Variables Measured:	Water Level, Precipitation, Air Temperature, Relative Humidity, and Water Temperature	Active:	Year Round
Period of Record:	July 1997 to Present	Lat/Long:	57°29'30" N, 111°16'37" W
Access:	Helicopter	NTS Map:	74E06
Drainage Area:	191 km ²	ATS:	NW-12-98-9-W4
Coordinates:	483430 E, 6371950 N		

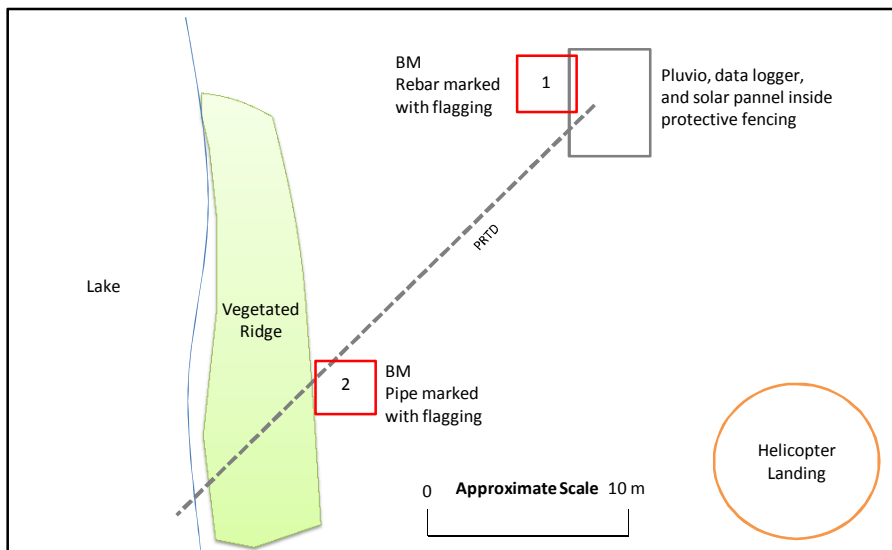


Map Grid Based on UTM NAD 27

Benchmarks:

BM: 1
Elevation: 294.731 m
Basis: Level survey from BM2
Location: Next to fence towards lake
Description: Iron rod, 0.4 m out of ground

BM: 2
Elevation: 294.865 m
Basis: Assumed
Location: 2m towards fencing from old station mast
Description: Steel pipe, 0.4 m out of water



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 294.5 ±0.5m

Revised 8 March, 2012

Location and Purpose

Established to monitor water levels in Kearl Lake.

Variable Measured:	Water Level, Precipitation, Water Temperature, Air Temperature, and Relative Humidity	Active:	Year Round
Period of Record:	May 1999 to Present	Lat/Long:	57°18' 8.3" N, 111 °15' 5.8" W
Access:	2WD Access via Canterra Road	NTS Map:	74E06
Drainage Area:	72.6 km ²	ATS:	4-16-96-11-W4
Coordinates:	484839 E, 6351065 N (UTM NAD 83)		

Previous Locations:

Period:	May 1999 to November 2001
Coordinates:	485184 E, 6351267 N (UTM NAD 83)
Period:	November 2001 to September 2007
Coordinates:	484935 E, 6349023 N (UTM NAD 83)

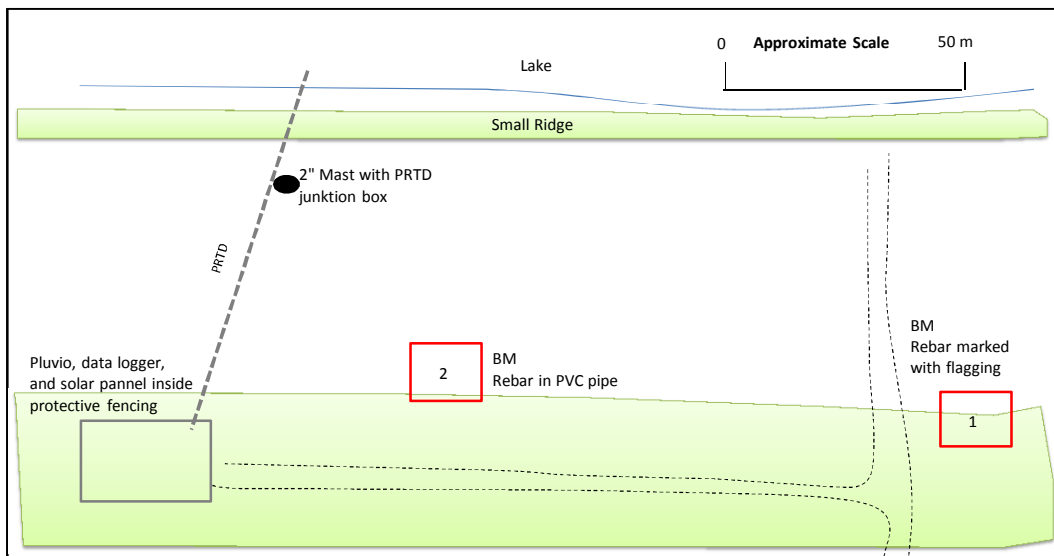


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 333.058 m
Basis: Level survey from BM2
Location: 3 m south of trail at edge of tree line.
Description: Re-bar extending 0.3 m from ground

BM: 2
Elevation: 332.424
Basis: GPS Survey ± 13 mm referenced to Kearl Project
Location: 20 m South of logger at edge of tree line
Description: Iron rod in PVC cover



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 332 ± 0.5m

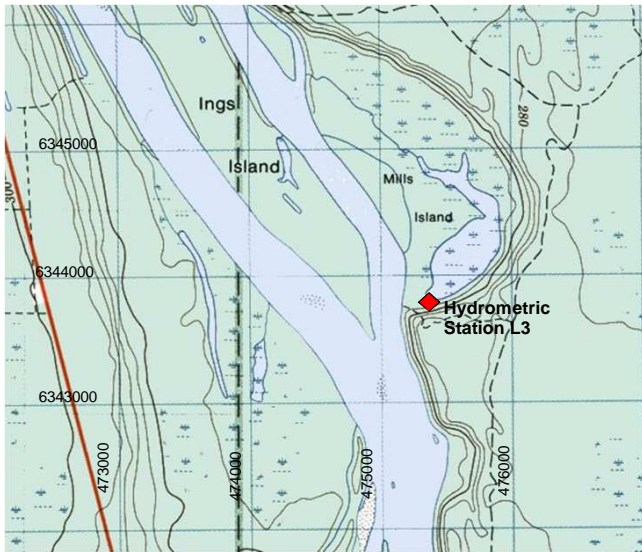
Revised 8 March, 2012

Location and Purpose:

Established to monitor water levels in Isadore's Lake.

Variable Measured: Water Level, Water Temperature
Period of Record: February 2000 to Present
Access: 4WD road access off Highway 63
Drainage Area: 28.0 km²
Coordinates: 463305 E, 6342967 N (UTM NAD 83)

Active: Year Round
Lat/Long: 57°13'42.6" N, 111°36'28.5" W
NTS Map: 74E04
LSD: 16-7-95-10-W4



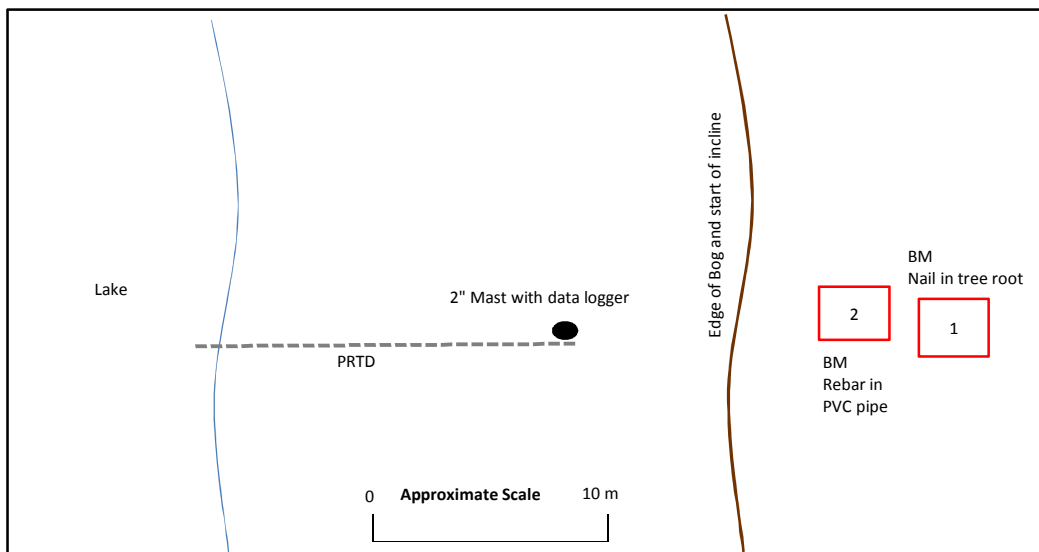
Map Grid Based on UTM NAD 27



Benchmarks

BM: 1
Elevation: 235.901 m
Basis: Level survey from BM2
Location: 35 m south of data logger box
Description: Nail in root of spruce tree upslope of lake, nail is flagged with orange tape

BM: 2
Elevation: 234.506 m
Basis: Assumed
Location: 30 m south of data logger box
Description: Rebar in PVC Pipe
 BM #1 and data logger box



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 234 ± 0.5m

Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on Jackpine Creek upstream of the Muskeg River. Replaced an Environment Canada hydrometric station (07DA009) that previously operated at the original site from 1975 to 1993. Station was moved to present location in 2000 to allow road access and avoid beaver dams.

Variable Measured: Water Level, Discharge, and water temperature

Period of Record: May 1995 to Present

Access: 2WD Access on Canterra Rd.

Drainage Area: 358 km²

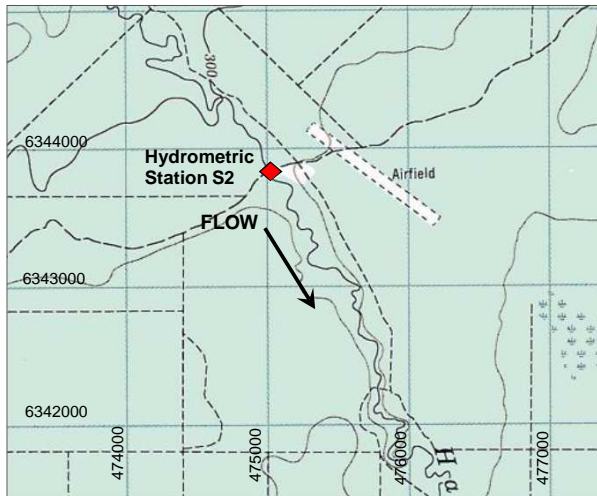
Coordinates: 474961 E, 6344087 N (UTM NAD 83)

Active: Year Round

Lat/Long: 57°14'21" N, 111°24'53" W

NTS Map: 74E / 3

LSD: SE-17-95-9-W4

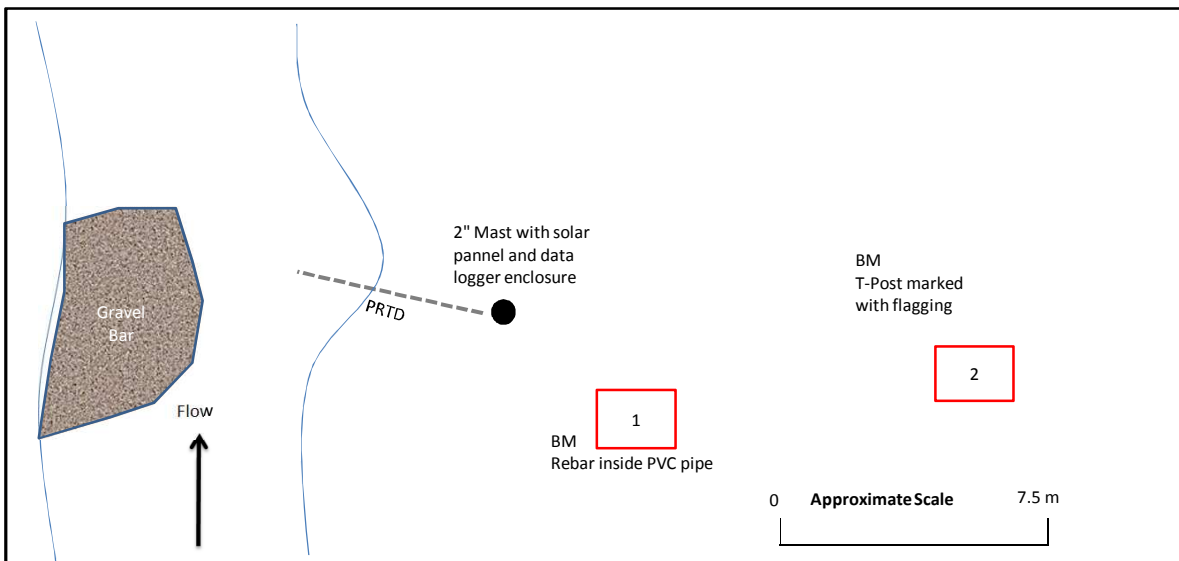


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 297.990 m
Basis: survey date unknown
Location: 5 m South of data logger
Description: Rebar in white PVC pipe on right bank just upstream of the logger box

BM: 2
Elevation: 298.161 m
Basis: Level Survey from BM 1
Location: 6 m SE of data logger
Description: T-Post marked with pink flagging



Benchmark Notes: Approximate geodetic elevation of Benchmark Benchmark 2 based on 2011 differential GPS program 297.5 ± 0.5m

Updated 6 March, 2012

Location and Purpose:

Established to monitor discharge on Iyininim Creek upstream of Kearl Lake. This station is intended to characterize runoff from the North / West slopes of Muskeg Mountain and provide input to Kearl Lake water balance calculations. A rain gauge was added to the station in 1998.

Variables Measured: Water Level, Discharge, Water Temperature, and Rainfall

Period of Record: May 1995 to October 1999; May 2001 to Present

Access: Helicopter

Drainage Area: 32.2 km²

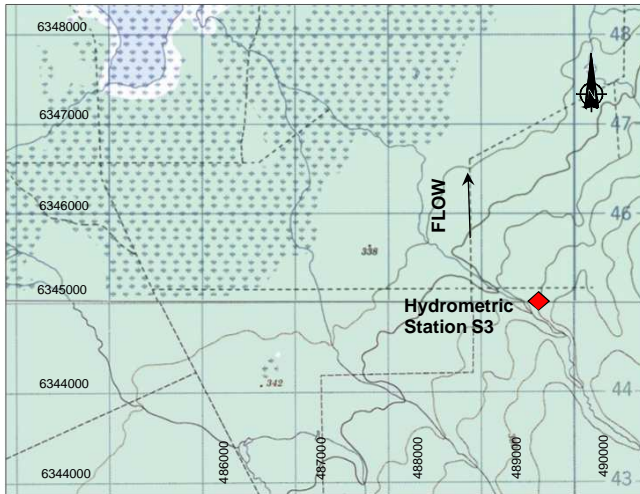
Coordinates: 489491 E, 6345029 N (UTM NAD 83)

Active: Open Water Season

Lat/Long: 57° 15' 00" N, 111° 10' 10" W

NTS Map: 74E06

LSD: NE-14-95-8-W4



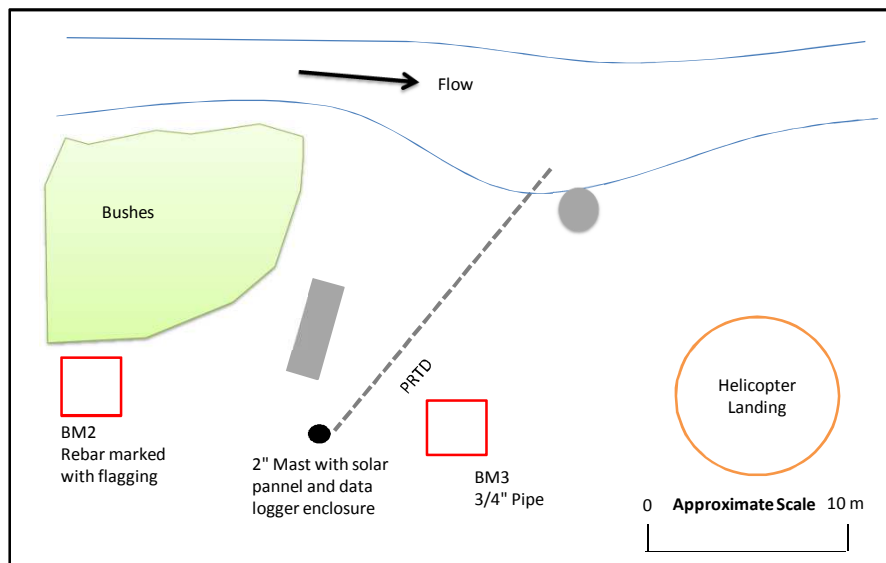
Map Grid Based on UTM NAD 27



Benchmarks:

BM: 2
Elevation: 360.514m
Basis: Unknown
Location: 8m west of data logger
Description: Re-bar marked with pink flagging

BM: 3
Elevation: 361.385m
Basis: Level survey from BM2
Location: 3m east of data logger station
Description: 3/4" Pipe



Benchmark Notes: Approximate geodetic elevation of Benchmark 3 based on 2011 differential GPS program 361.5 ± 0.5m

Revised 6 March, 2012

Location and Purpose:

Established originally in 1995 to monitor discharge on the Muskeg River above disturbed watersheds. Decommissioned in 1996, station was re-activated in 2003 in accordance with regulatory monitoring.

Variable Measured: Water Level, Discharge, and Water Temperature

Period of Record: Aug 1995 to Dec 1996; Feb 2003 to Present

Access: Helicopter

Drainage Area: 395 km²

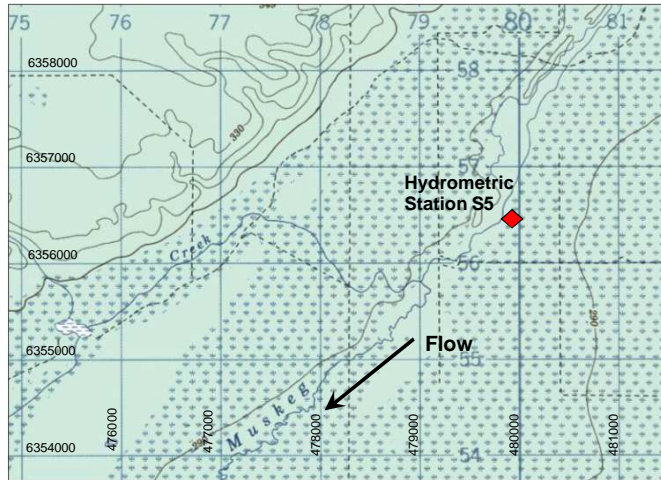
Coordinates: 479760 E, 6356755 N (UTM NAD 83)

Active: Year Round

Lat/Long: 57°21'11" N, 111°20'10" W

NTS Map: 74E06

LSD: SE-26-96-9-W4



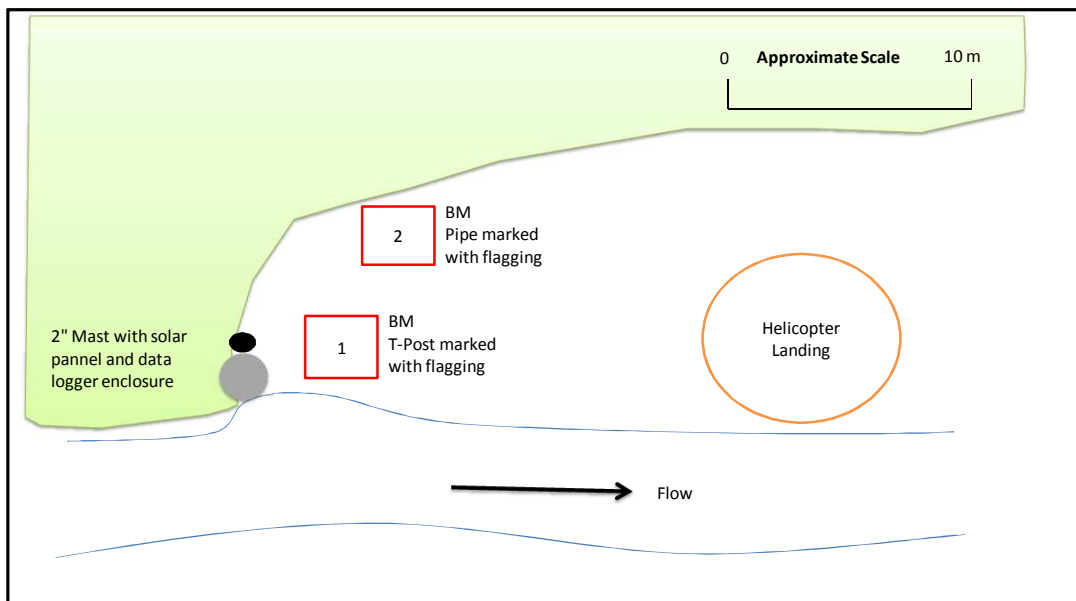
Map Grid Based on UTM NAD 27



Benchmarks

BM: 1
Elevation: 98.346 m
Basis: Level survey from BM2
Location: 3 metres downstream of stilling well
Description: T-post 0.4 m from surface

BM: 2
Elevation: 98.369 m
Basis: assumed
Location: 6 metres south of stilling well under bushes
Description: pipe 0.4 m from surface marked with pink flag



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 285.5±0.5m

Location and Purpose:

Established to monitor discharge on the Muskeg River upstream of disturbed watersheds. The station was relocated in 1998 to allow road access.

Variable Measured: Water Level, Discharge, Barometric Pressure, and Water Temperature

Period of Record: Aug 1995 to Present

Access: 2WD road via the Syncrude Aurora North Mine

Drainage Area: 552 km² (was 390 km² until 1998)

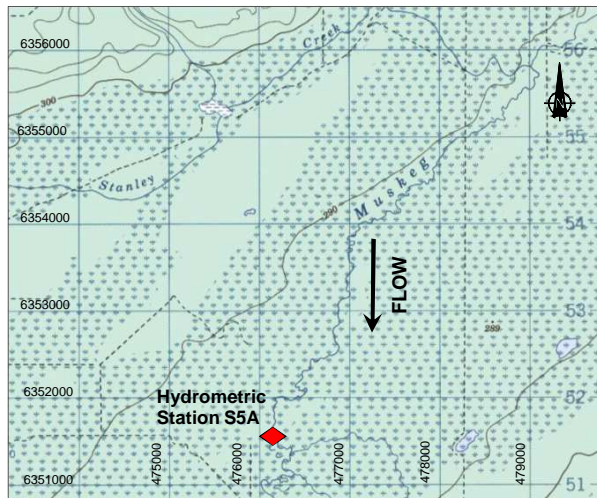
Coordinates: 476100 E, 6351600 N (UTM NAD 83)

Active: Year Round

Lat/Long: 57°18'30" N, 111°23'43" W

NTS Map: 74E06

LSD: SE-9-96-9-W4



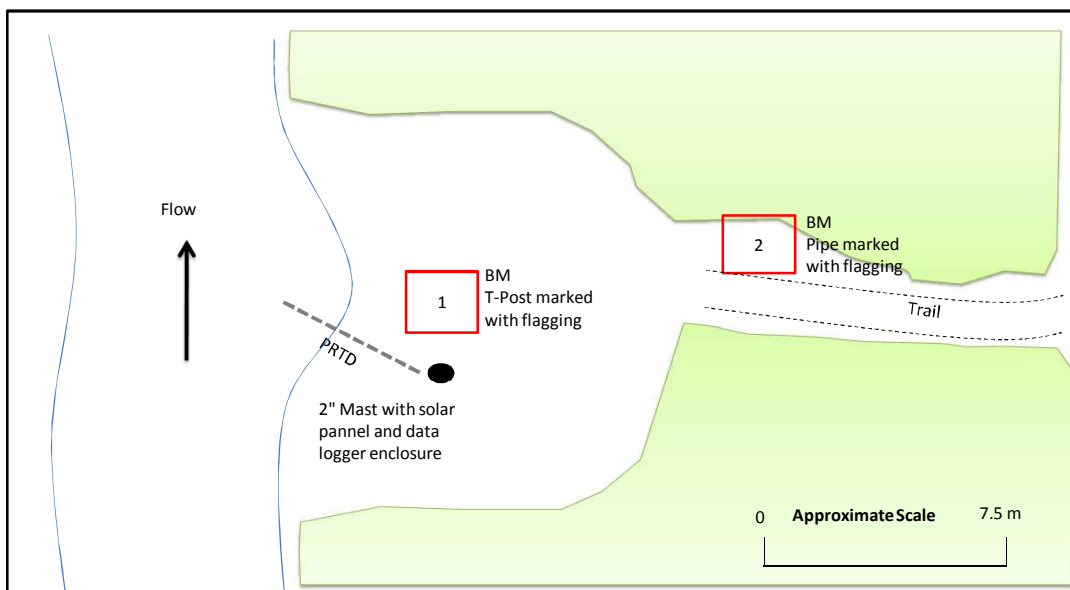
Map Grid Based on UTM NAD 27



Benchmarks:

BM: 1
Elevation: 282.676 m
Basis: Level survey from BM2
Location: 6 m east of data logger
Description: T-Post near data logger marked with orange flagging

BM: 2
Elevation: 282.159 m
Basis: survey date unknown
Location: 2 m past edge of willow to south of path
Description: pipe driven to 0.4 m of ground



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 283±0.5m

Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on Mills Creek, downstream of the Mills Creek fen and upstream of Isadore's Lake. The original plywood and timber pile V-notch weir was replaced with steel piles and sheet steel weir in October 2005.

Variable Measured: Water level, discharge, and water temperature

Period of Record: May 1997 to Present

Access: 2WD road access along Highway 63 (paved)

Drainage Area: 9 km²

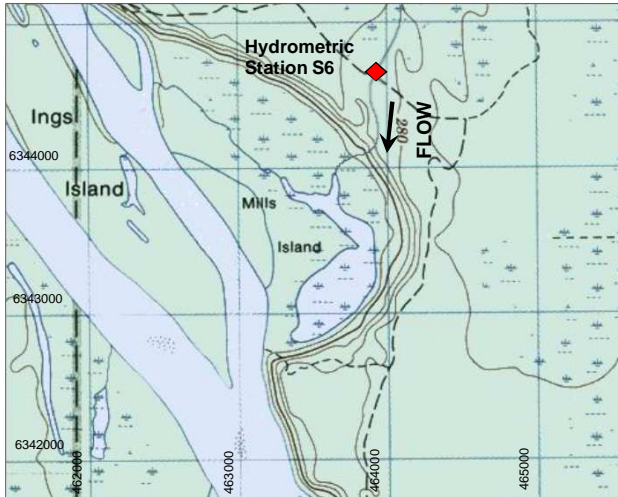
Coordinates: 463829 E, 6344743 N (UTM NAD 83)

Active: Year Round

Lat/Long: 57°14'44" N, 111°35'57" W

NTS Map: 74E04

LSD: NW-17-95-10-W4



Map Grid Based on UTM NAD 27



Benchmarks: BM1

Elevation: 273.600 m

Basis: survey date unknown

Location: 7 m north west of data logger

Description: Rebar in white PVC pipe just uphill (in gully) from the data logger

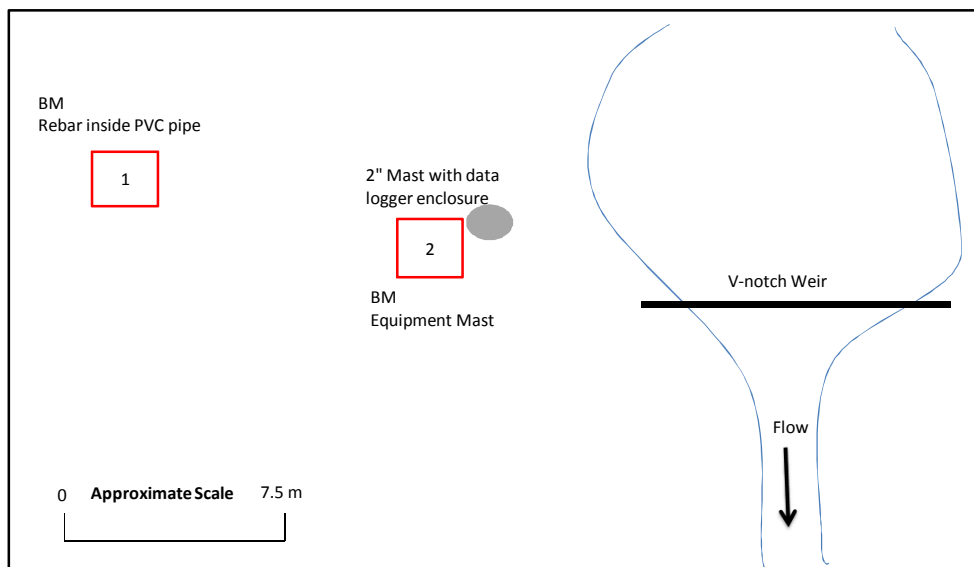
BM2

Elevation: 274.139 m

Basis: Level survey from BM1

Location: At the equipment mast itself

Description: top of equipment mast or steel pipe on which the logger box is mounted, beside the stilling well



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 273.5±0.5m

Revised 6 March, 2012

Location and Purpose:

Established to monitor winter discharge on the Muskeg River at the Environment Canada hydrometric station 07DA008. The Environment Canada hydrometric station has operated since 1975 but discharges are only published for the March-October period.

Variable Measured: Water level, discharge, and water temperature

Period of Record: October 1999 to Present

Access: 2WD access off of Canterra Road (gravel)

Drainage Area: 1457 km²

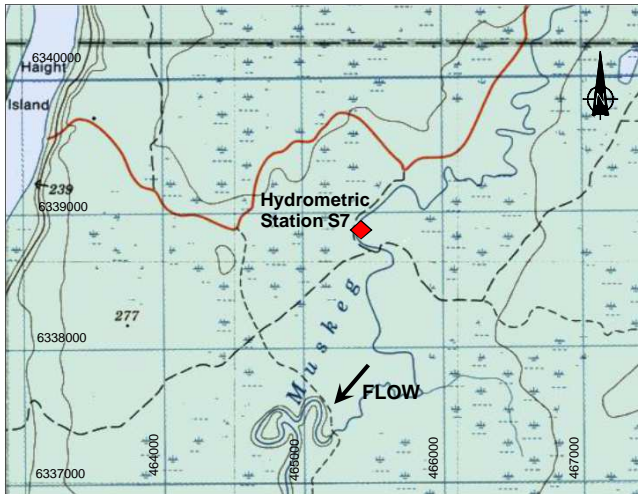
Coordinates: 465408 E, 6338944 N (UTM NAD 83)

Active: Year Round

Lat/Long: 57°11'32" N, 111°34'21" W

NTS Map: 74E04

LSD: SE-32-94-10-W4



Map Grid Based on UTM NAD 27



Benchmarks:

Elevation: 275.549 m

Basis: Level survey from BM2

Location: 25 m west of data logger

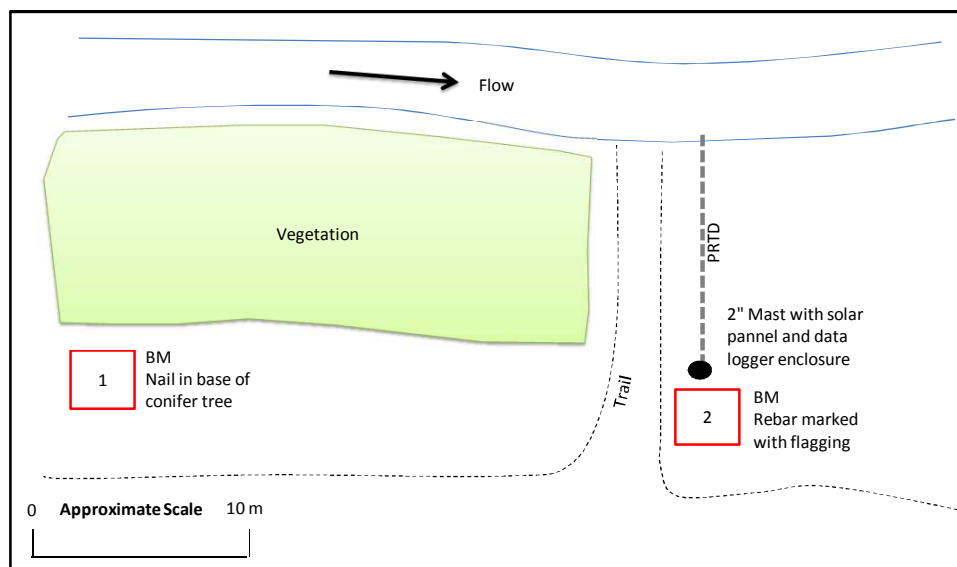
Description: Nail in tree ~ 3 m north of road and ~ 25 m west of data logger box

Elevation: 275.406 m

Basis: Assumed

Location: ~2 m SW of data logger box

Description: Rebar in black PVC with orange cap



Benchmark Notes: Approximate geodetic elevation of Benchmark 3 based on 2011 differential GPS program 275±0.5m

Location and Purpose:

Established to monitor discharge on the Kearl Lake Outlet channel to provide data for the Kearl Lake water balance and to assess the effects of development on the lake. The station was relocated approximately 50 m downstream in November 2005 to avoid the influence of beaver dams. The station was located just upstream of a road culvert crossing before the move and is currently of the crossing.

Variable Measured: Water level, discharge, and water temperature

Period of Record: May 2000 - Oct. 2002; April 2006 - Present

Access: 4WD road access

Drainage Area: 73.6 km²

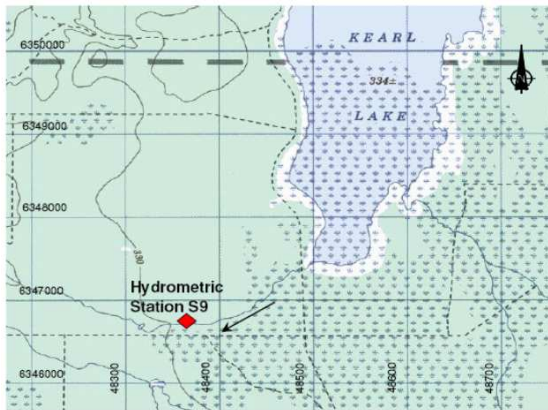
Coordinates: 483962 E, 6346990 N (UTM NAD 83)

Active: Year Round, data logger installed in open water season only

Lat/Long: 57°15'56.38" N, 111°15'57.27" W

NTS Map: 74E06

LSD: SE-29-95-8-W4



Map Grid Based on UTM NAD 27

Benchmarks:

BM : 1

Elevation: 329.796 m

Basis: Geodetic

Location: Birch tree 6 m North of data logger enclosure

Description: Nail in base of Birch tree

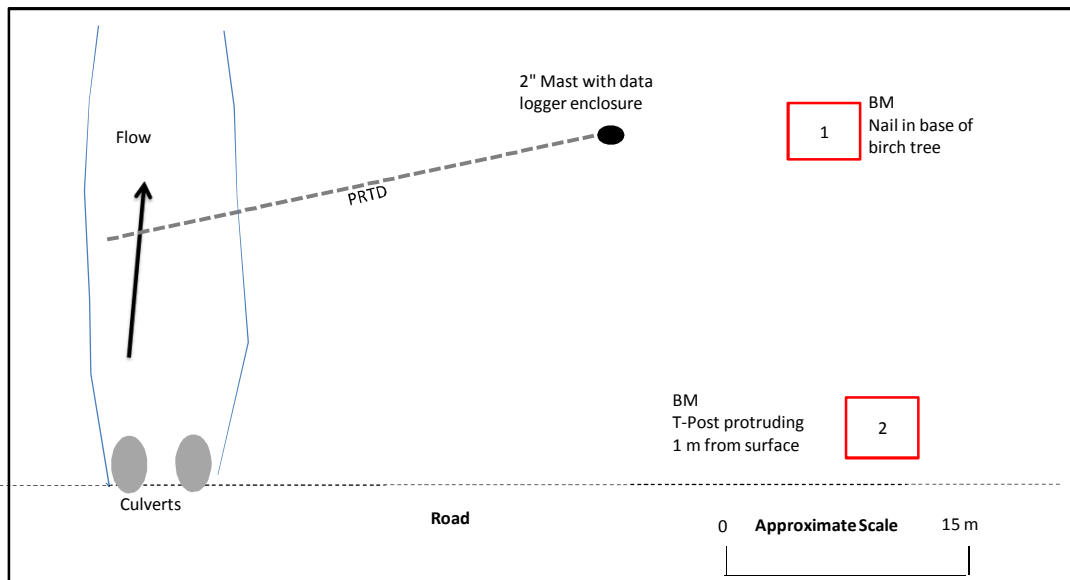
BM : 2

Elevation: 331.024 m

Basis: Level survey from BM1

Location: 6 m West of road towards data logger enclosure

Description: T-Post protruding 0.75 m from ground



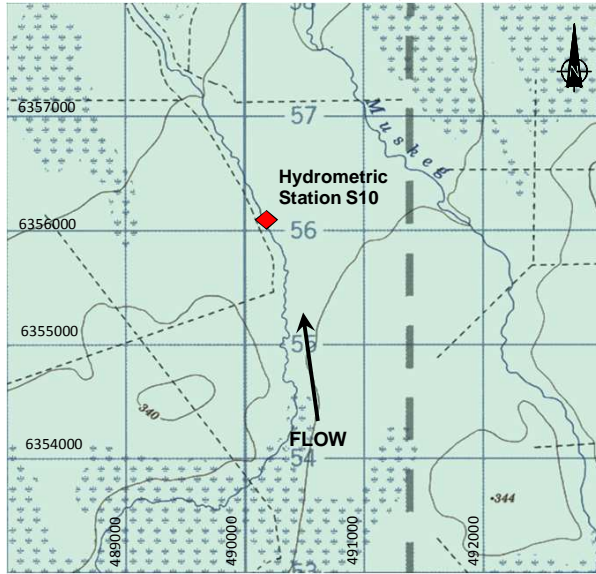
Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 331±0.5m

Location and Purpose:

Established to monitor discharge on the Wapasu Creek upstream of the Muskeg River. Extensive beaver activity since 2009 has flooded most of the area.

Variable Measured: Water level, discharge, and water temperature
Period of Record: March 1998 - Oct. 1999; May 2001 - Present
Access: 4WD road access on Canterra Rd.
Drainage Area: 90.7 km²
Coordinates: 490350 E, 6355500 N (UTM NAD 83)

Active: Year Round
Lat/Long: 57°20'35" N, 111°09'40" W
NTS Map: 74E06
LSD: NW-24-96-8-W4



Map Grid Based on UTM NAD 27

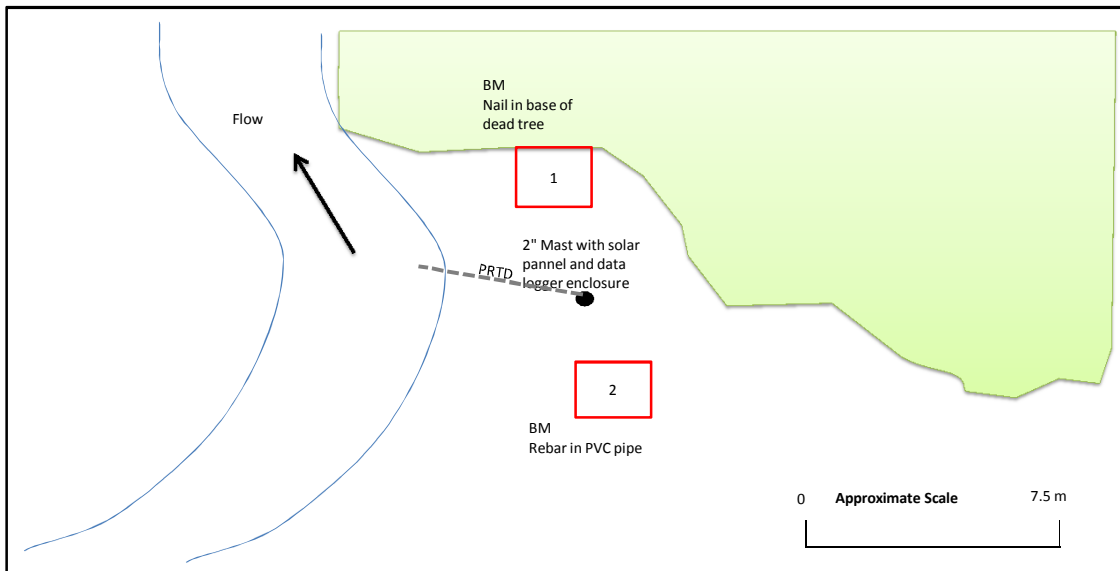
Benchmarks:

BM : 1

Elevation: 100.585 m
Basis: Assumed
Location: Large tree 6 m North of data logger enclosure
Description: Nail in base of tree

BM : 2

Elevation: 100.657 m
Basis: Assumed
Location: 4 m South of data logger enclosure
Description: Rebar in PVC Pipe



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 320±0.5m

Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on Poplar Creek upstream of the Athabasca River. The station is at the site of Environment Canada hydrometric station (07DA007) that operated from 1973 to 1986.

Variable Measured: Variable Measured: Water level, discharge, and water temperature

Period of Record: May 1997 to Present

Active: Year Round, data logger installed in open water season only

Access: 2WD access on Hwy 63 (paved)

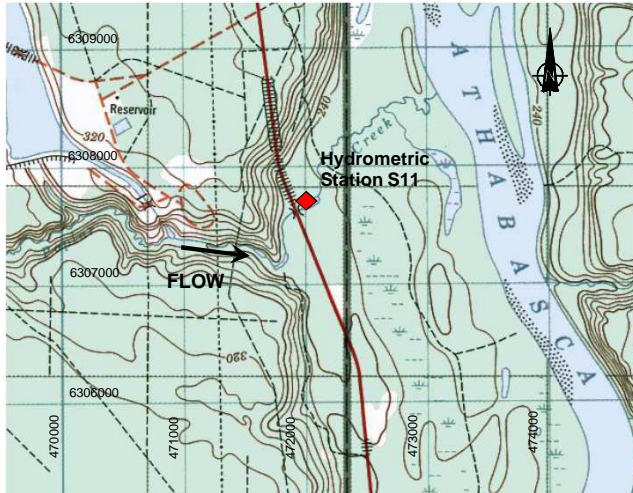
Lat/Long: 56°54'46" N, 111°27'44" W

Drainage Area: 151 km²

NTS Map: 74D14

Coordinates: 472000 E, 6307650 N (UTM NAD 83)

LSD: NE-24-91-19-W4



Map Grid Based UTM NAD 27

Benchmarks:

BM: 1

Elevation: 242.095 m

Basis: Level survey from BM2

Location: On river right, 15 m upstream from the logger

Description: ASCM marker, square pin next to orange stake

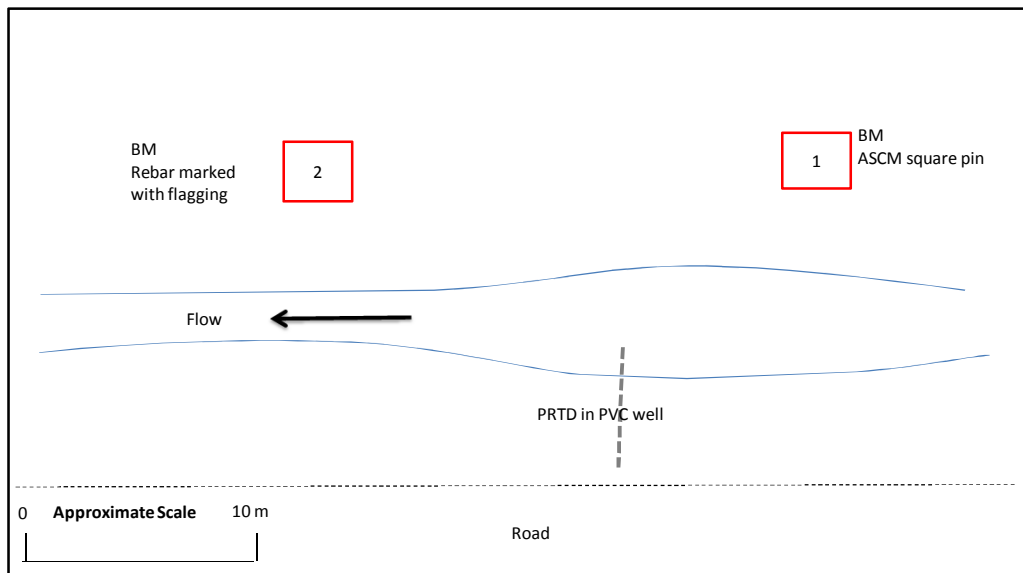
BM: 2

Elevation: 242.382 m

Basis: Geodetic

Location: On river right 25 m downstream of ASCM Monument

Description: Rebar protruding 0.3m from ground surface



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 242.5±0.5m

Location and Purpose:

Established in May 2000 to monitor discharge on Fort Creek upstream of the Athabasca River and was discontinued in 2002. The station was reactivated in 2006 to monitor streamflow downstream of the Fort Hills development. In August 2009 the station was moved 50 m downstream due to road construction.

Variable Measured: Water level, discharge, and water temperature

Period of Record: May 2000 - Oct. 2002; April 2006 - Present

Access: 2WD road access via Hwy 63 extension

Drainage Area: 32 km²

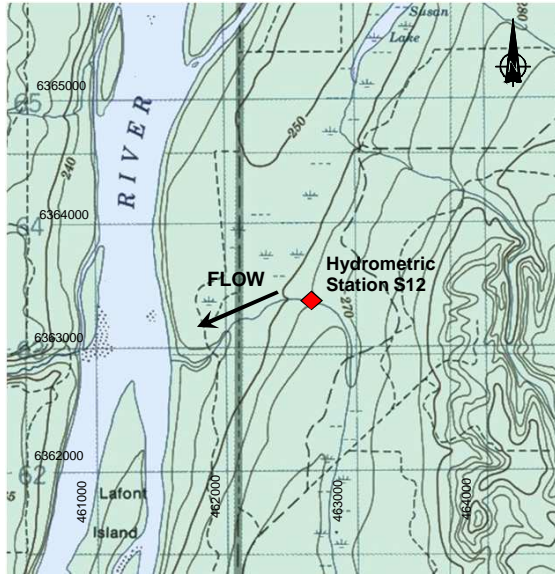
Coordinates: 462600 E, 6363400 N (UTM NAD 83)

Active: Open Water Season

Lat/Long: 57°24'48" N, 111°37'18" W

NTS Map: 74E05

LSD: SW-18-97-10-W4



Benchmarks:

BM : 1

Elevation: 98.699 m

Basis: Assumed

Location: 5 m upstream of data logger on left bank

Description: T-Post protruding 0.3 m from ground

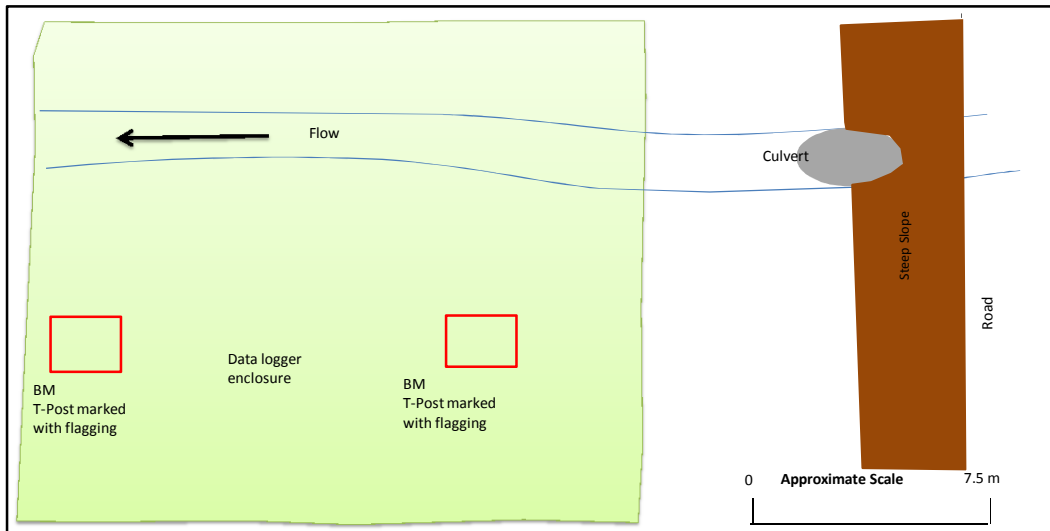
BM : 2

Elevation: 98.470 m

Basis: Level survey from BM1

Location: 5 m downstream of data logger on left bank

Description: T-Post protruding 0.3 m from ground



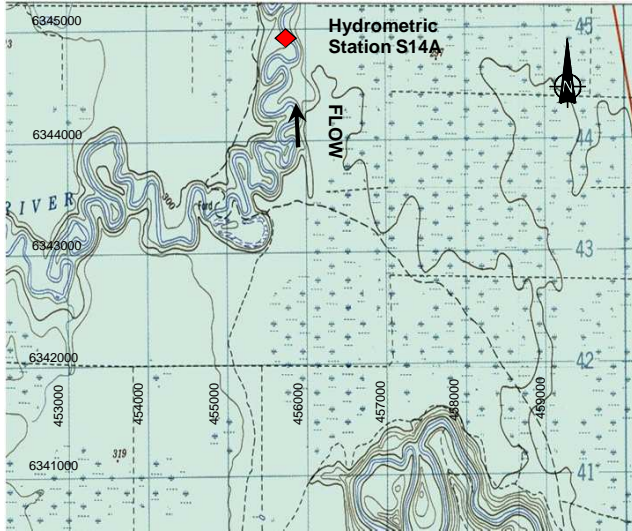
Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 252.5±0.5m

Revised 6 March, 2012

Location and Purpose

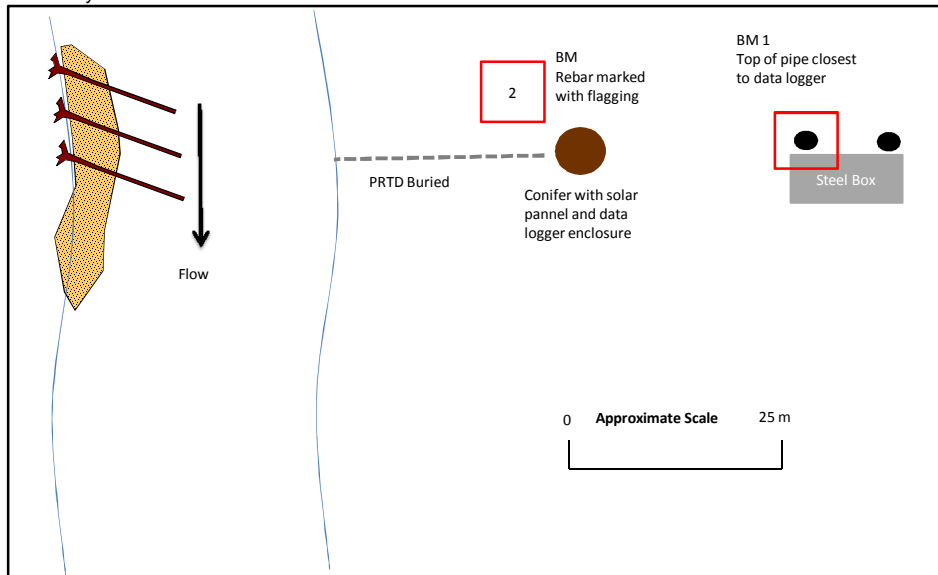
Established in October 2004 to monitor discharge on the Ells River. This station replaced station S14.

Variable Measured:	Water level, discharge, and water temperature	Active:	Year Round
Period of Record:	October 2004 to present	Lat/Long:	57°14'44" N, 111°43'56" W
Access:	2WD Road Access	NTS Map:	74E04
Drainage Area:	2450 km ²	ATS:	NW-16-95-11-W4
Coordinates:	455748 E, 6344947 N (UTM NAD 83)		



Benchmarks

BM:	1	BM:	2
Elevation:	101.930 m	Elevation:	100.12
Basis:	Assumed	Basis:	Level survey from BM1
Location:	8 m north east of data logger box	Location:	3 m to the left of data logger
Description:	Top of pipe closer to left bank that supports the bubbler system enclosure.	Description:	Rebar in ground marked with orange flagging tape



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 277.5±0.5m

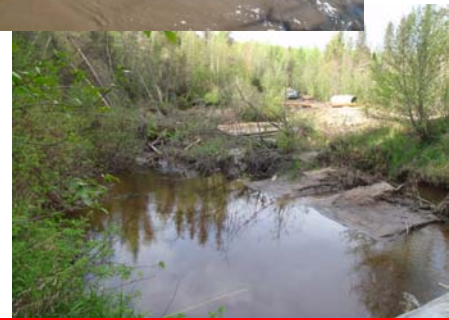
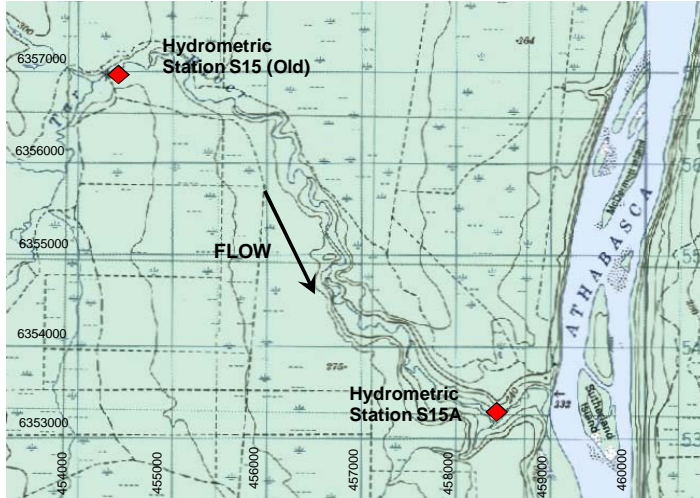
Revised 6 March, 2012

Location and Purpose

Established on May 1, 2007 to replace station S15. The purpose of the station is to monitor the discharge on the Tar River below development.

Variable Measured: Water Level, Discharge and Water temperature
Period of Record: May 1st 2007 to present
Access: Truck
Drainage Area: 333 km²
Coordinates: 458395 E, 6353391 N (UTM NAD 83)

Active: Year Round
Lat/Long: 57°19'17.57" N, 111°41'27.08" W
NTS Map: 74E05
ATS: 16-10-96-11-W4

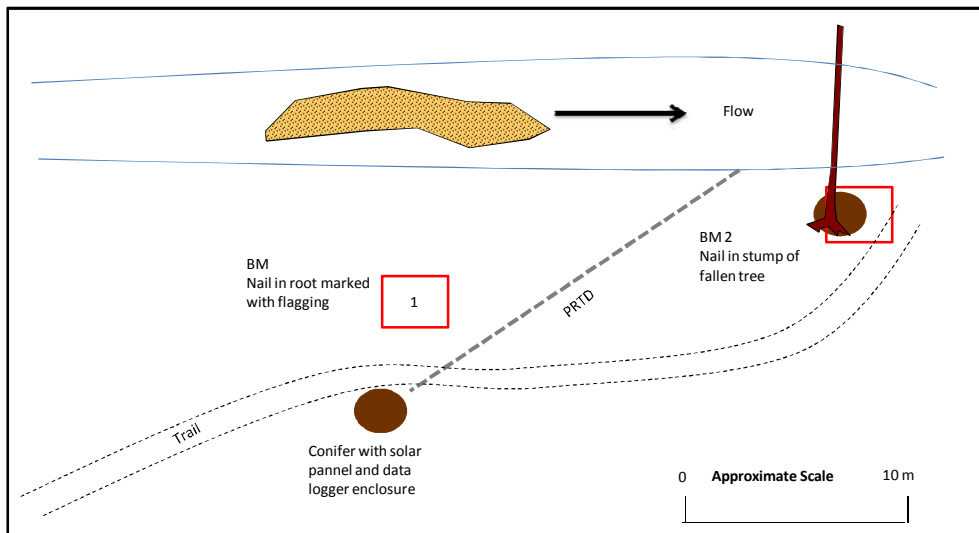


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 100.000 m (assumed)
Basis: Assumed
Location: At base of large log spanning river on RB side
Description: Nail in stump with purple flagging.

BM: 2
Elevation: 100.356
Basis: Level survey from BM 1
Location: 1 metre DS from logger box on tree root
Description: Nail in tree root with purple flagging.



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 233±0.5m

Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on Calumet River near the Mouth. Located approximately 2 km upstream of abandoned Environment Canada hydrometric station (07DA014) from 1975-1977. Station was operated as S16 from 2001 to 2004, CR-1 2005-2009 by CNRL Horizon, and as S16A 2010 - Present.

Variable Measured: Discharge

Period of Record: May 2001 to Present

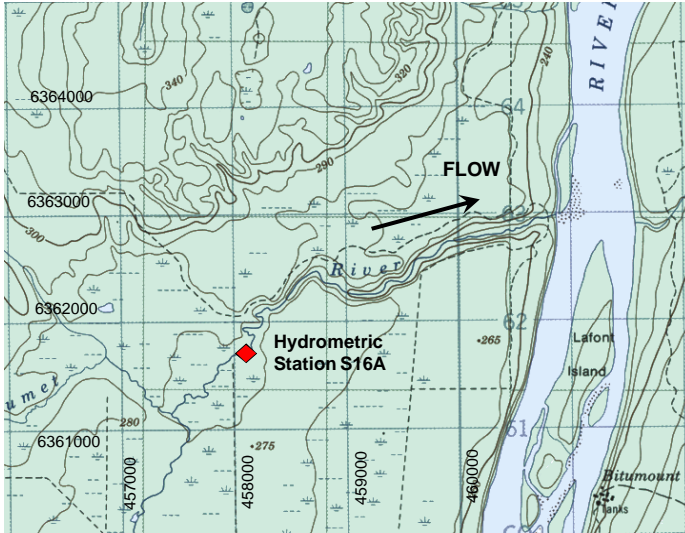
Access: Helicopter

Drainage Area: 174 km²

Coordinates: 458147 E, 6361695 N (UTM NAD 83)

Lat/Long: 57°23'46" N, 111°41'47" W

NTS Map: 74E / 5

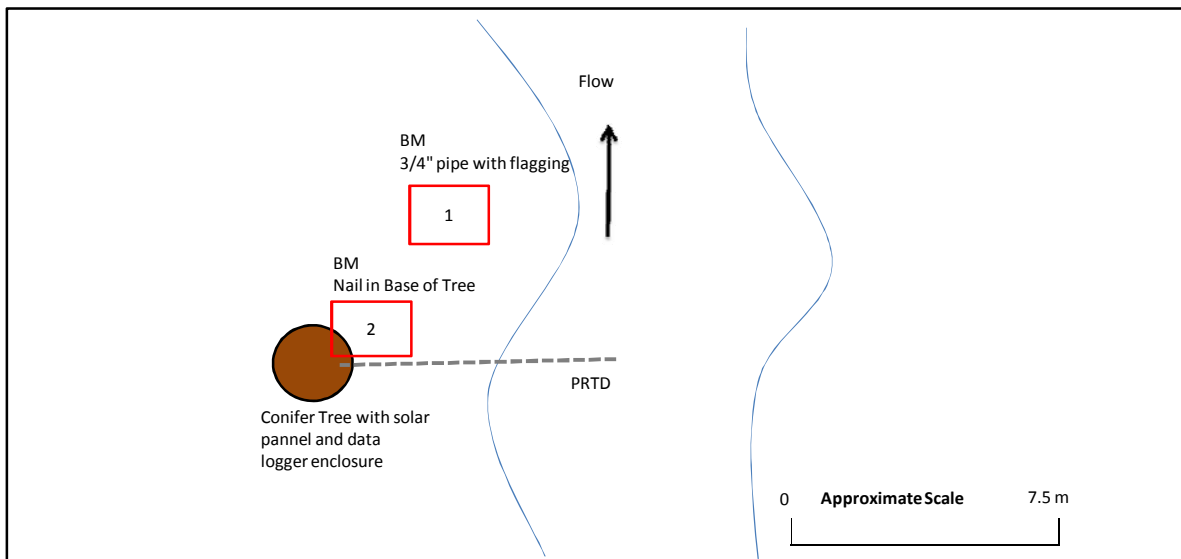


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 99.525 m
Basis: Assumed
Location: 5 m downstream of tree with logger
Description: 3/4" pipe protruding 0.4 m from ground with flagging

BM: 2
Elevation: 99.706 m
Basis: Level survey from BM1
Location: Nail in base of Tree with Logger
Description: Nail with flagging in base of tree



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 263.5±0.5m

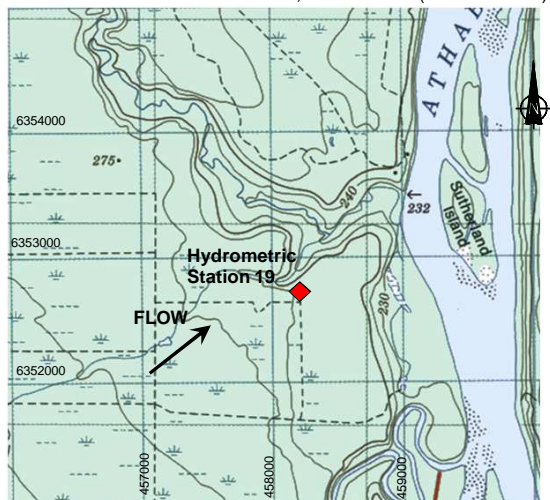
Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge and rainfall data adjacent to CNRL mine

Variable Measured: Water level, discharge, and rainfall
Period of Record: June 2002 to Present
Access: Truck access via CNRL Horizon Mine
Drainage Area: 11.5 km²
Coordinates: 457315 E, 6352863 N (UTM NAD 83)

Active: Open Water Period
Lat/Long: N57 18 59.5 W111 42 30.5
NTS Map: 74E05
LSD: SE-4-97-12-14 SE/C 1114.2 6



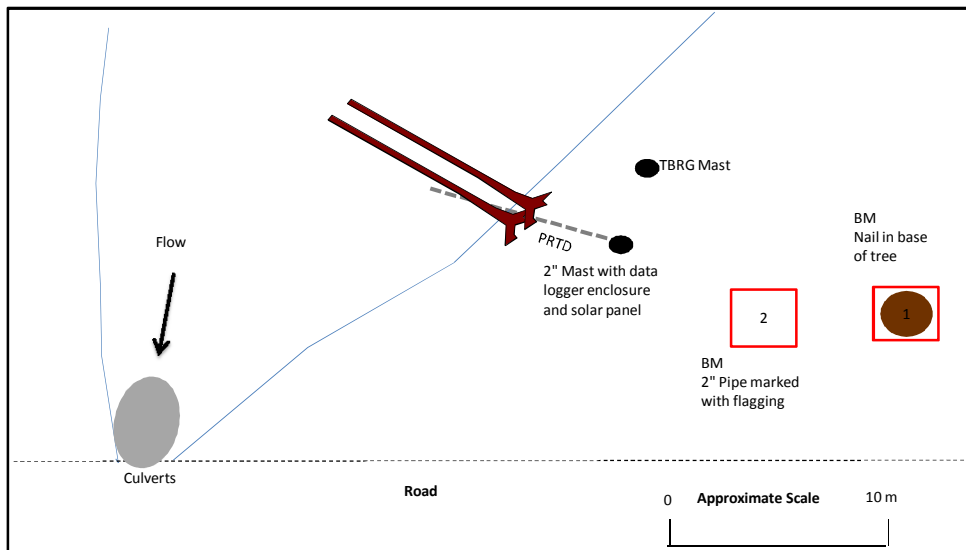
Map Grid Based on UTM NAD 27



Benchmarks:

BM: 1
Elevation: 101.431 m
Basis: Assumed
Location: 6 m West of road
Description: Nail in the base of a tree marked with pink flagging

BM: 2
Elevation: 101.355 m
Basis: Assumed
Location: 5 m East of BM 1
Description: 2 inch pipe protruding 0.3 m from ground



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 273.5±0.5m

Revised 6 March, 2012

Location and Purpose

Established to monitor discharge on the upper reach of the Muskeg River

Variable Measured: Water level, discharge

Period of Record: May 2001 to present

Access: Truck access on Canterra Rd. in Kearl Project

Drainage Area: 157 km²

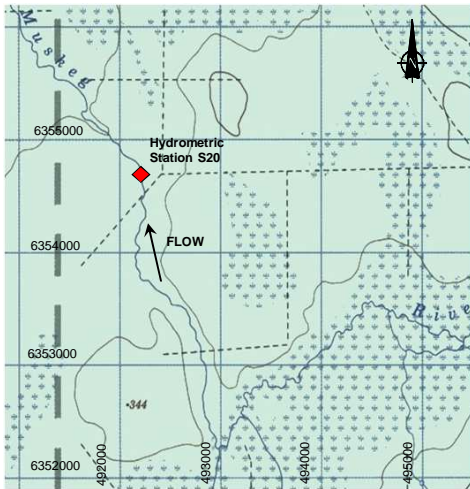
Coordinates: 49178 E, 6354787 N (UTM NAD 83)

Active: Open Water Period

Lat/Long: 57°20'09" N, 111°07'48" W

NTS Map: 74E06

ATS: SE-19-96-7-W4

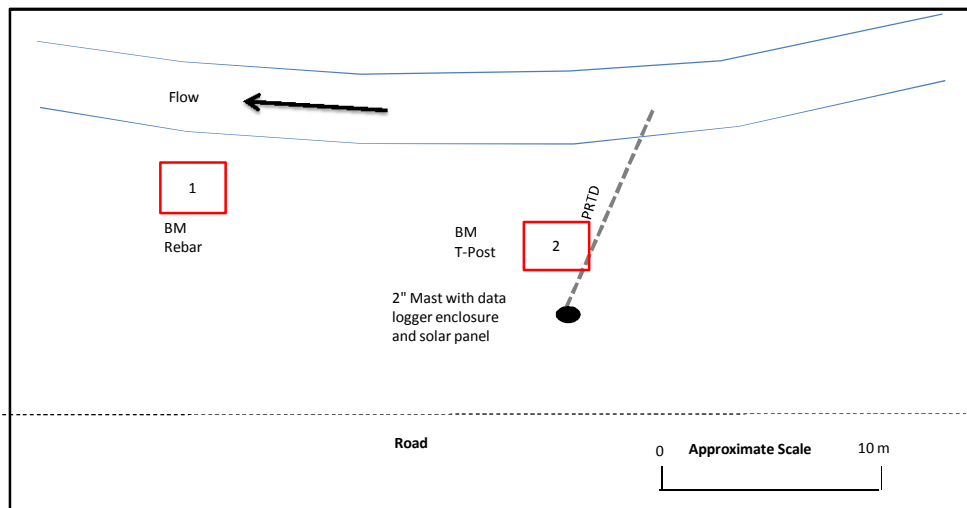


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 327.821 m
Basis: Level survey from BM2
Location: 15 m down river of station
Description: Rebar protruding 0.5 m from ground

BM: 2
Elevation: 328.976 m
Basis: Geodetic Survey
Location: 2 m downslope of data logger
Description: T-post



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 329±0.5m

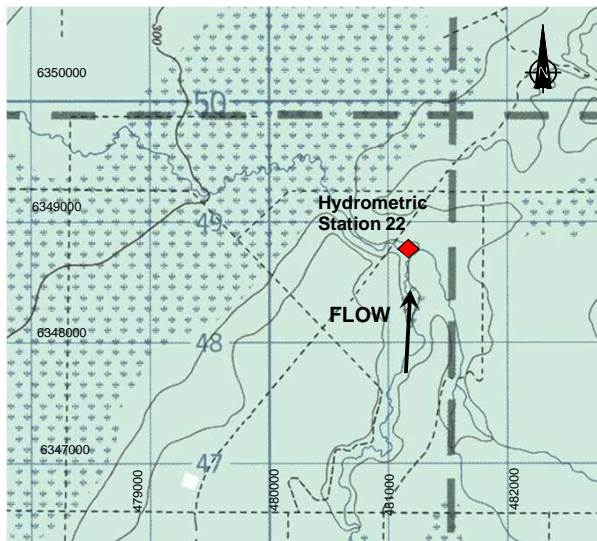
Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on Muskeg Creek upstream of the Muskeg River.

Variables Measured: Water Level and Discharge
Period of Record: May 2001 to Present
Access: 2WD road access on Canterra Road
Drainage Area: 369 km²
Coordinates: 481036 E, 6348856 N (UTM NAD 83)

Active: Open Water Period
Lat/Long: 57°17'3.5" N, 111°18'56.5" W
NTS Map: 74E06
LSD: SE-36-95-9-W4



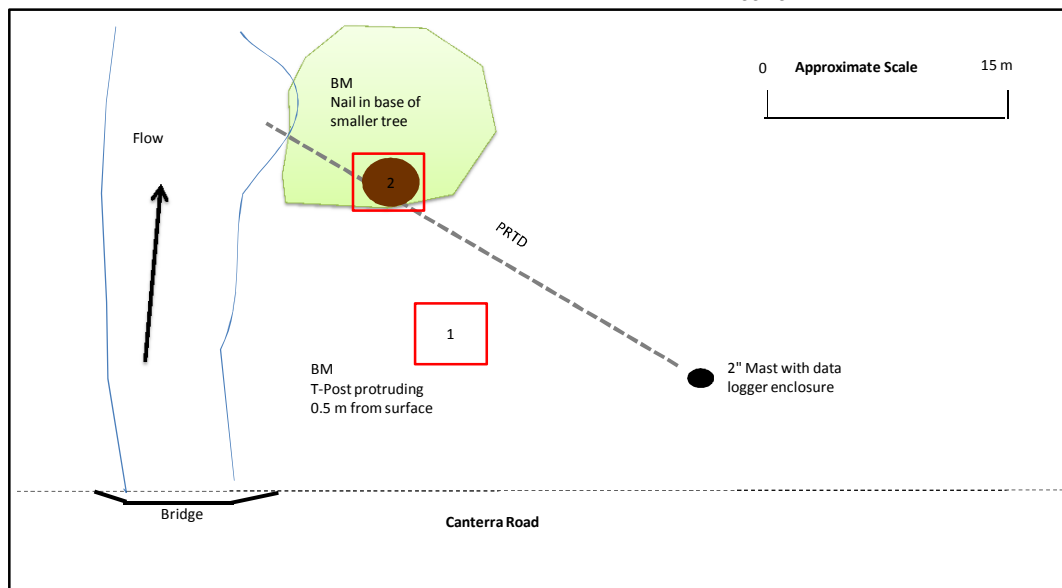
Map Grid Based on UTM NAD 27



Benchmarks:

BM 1:
Elevation: 306.476 m
Basis: unknown survey date: (shown on 2002 fact sheet)
Location: 1.5 m SW of data logger
Description: Metal T-bar on right bank near equipment mast

BM 2:
Elevation: 305.214 m
Basis: Level survey from BM 1
Location: ~2 m NW of the datalogger box
Description: Nail in tree, on right bank, marked with orange flagging.



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 305±0.5m

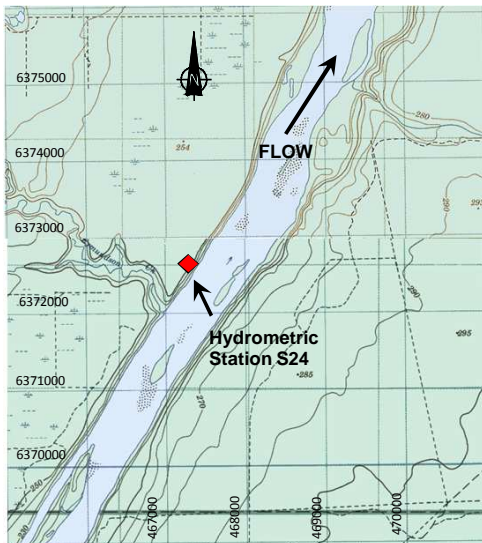
Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on the Athabasca River downstream of Eymundson Creek.

Variable Measured: Water level, discharge, and water temperature
Period of Record: May 2001 to Present
Access: Boat (summer) or snowmobile (winter)
Drainage Area: 146,000 km²
Station: 466313 E, 6372760 N (UTM NAD 83)
Manual Discharge: 467570 E, 6375010 N (UTM NAD 83)

Active: Year Round
Lat/Long: 57°29'46" N, 111°33'43" W
NTS Map: 74E05
LSD: NE-9-98-10-W4



Map Grid Based on UTM NAD 27

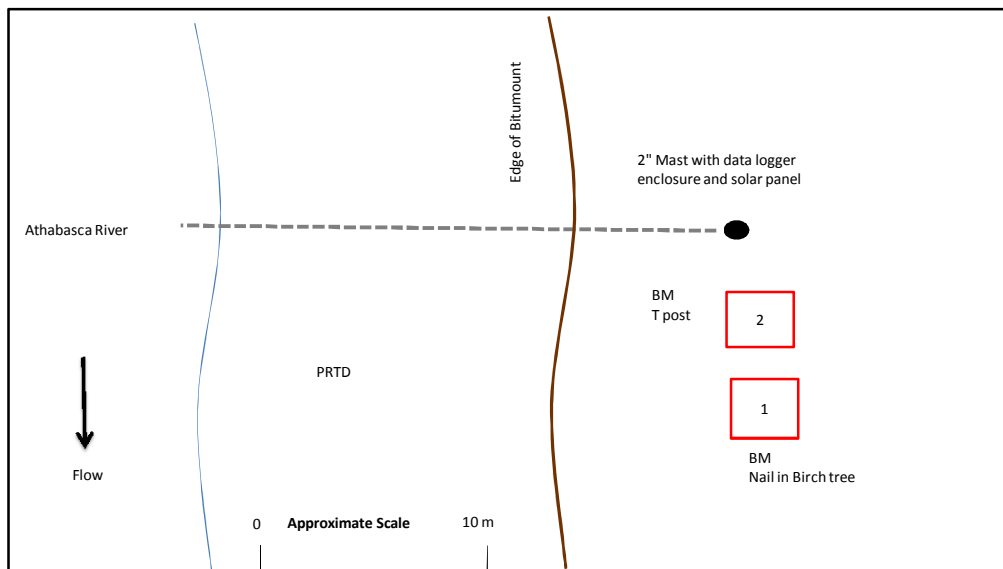
Benchmarks:

BM: 1

Elevation: 231.347 m
Basis: Geodetic
Location: 2 m North of data logger box
Description: T-bar, rusty, about 1 m tall

BM: 2

Elevation: 231.081
Basis: Level survey from BM1
Location: 4 m North of the datalogger box
Description: Nail in birch tree at base of tree, tree and nail marked with yellow flags.



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 229.5±0.5m

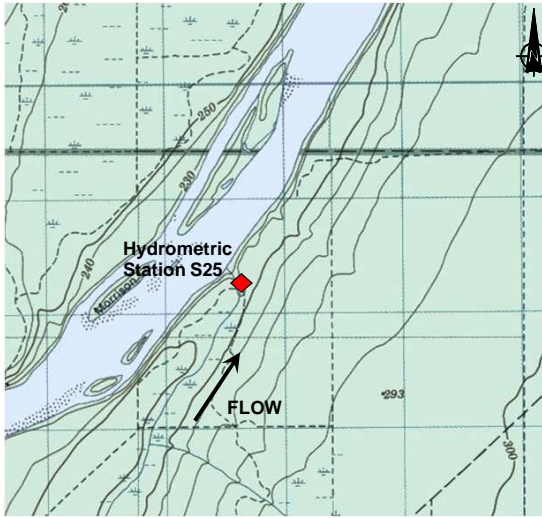
Revised 26 March, 2012

Location and Purpose:

Established in May 2002 to monitor discharge on Susan Lake Outlet upstream of the Athabasca River. The station was discontinued after the 2002 season, and was reactivated in May 2006 to monitor flows downstream of the Fort Hills development.

Variable Measured: Water level, discharge
Period of Record: Aug. - Oct. 2002; May 2006 - present
Access: Boat via the Athabasca River
Drainage Area: 13.6 km² (including Susan Lake)
Coordinates: 464491 E, 6368503 N (UTM NAD 83)

Active: Open Water Season
Lat/Long: 57°27'28" N, 111°35'30" W
NTS Map: 74E05
LSD: SW-32-97-10-W4

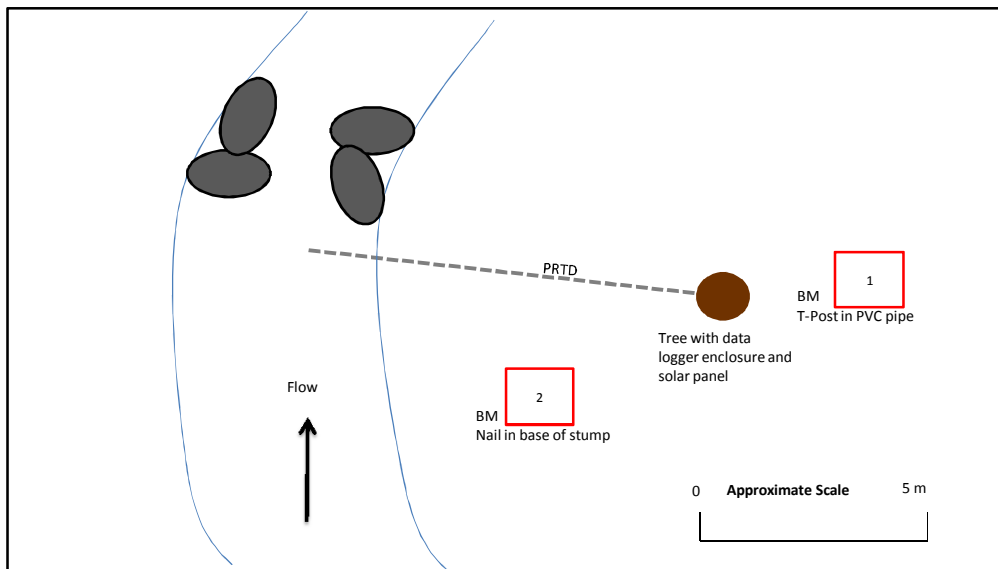


Map Based on UTM NAD 27

Benchmarks:

BM: 1
Elevation: 100.000 m
Basis: Assumed
Location: 2 m north from the logger
Description: Tpost in PVC

BM: 2
Elevation: 99.977 m
Basis: Level Survey from BM 1
Location: Spike in stump west of logger
Description: Spike in tree with orange flagging



Benchmark Notes: Not geodetic elevation is available for this station

Revised 26 March, 2012

Location and Purpose:

Established to monitor winter discharge on the Mackay River at the Water Survey of Canada gauging station 07DB001. The WSC station has operated since 1972 but discharges are currently only published for the March-October period.

Variable Measured: Discharge

Period of Record: November 2001 to Present

Access: Truck or Helicopter

Drainage Area: 5569.3 km²

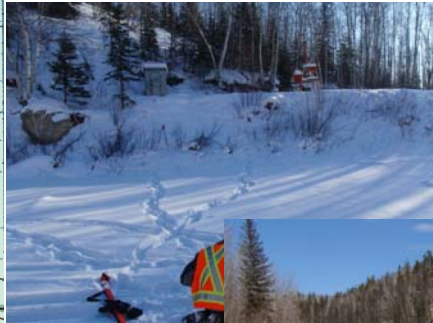
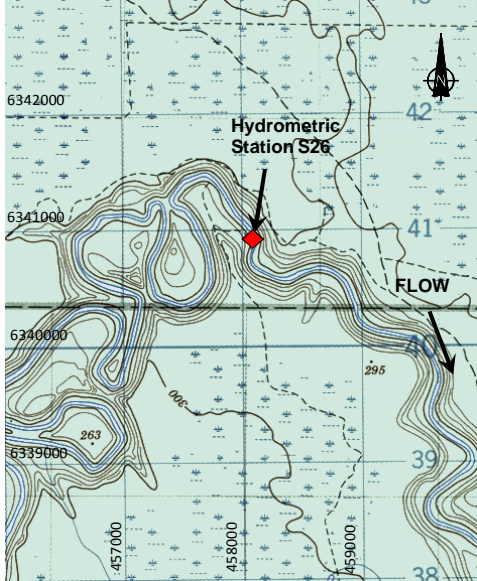
Coordinates: 458031 E, 6341078 N (UTM NAD 83)

Active: WSC March 1 - October 31, RAMP
November 1 - February 28/29

Lat/Long: 57°12'39" N, 111°41'41" W

NTS Map: 74E04

LSD: SE-3-95-11-W4



Map Grid Based on UTM NAD 27

Benchmarks:

Elevation: 100.000 m (assumed)

Basis:

Location: 5 m upstream from WSC shack

Description: Rock with yellow paint in circular shape. Branch/bush above flagged with orange flagging.

Elevation:

Basis:

Location:

Description:



Benchmark Notes: No geodetic elevation is available for this station

Revised 26 March, 2012

Location and Purpose:

Established to monitor winter discharge on the Firebag River just upstream of Environment Canada hydrometric station 07DC001. The Environment Canada hydrometric station has operated since 1971 but discharges are currently only published for the March-October period.

Variable Measured: Discharge

Period of Record: November 2001 to Present

Access: Helicopter or Winter Road

Drainage Area: 5687.6 km²

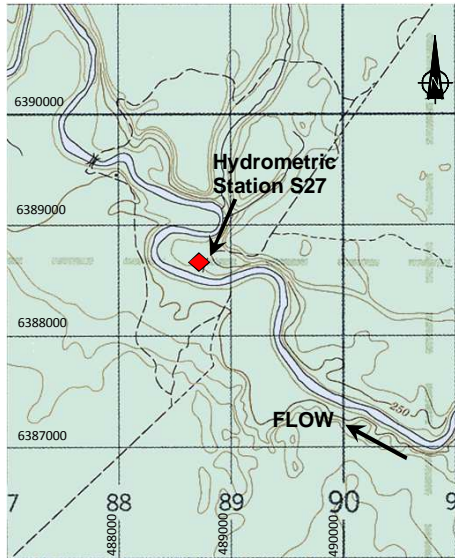
Coordinates: 488685 E, 6388706 N (UTM NAD 83)

Active: WSC March 1 - October 31, RAMP
November 1 - February 28/29

Lat/Long: 57°38'26" N, 111°11'22" W

NTS Map: 74E / 11

LSD: SE-35-99-8-W4



Map Grid Based on UTM NAD 27



Benchmarks:

Elevation: 100.000 m (assumed)

Basis:

Location: 1 m West of logger box

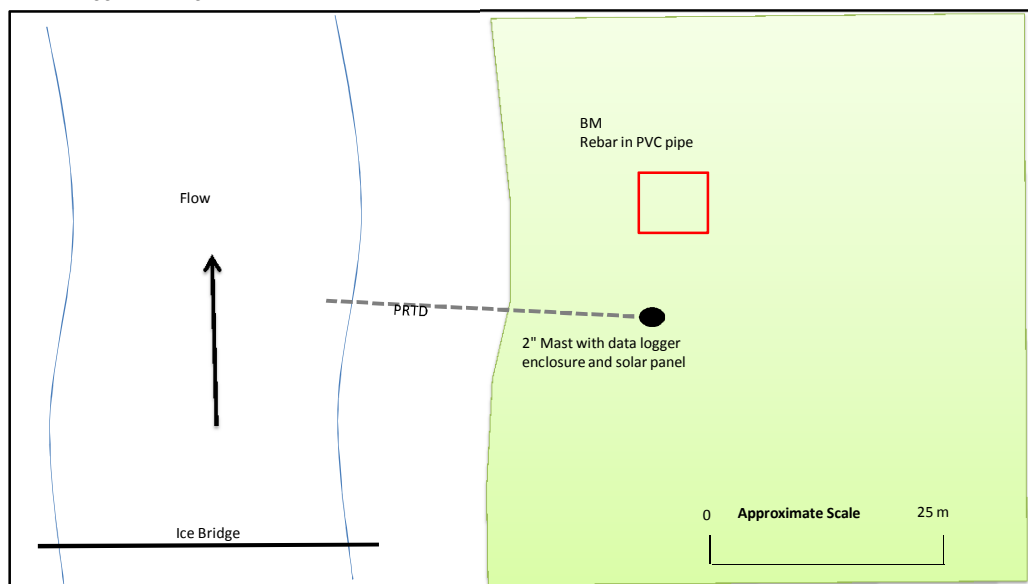
Description: Rebar in PVC Located on right bank immediately west of the logger housing.

Elevation:

Basis:

Location:

Description:



Benchmark Notes: No geodetic elevation is available for this station

Revised 26 March, 2012

Location and Purpose:

Established to monitor discharge on Christina River during the winter period to supllment the WSC data record from March - October.

Variable Measured: Discharge

Period of Record: April 2004 to Present

Access: Truck

Drainage Area: 4860km²

Coordinates: 508183 E, 6187926 N (UTM NAD 83)

Active: WSC March 1 - October 31, RAMP
November 1 - February 28/29

Lat/Long: 110°52' 9.64" W 55°50' 12.55" N

NTS Map: 73M10

ATS: 16-9-79-6-W4



Map Grid Based on UTM NAD 27



BM 87-1

Elevation: 6.963 m

Basis: Assumed

Location: On bridge pier, left bank and upstream side

Description: Lag bolt marked with orange paint "BM"

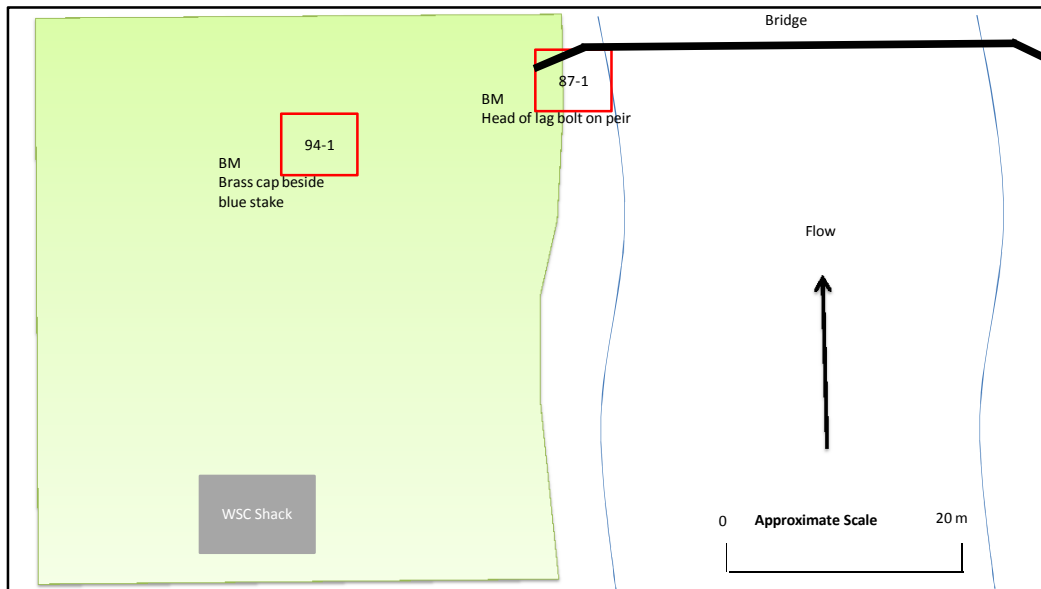
BM 94-1

Elevation: 10.091 m

Basis: Level survey from BM1

Location: 20 m north of shelter

Description: Brass cap beside blue stake



Benchmark Notes: No geodetic elevation available for this station

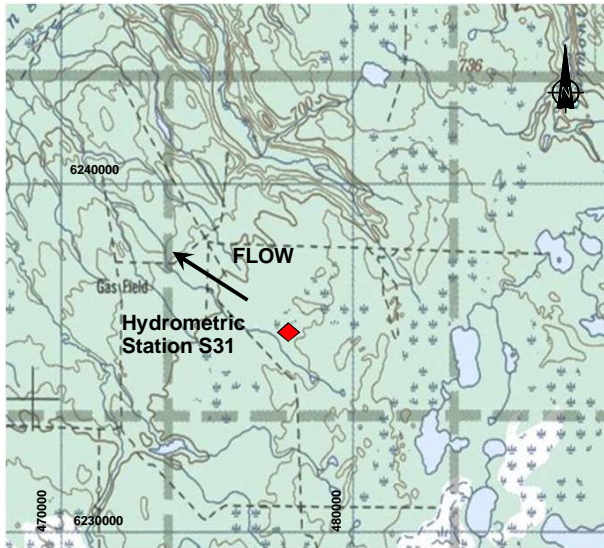
Revised 6 March, 2012

Location and Purpose:

Established to monitor discharge on Hangingsone Creek.

Variable Measured: Water level, discharge, and rainfall
Period of Record: April 2004 to Present
Access: Truck
Drainage Area: 160km²
Coordinates: 476969 E, 6236095 N (UTM NAD 83)

Active: Open Water Period
Lat/Long: 111°22' 18.72" W, 56°16' 8.84" N
NTS Map: 74D06
ATS: 12-9-84-9-W4



Map Grid Based on UTM NAD 27

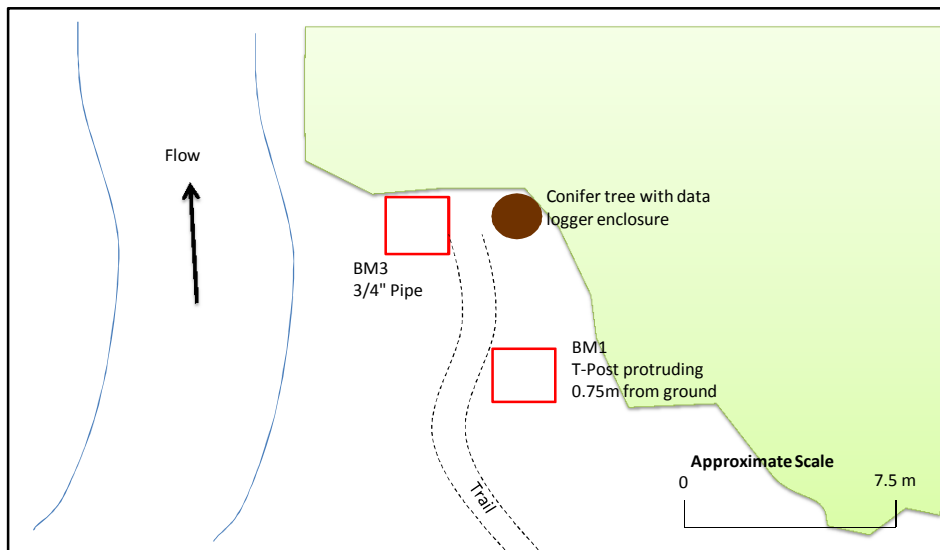


BM1

Elevation: 100.128 m
Basis: Assumed
Location: 7 m upstream of data logger enclosure
Description: T-Post on Right Bank

BM3

Elevation: 99.71
Basis: Level survey from BM1
Location: 1.5 m West of data logger enclosure
Description: 3/4" Pipe in ground



Benchmark Notes: Approximate geodetic elevation of Benchmark 3 based on 2011 differential GPS program 650.5±0.5m

Location and Purpose:

Established to monitor discharge on Surmont Creek..

Variable Measured: Water level, discharge, and water temperature
Period of Record: April 2004 to Present
Access: Truck via Hwy 881
Drainage Area: 158 km²
Coordinates: 490252 E, 6254511 N (UTM NAD 83)

Active: Open Water Period
Lat/Long: 111°9' 29.08" W, 56°26' 6.14" N
NTS Map: 74D06
LSD: 14-2-86-8-W4



Map Grid Based on UTM NAD 27

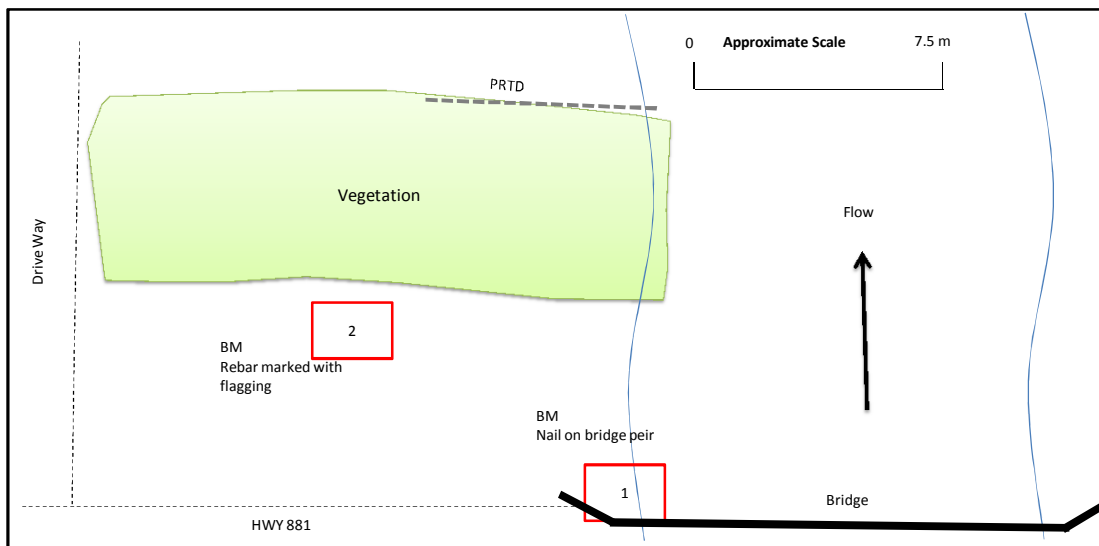


BM1

Elevation: 98.040 m
Basis: Level survey from BM2
Location: 15 m upstream of logger box
Description: Nail in wooden pile supporting abutment on downstream left side of bridge

BM2

Elevation: 98.981m
Basis: Assumed
Location: 3 m upstream of logger box
Description: Iron rod roughly 1.5 feet out of the ground on LB.



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 480.5±0.5m

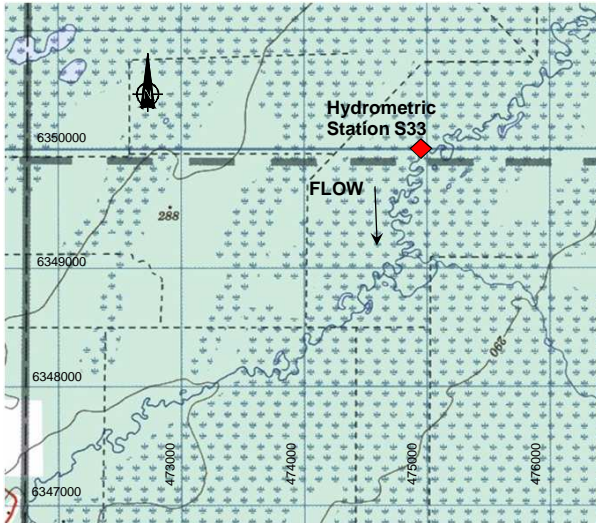
Revised 6 March, 2012

Location and Purpose:

Established in April 2003 to monitor discharge on the Muskeg River at the Aurora - Albian lease boundary in compliance with monitoring requirements. LOC # 040365

Variable Measured: Water level, discharge, and water temperature
Period of Record: April 2003 to Present
Access: 2WD road via the Syncrude Aurora North mine
Drainage Area: 728 km²
Coordinates: 474876 E, 6350204 N (UTM NAD 83)

Active: Year Round
Lat/Long: 57°17'39" N, 111°25'1" W
NTS Map: 74E06
LSD: SE-5-96-9-W4



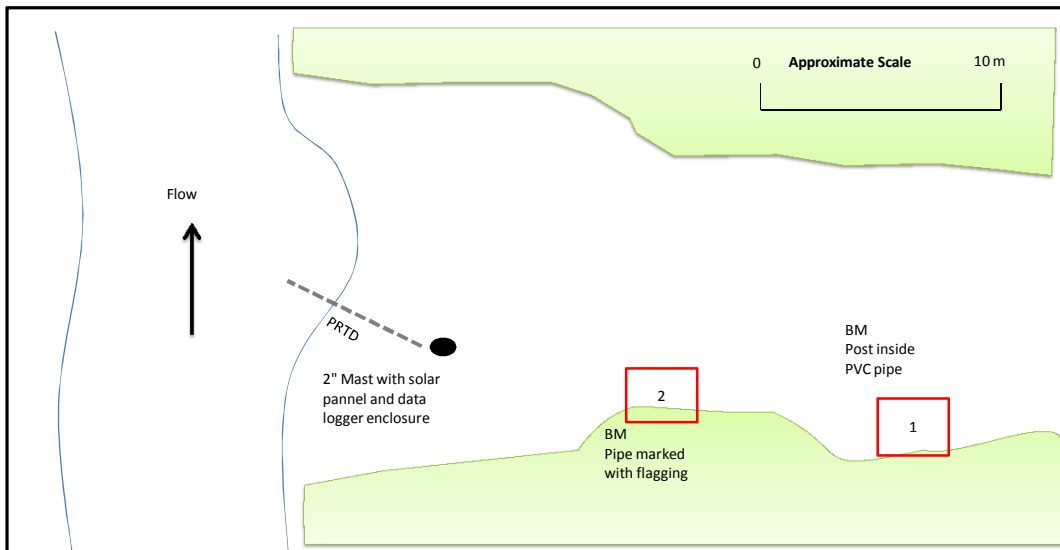
Map Grid Based on UTM NAD 27



Benchmarks:

Elevation: 281.836 m
Basis: Level survey from BM2
Location: On the right bank in the upstream brush
Description: Rebar sticking up approximately 0.3 m from ground with PVC cover

Elevation: 281.550 m
Basis: Geodetic
Location: Half way between BM1 and data logger mast
Description: Pipe sticking up approximately 0.3 m from ground marked with flagging



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 282±0.5m

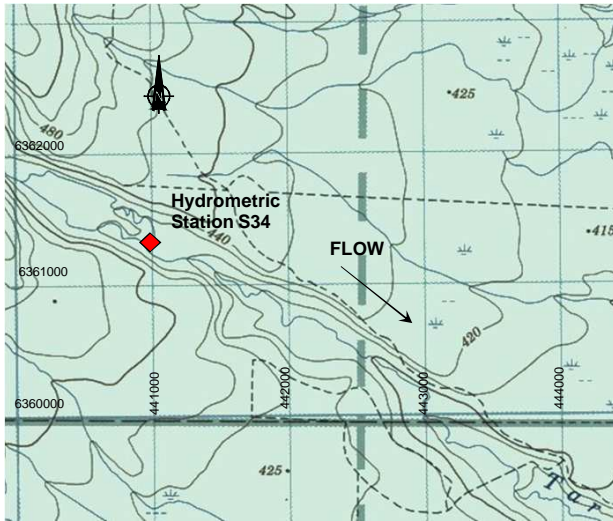
Revised 7 March, 2012

Location and Purpose:

Established in April 2005 to monitor discharge on the Tar River above the CNRL Compensation Lake.

Variable Measured: Water level, discharge, and water temperature
Period of Record: April 2005 to Present
Access: Helicopter
Drainage Area: 134 km²
Coordinates: 440712 E, 6361615 N (UTM NAD 83)

Active: Year Round
Lat/Long: 57°23'38.84" N, 111°59'10.17" W
NTS Map: 74E05
LSD: NW-2-97-13-W4



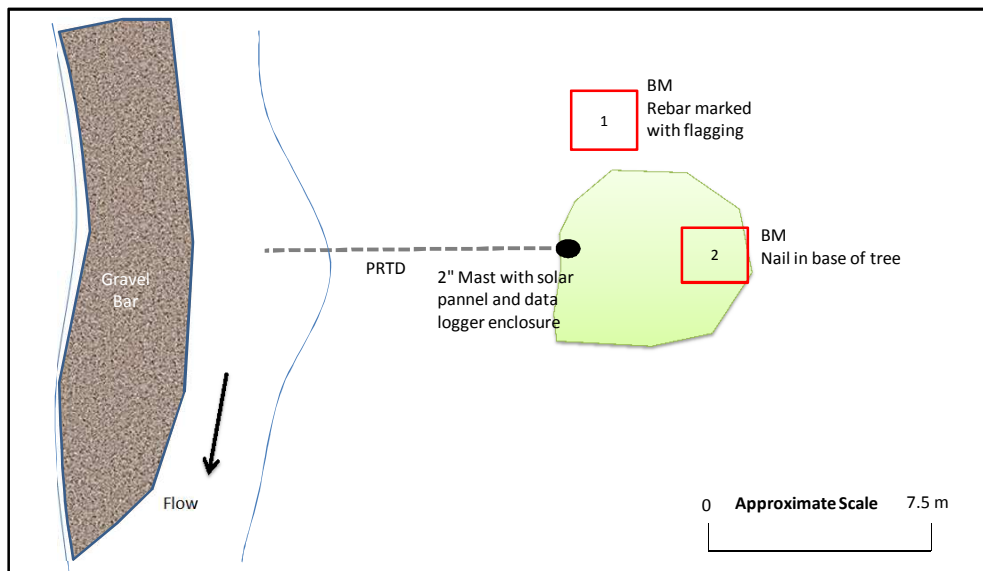
Map Grid Based on UTM NAD 27



Benchmarks:

BM: 1
Elevation: 98.630 m
Basis: Assumed
Location: 2 m north of data logger
Description: Rebar on Left Bank, about 0.3 m above the ground

BM: 2
Elevation: 98.415 m
Basis: Level survey from BM1
Location: Bottom of tree below the logger box, facing north
Description: Nail in base of logger tree



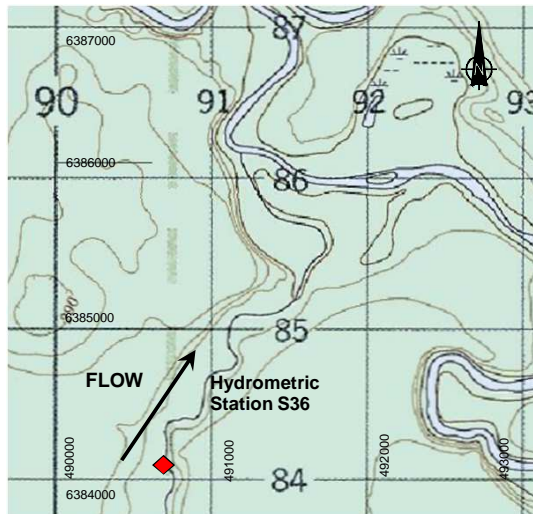
Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 421.5±0.5m

Location and Purpose:

Established in May 2008 to assist in monitoring runoff values for the entire catchment surrounding McClelland Lake. This is an open water station.

Variables Measured: Water level, discharge, and water temperature
Period of Record: May 2008 - Present
Access: Helicopter
Drainage Area: 330 km²
Coordinates: 490626 E, 6384064 N (UTM NAD 83)

Active: Open Water Period
Lat/Long: 111°09' 24.62" W , 57°35' 55.95" N
LSD: SE-13-99-8-W4

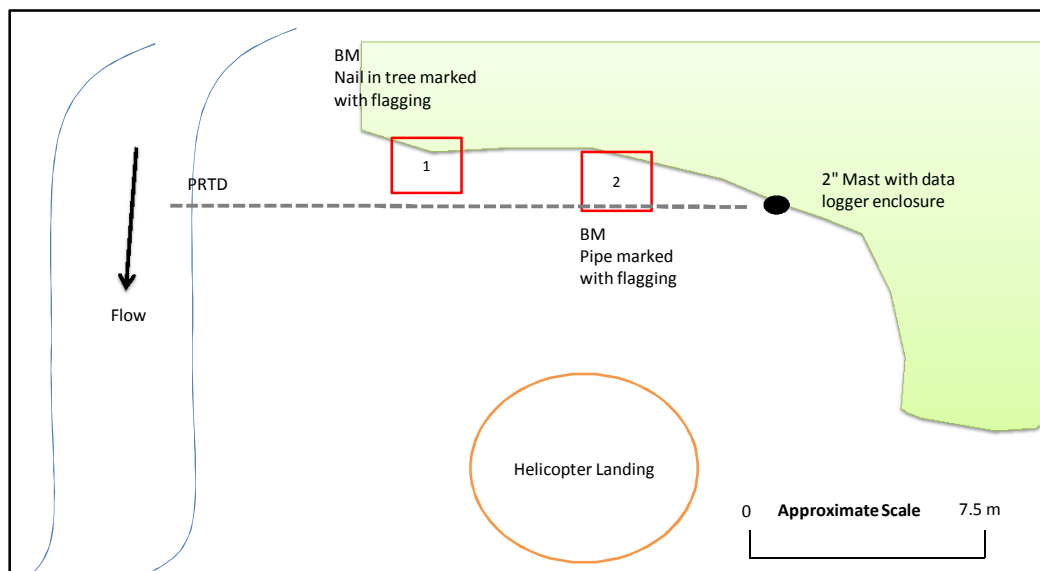


Map Grid Based on UTM NAD 27

Benchmarks:

BM 1:
Elevation: 100.034 m
Basis: Level survey from BM2
Location: Left bank immediately upstream of helicopter landing site
Description: nail in tree 3 meters away from the river

BM 2:
Elevation: 99.923 m
Basis: Assumed
Location: 3 metres East of BM1
Description: Pipe protruding 0.4 m from gro



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 256±0.5m

Location and Purpose

Established to monitor discharge on an upland reference location in the Muskeg River catchment.

Variable Measured: Water level, discharge, and water temperature

Period of Record: September 2007 to Present

Access: Helicopter

Drainage Area: 33.0 km²

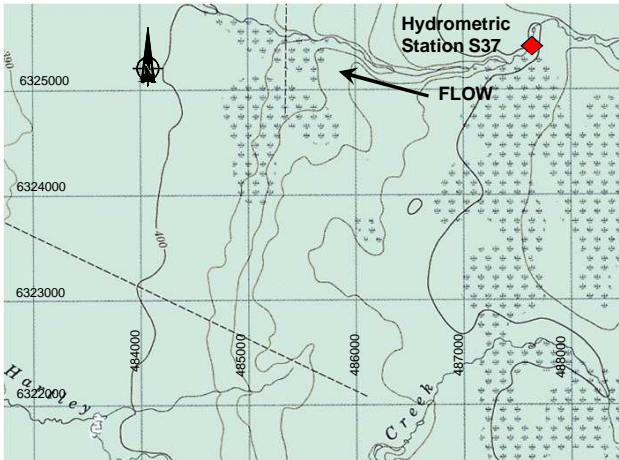
Coordinates: 487840 E, 6325424 N (UTM NAD 83)

Active: Open Water Period

Lat/Long: 57°4'19.4" N, 111°12'2.0" W

NTS Map: 74E03

ATS: SE-15-8-93-W4



Map Grid Based on UTM NAD 27

Benchmarks

BM 1

Elevation: 100.000 m (assumed)

Basis: Assumed

Location: Furthest upstream LB post

Description: Nail in stump

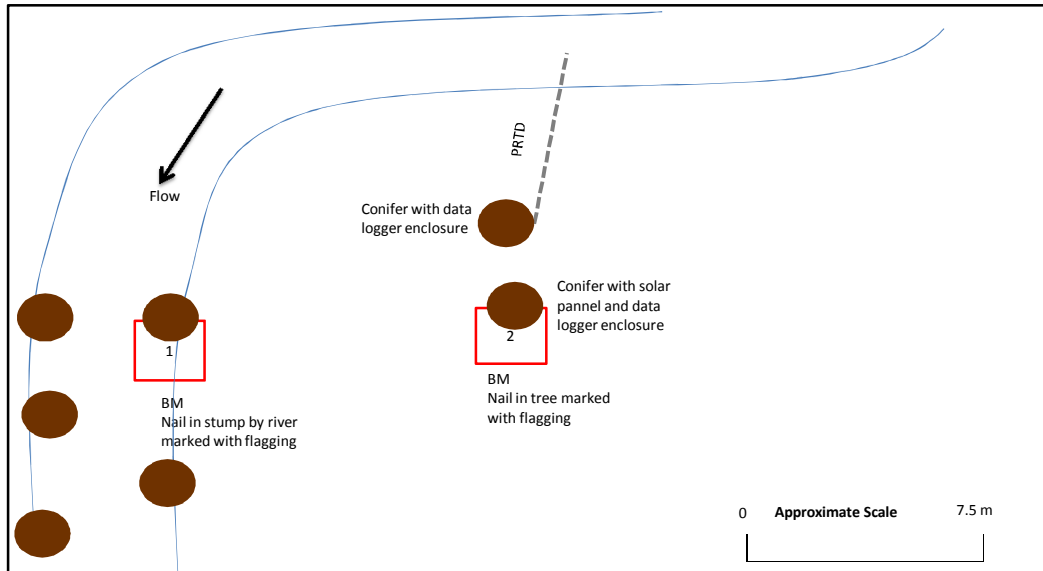
BM 2

Elevation: 101.075 m

Basis: Level survey from BM1

Location: Tree with solar panel attached

Description: Nail in tree



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 431±0.5m

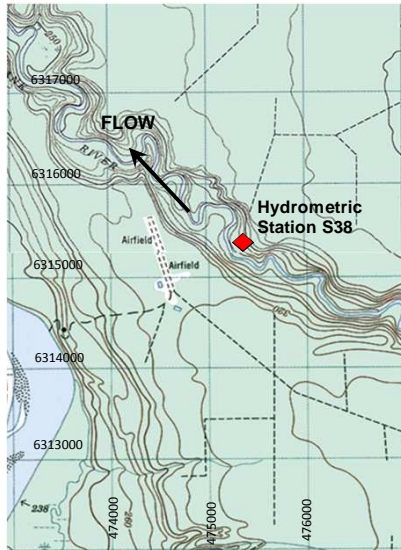
Revised 26 March, 2012

Location and Purpose:

Established by Water Survey of Canada in 1972 to monitor discharge on Steepbank River 7 km upstream of the confluence of the Athabasca River. Station was moved 700 m upstream to present location on October 3, 2006. WSC continues to operate station, RAMP collects winter flow measurements.

Variable Measured: Discharge
Period of Record: 1972 - present
Access: Helicopter access
Drainage Area: 1320 km²
Coordinates: 12 V 475293 E, 6317385 N (UTM)

Active: WSC March 1 - October 31, RAMP
November 1 - February 28/29
Lat/Long: 56°59'58" N, 111°24'24" W
NTS Map:

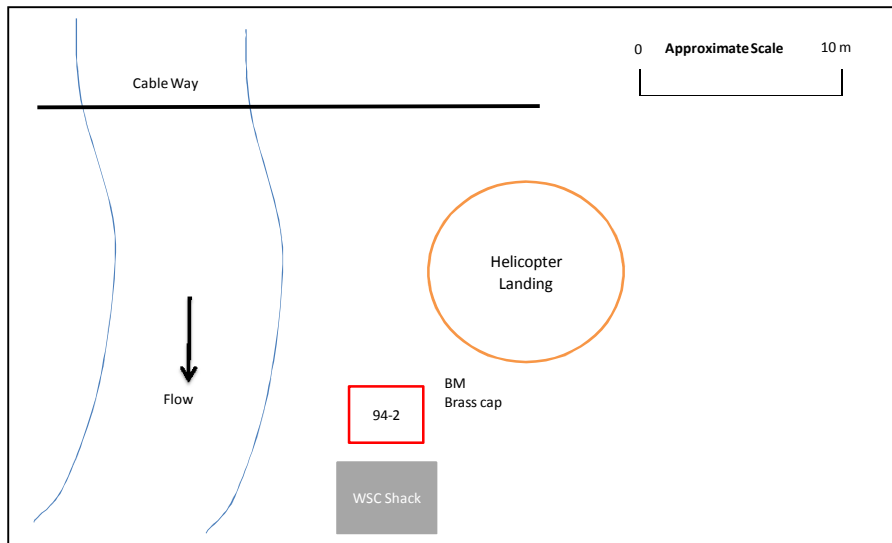


Map Grid Based on UTM NAD 27



Benchmarks

BM: BM 06-3
Elevation: 98.672 m (ref from BM 06-1)
Basis: survey date unknown
Location: 6 m, 50° from gauge.
Description: WSC brass cap on 3 m rod.



Benchmark Notes: No geodetic elevation available for this station

Revised: 26 March, 2012

Location and Purpose:

Established to monitor winter discharge on Beaver River above Syncrude at WSC station 07DA018. The Environment Canada hydrometric station has operated since 1975, but discharges are currently only published for the March-October period.

Variable Measured: Discharge

Period of Record: January 2008 to Present

Access: Truck

Drainage Area: 165 km²

Coordinates: 465542 E, 6311435 N (UTM NAD 83)

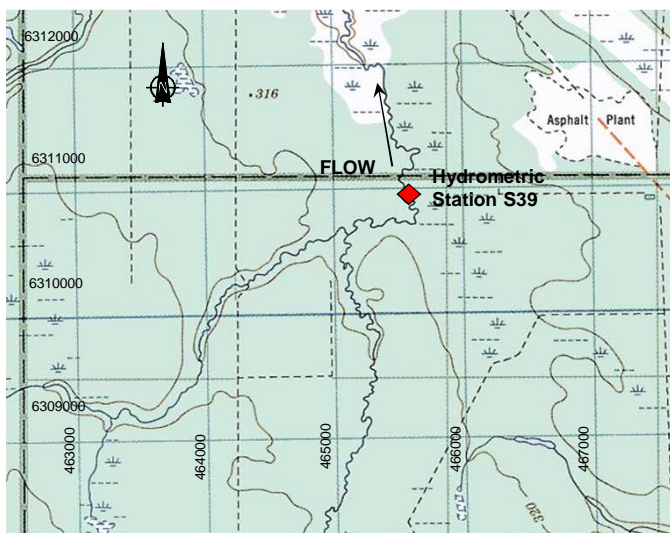
Active: WSC March 1 - October 31, RAMP

November 1 - February 28/29

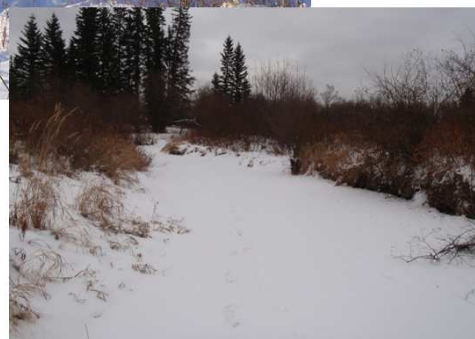
Lat/Long: 111°33' 59" W, 56°56' 42" N

NTS Map: 74D13

ATS: 9-32-91-10-W4



Map Grid Based on UTM NAD 27



BM94-2

Elevation: 29.696 m

Bases: Assumed

Location: 6.9 m S of SW corner of gauge.

Description: Brass cap on top of rebar driven to refusal

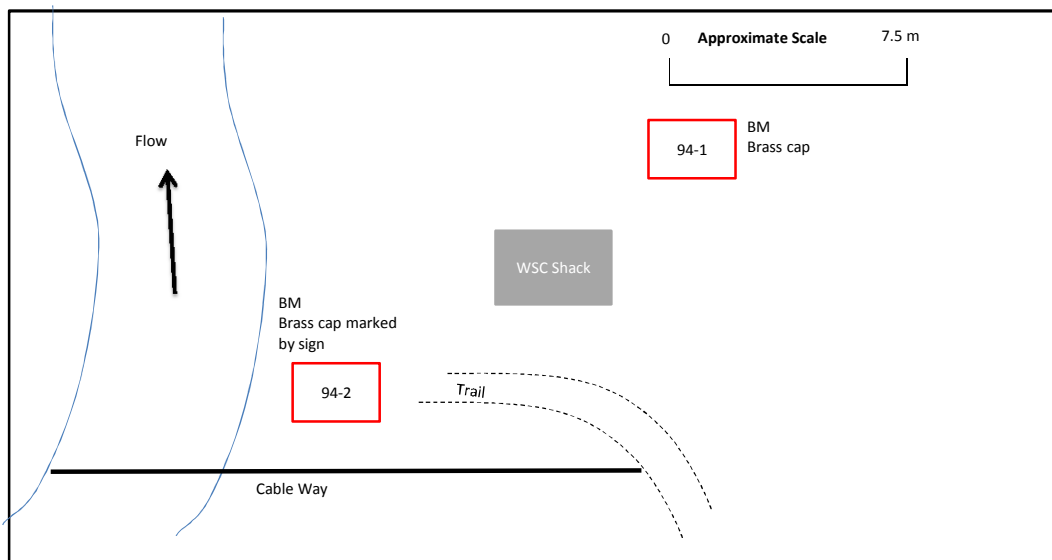
BM94-1

Elevation: 30.464 m

Bases:

Location: 4.4 m from NW corner of gauge.

Description: Brass cap on top of rebar driven to refusal



Benchmark Notes: No geodetic elevation available for this station

Revised 7 March, 2012

Location and Purpose:

Established to monitor discharge on Mackay River at the Petro-Canada Bridge.

Variable Measured: Water level, discharge, water temperature, and rainfall

Period of Record: January 2008 to Present

Access: Truck

Drainage Area: 5290km²

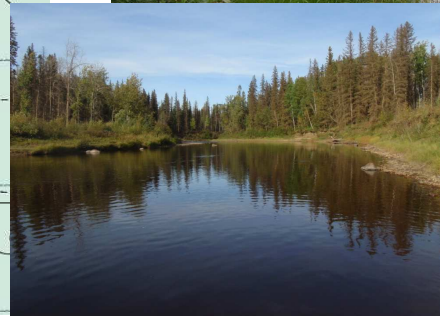
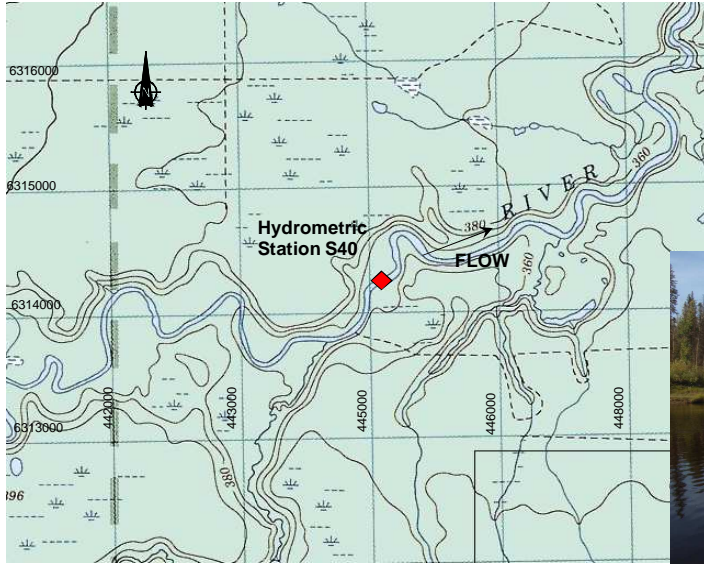
Coordinates: 445023 E, 6314256 N (UTM NAD 83)

Active: Year Round

Lat/Long: 111°54' 15.33" W, 56°58' 7.01" N

NTS Map: 74D13

ATS: 12-8-92-12-W4



Map Grid Based on UTM NAD 27

BM1

Elevation: 100.000 (Assumed)

Bases:

Location: On right bank behind data logger enclosure and vegetation

Description: 3/4" pipe marked with flagging

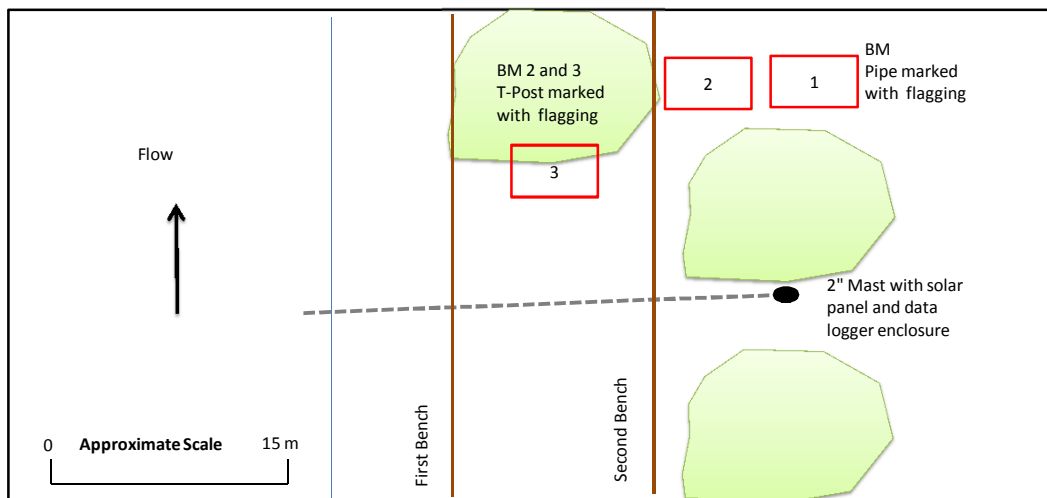
BM2

Elevation: 97.932 m

Bases:

Location: On right bank, on second bench to East of BM 1.

Description: T-Post sticking approximately 0.25 m out of the ground



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 357.5±0.5m

Revised 8 March, 2012

Location and Purpose:

Water Survey of Canada monitoring site which is monitored by RAMP in the winter period to provide year round monitoring. This site is monitored to estimate values on the Christina River using a mass balance approach for this site and the Clearwater River at Draper site.

Variable Measured: Discharge

Period of Record: September 1975 RAMP Winter 2008/2009

Access: Helicopter

Drainage Area: 17,017 km²

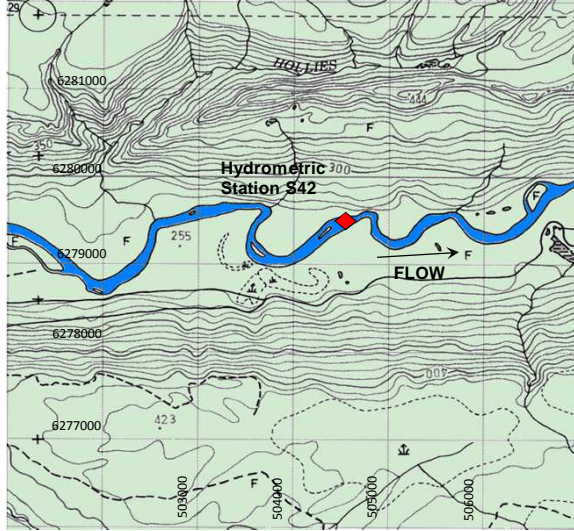
Coordinates: 12 V 504427 E, 6279666 N

Active: WSC March 1 - October 31, RAMP
November 1 - February 28/29

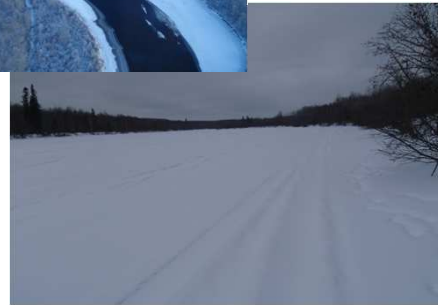
Lat/Long: 56°39'40" N, 110°55'40" W

NTS Map: 74D10

LSD: NW29 6 88W4



Map Grid Based on UTM NAD 27



Benchmarks

BM: 94-2
Elevation: 25.299
Basis: unknown
Location: Under BM Sign on Right Bank
Description: Brass cap on Right Bank

BM: 86-1
Elevation: 26.749 m
Basis: Level survey from BM1
Location: Under BM Sign on Right Bank
Description: T-Post



Benchmark Notes: No geodetic elevation available for this station

Revised 8 March, 2012

Location and Purpose:

Established in May 2009 to monitor discharge on the Firebag River upstream of oil sands operations.

Variable Measured: Water level, discharge, water temperature, and rainfall

Period of Record: May 2009 to Present

Access: Helicopter

Drainage Area: 2437 km²

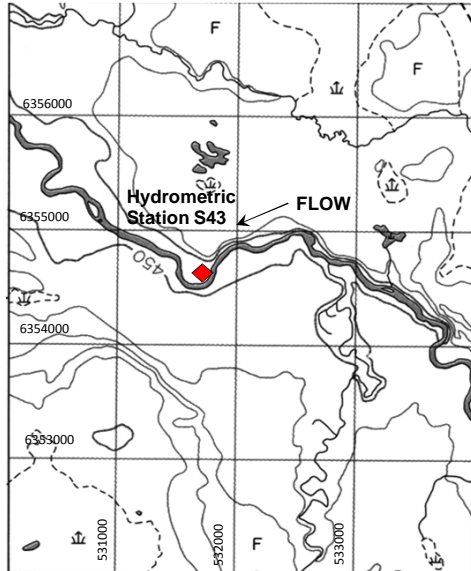
Coordinates: 12 V 531528 E, 6354782 N

Active: Year around

Lat/Long: 57°20'05" N, 110°28'35" W

NTS Map: 74E08

LSD:



Map Grid Based on UTM NAD 27

Benchmarks

BM 1

Elevation: 100.270 m

Basis: Assumed

Location: 4 m towards river from station

Description: Pipe protruding from ground 0.4 m marked with flagging

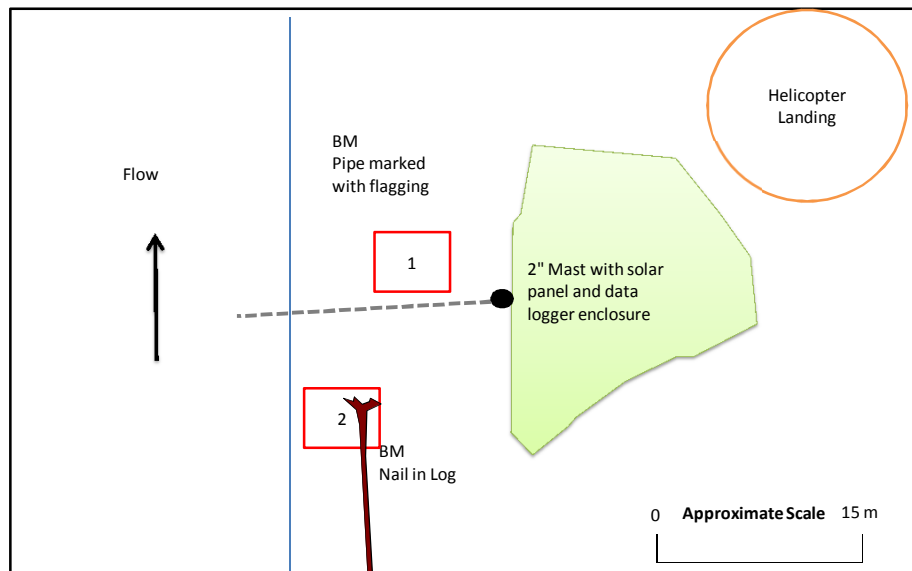
BM 2

Elevation: 100.085 m

Basis: Level survey from BM1

Location: Log on right bank 25 m up:

Description: Nail in log marked with flagging.



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 446±0.5m

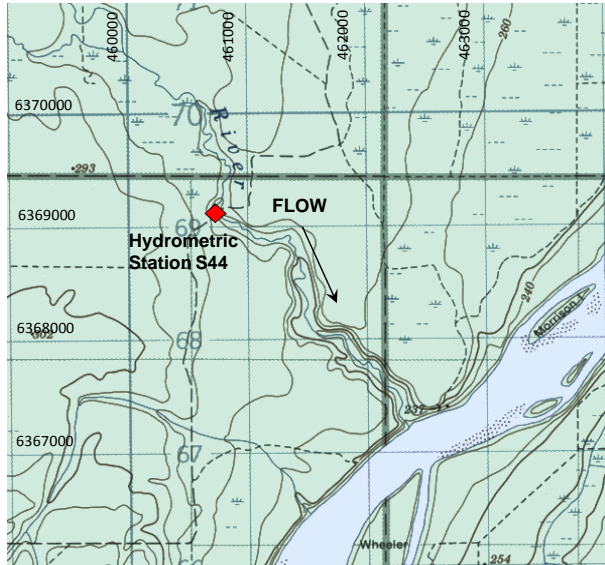
Revised 8 March, 2012

Location and Purpose:

Established to monitor discharge on Pierre River. Installed at Environment Canada hydrometric station (07DA013) that previously operated from 1975 to 1977.

Variable Measured: Water level, discharge, and water temperature
Period of Record: 1975-1977, May 2009 - present
Access: Helicopter access
Drainage Area: 123 km²
Coordinates: 12 V 460775 E, 6369400 N

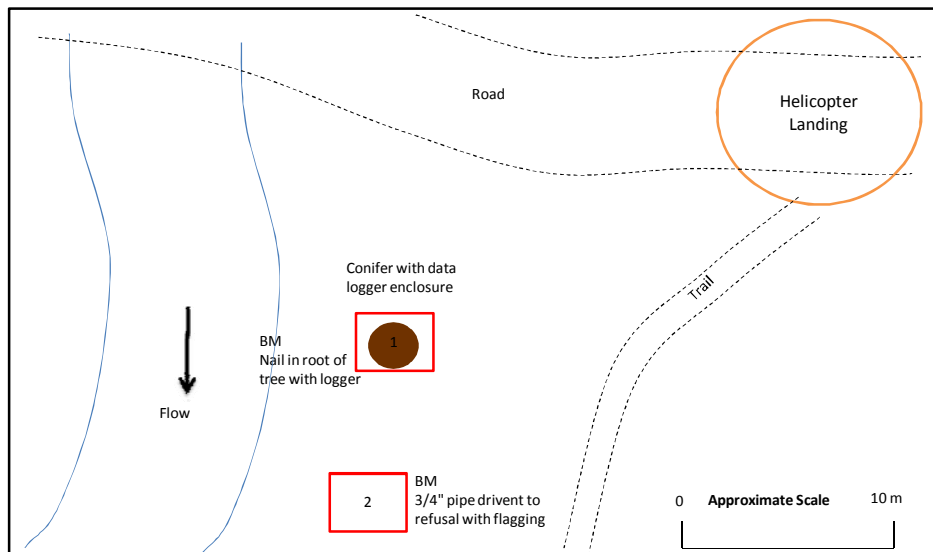
Active: Open Water Period
Lat/Long: 57°27'52.5" N, 111°39'14.9" W
NTS Map: 74E05
LSD:



Benchmarks

BM: 1
Elevation: 99.996 m
Basis: Level survey from BM2
Location: Tree with data logger enclosure attached
Description: Nail in tree root.

BM: 2
Elevation: 99.878 m
Basis: Assumed
Location: 3/4" pipe driven to refusal
Description: Pipe with flagging



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 261±0.5m

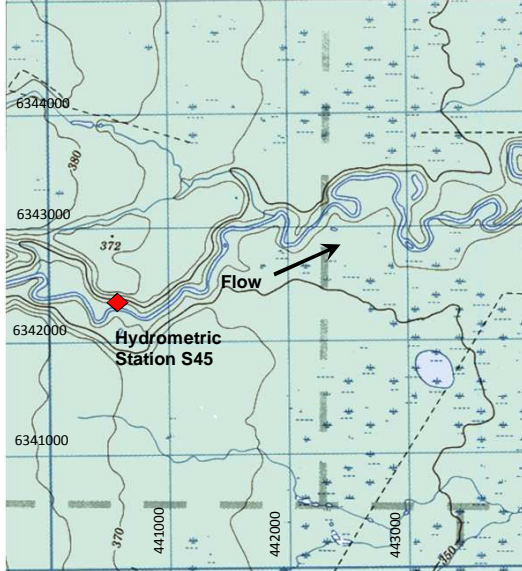
Revised 8 March, 2012

Location and Purpose:

Established to monitor discharge on Ells River upstream of the proposed Joslyn Creek Diversion and the Fort McKay water intake.

Variable Measured: Water level, discharge, and water temperature
Period of Record: June 2009 - present
Access: Helicopter access
Drainage Area: 2450 km²
Coordinates: 12V 440605 E, 6342459 N

Active: Year around
Lat/Long: 57°13'17" N, 111°59'01" W
NTS Map: 74E04
LSD:



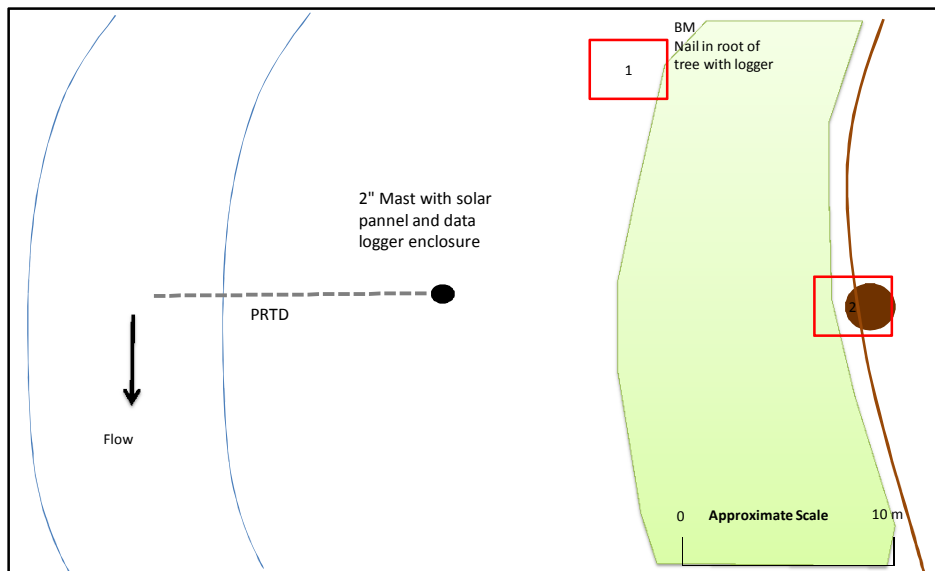
Map Grid Based on UTM NAD 27



Benchmarks

BM: 1
Elevation: 100
Basis: Assumed, survey date unknown
Location: 15 m upstream of data logger set up on left bank
Description: 3/4" pipe protruding 0.4m from surface

BM: 2
Elevation: 100.049 m
Basis: Level survey from BM1
Location: 10 m behind data logger set up
Description: Nail in stump on ledge



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 337±0.5m

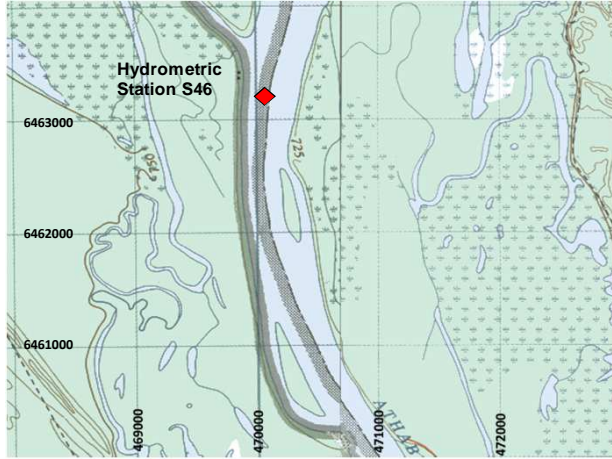
Revised 27 March, 2012

Location and Purpose:

Station was established in August 2011 to monitor water level and discharge downstream of Oil Sands development.

Variable Measured: Water level, discharge, and water temperature
Period of Record: August 2011 to present
Access: Helicopter
Drainage Area: 162000 km²
Coordinates: 470241 E, 6463206 N (NAD 83) 12 V

Active: Year Round
Lat/Long: 58°18'32" N, 111°30'28" W
NTS Map: 74L05/06

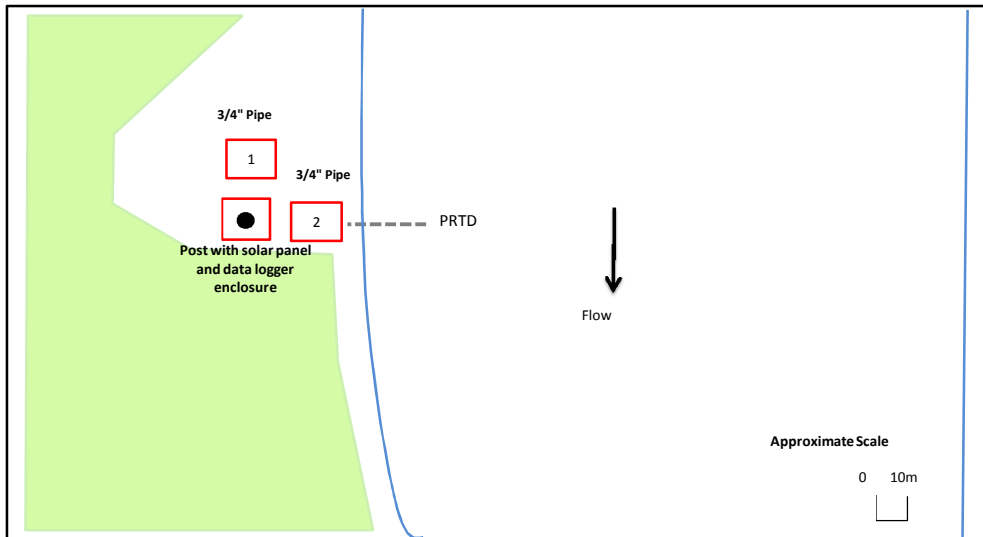


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 100.00m
Basis: Assumed
Location:
Description: 3/4" pipe on upper bench

BM: 2
Elevation: 98.503m
Basis: Level survey from BM1
Location:
Description: 3/4" pipe on lower bench



Benchmark Notes: Approximate geodetic elevation of Benchmark 2 based on 2011 differential GPS program 216 ± 0.5m

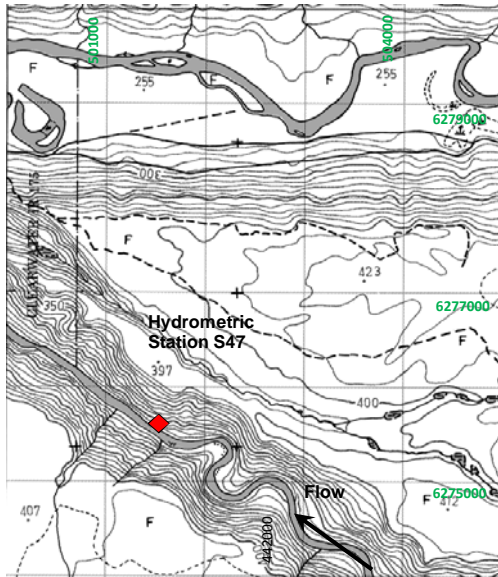
Revised 8 March, 2012

Location and Purpose:

Established to monitor water level and discharge on the Christina River near the mouth and downstream of all development in the Christina watershed.

Variable Measured: Water level, discharge, and water temperature
Period of Record: May 2011 - present
Access: Helicopter access
Drainage Area: 13,455 km²
Coordinates: 12V 500672 E, 6276404 N

Active: Year Round
Lat/Long: 56°37'54"N, 110°59'20"W
NTS Map: 74D10
LSD:

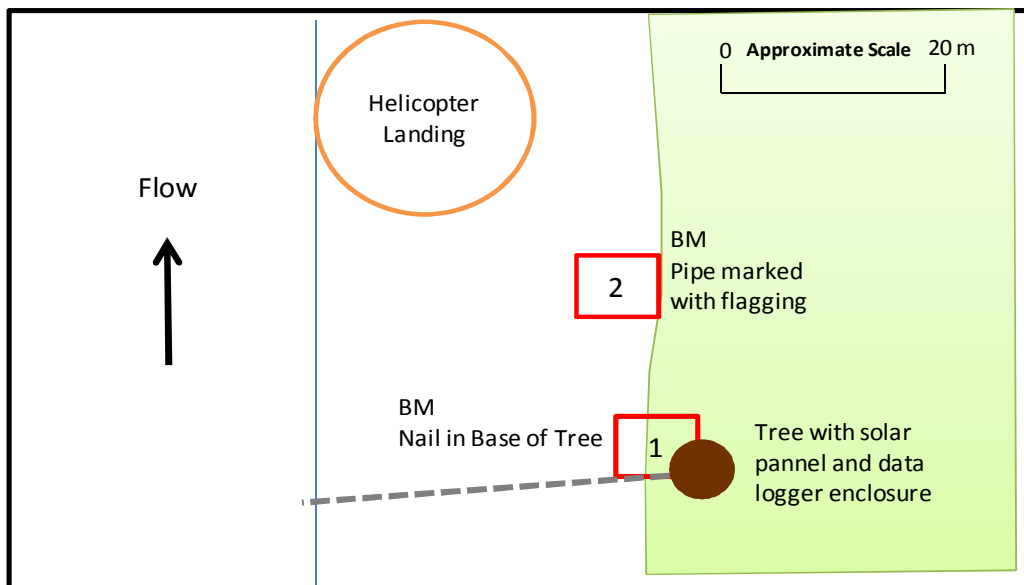


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 100.095 m
Basis: Level survey from BM2
Location: Nail in Base of Tree with Data logger attached
Description: Nail with flagging

BM: 2
Elevation: 100.000 m
Basis: Assumed
Location: 10 metres downstream of tree with logger
Description: 3/4" Pipe with Flagging



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 261.5±0.5m

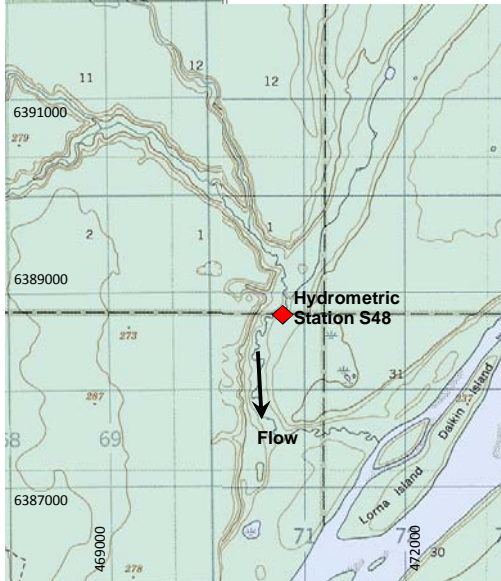
Revised 8 March, 2012

Location and Purpose:

Established to monitor water level and discharge on Big Creek near the mouth to establish baseline conditions prior to construction of the Pierre River Mine.

Variable Measured: Water level, discharge, and water temperature
Period of Record: May 2011 - present
Access: Helicopter access
Drainage Area: 304 km²
Coordinates: 12V 470894 E, 6389207 N

Active: Open Water Season
Lat/Long: 57°38'39" N, 111°29'15" W
NTS Map: 74E11
LSD:



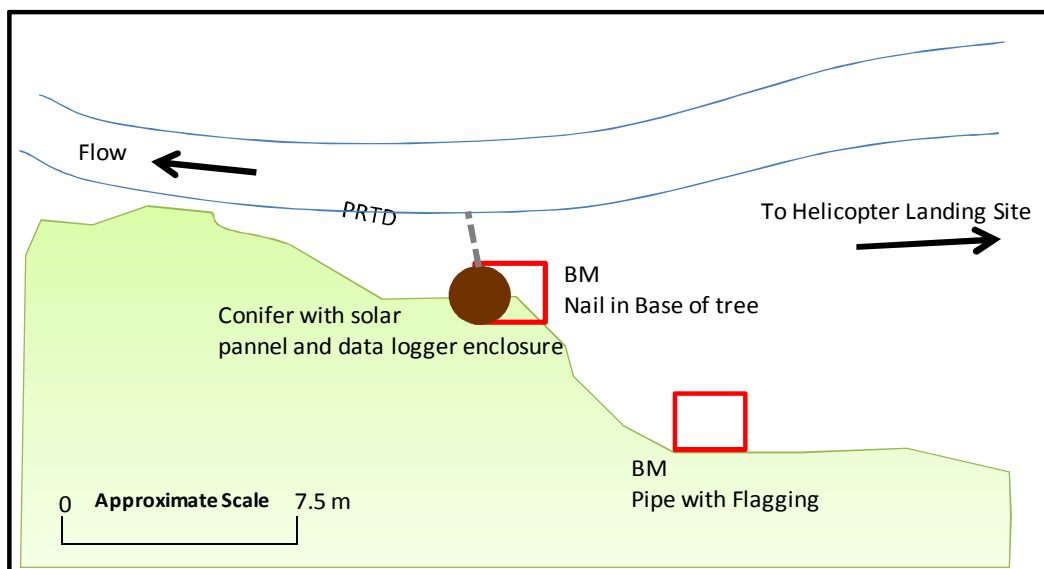
Map Grid Based on UTM NAD 27



Benchmarks

BM: 1
Elevation: 99.774 m
Basis: Level survey from BM2
Location: Nail in Base of Tree with Data logger attached
Description: Nail with flagging

BM: 2
Elevation: 100.000 m
Basis: Assumed
Location: 5 metres upstream of tree with logger
Description: 3/4" Pipe with Flagging



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 234±0.5m

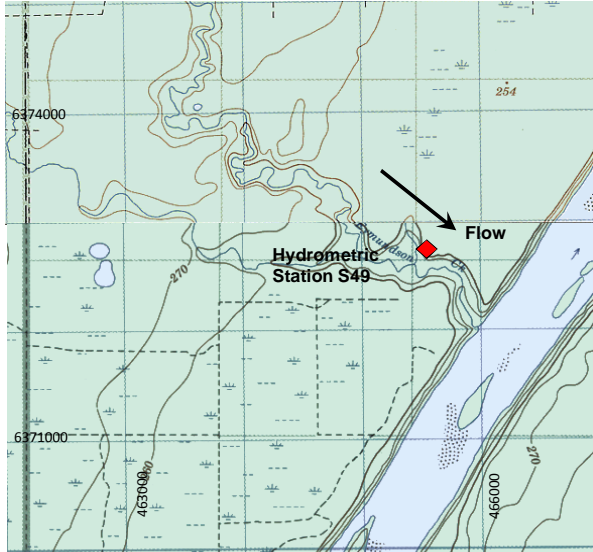
Revised 27 March, 2012

Location and Purpose:

Established to monitor water level and discharge on Eymundson Creek near the mouth to establish baseline conditions prior to construction of the Pierre River Mine.

Variable Measured: Water level, discharge, and water temperature
Period of Record: May 2011 - present
Access: Helicopter access
Drainage Area: 243 km²
Coordinates: 12V 465524 E, 6372768 N (NAD 83)

Active: Open Water Season
Lat/Long: 57°29'46"N, 111°34'30"W
NTS Map: 74E12
LSD:

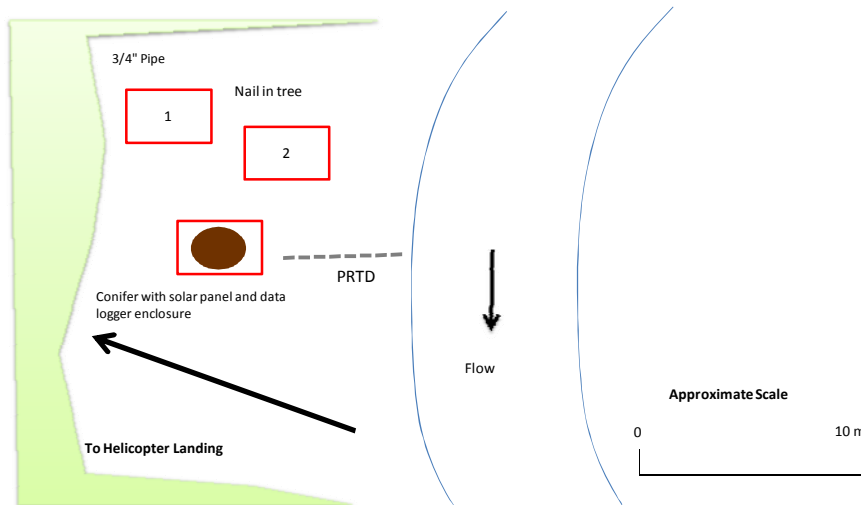


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 99.876 m
Basis: Level survey from BM2
Location: Nail in Base of Tree with Data logger attached
Description: Nail with flagging

BM: 2
Elevation: 100.000 m
Basis: Assumed
Location: 5 metres upstream of tree with logger
Description: 3/4" Pipe with Flagging



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 230.5±0.5m

Revised 8 March, 2012

Location and Purpose:

Established to monitor water level and discharge on Red Clay Creek near the mouth to establish baseline conditions prior to construction of the Pierre River Mine.

Variable Measured: Water level, discharge, and water temperature
Period of Record: May 2011 - present
Access: Helicopter access
Drainage Area: 187 km²
Coordinates: 12V 475701 E, 6395073 N

Active: Open Water Season
Lat/Long: 57°41'49" N, 111°24'27" W
NTS Map: 74E11
LSD:

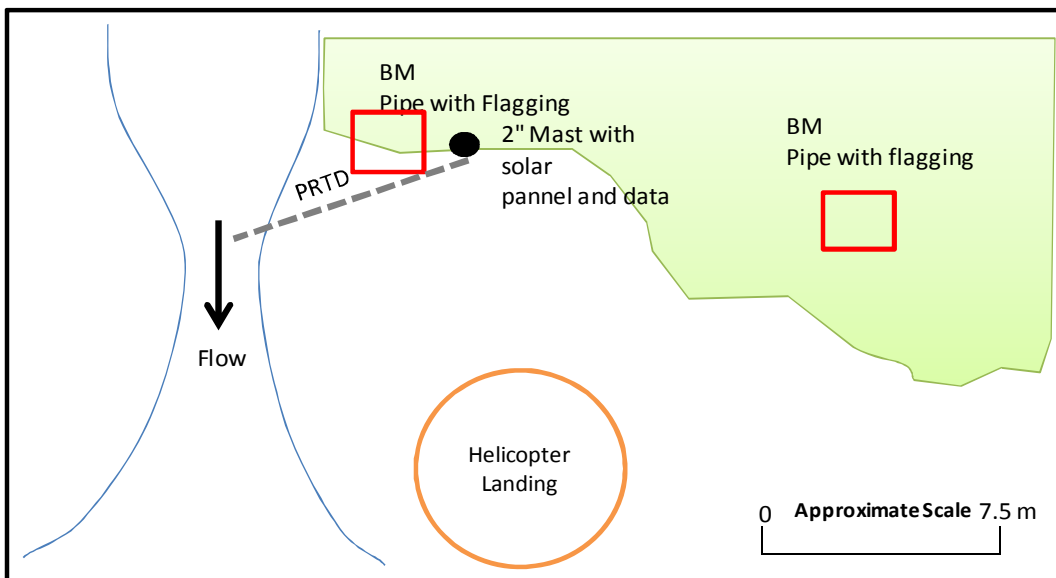


Map Grid Based on UTM NAD 27

Benchmarks

BM: 1
Elevation: 100.000 m
Basis: Assumed (survey date unknown)
Location: 4m West of Data Logger
Description: 3/4" pipe

BM: 2
Elevation: 99.791 m
Basis: Level survey from BM1
Location: 6m North of Data Logger
Description: Nail in clump



Benchmark Notes: Approximate geodetic elevation of Benchmark 1 based on 2011 differential GPS program 228±0.5m

C.6 INVENTORY OF CLIMATE AND HYDROLOGIC DATA IN THE RAMP DATABASE

An inventory of the climate and hydrologic data collected by RAMP, and contained in the RAMP database, is provided on the following pages (Table C.6-1). These data will be made available on the RAMP website, subsequent to this report being published.

In addition to the data collected by RAMP, data from the following sources contributed to the analyses in the 2011 WY RAMP Technical Report and Appendices including:

- Water Survey of Canada (WSC)
(<http://www.wsc.ec.gc.ca/>)
 - Provisional WSC hydrologic data has been used when final data are not yet available. In the RAMP database, data for a joint WSC/RAMP Station are provided starting with the year in which RAMP monitoring began. To provide regional context RAMP stations are identified where historic WSC data are available to extend the record length.
- Environment Canada (EC)
(http://climate.weatheroffice.gc.ca/climateData/canada_e.html)
 - Provisional EC climate data has been used when final data are not yet available.
- Industry Data
 - Volumes of water released and withdrawn, as part of RAMP focal activities, were supplied by each company.

Table C.6-1 Inventory of climate and hydrologic data collected by RAMP.

Hydrometric Station	Data Type	From	To
S01 - Alsands Drain	Discharge	1995-08-10	2002-12-31
	Water Level	1997-04-16	2002-12-30
S02 - Jackpine Creek at Canterra Road	Discharge	1995-05-06	2011-10-31
	Water Level	1997-04-17	2011-10-31
	Water Temperature	2007-10-20	2011-10-31
S03 - Iyininim Creek above Kearl Lake	Total Rainfall	1999-04-30	2011-10-29
	Discharge	1989-01-18	2011-10-29
	Water Level	1989-04-20	2011-10-29
	Water Temperature	2011-08-15	2011-10-29
S04 - Blackfly Creek near the mouth	Discharge	1989-02-15	1998-10-27
S04A - Blackfly Creek near the mouth	Discharge	2007-04-25	2007-10-25
	Water Level	2007-04-25	2007-10-25
S05 - Muskeg River above Stanley Creek	Discharge	2003-05-04	2011-10-31
	Water Level	2003-02-12	2011-10-31
	Water Temperature	2010-06-26	2011-10-31
S05A - Muskeg River above Muskeg Creek	Station Pressure	2002-03-16	2011-10-31
	Discharge	1995-08-11	2011-10-31
	Water Level	1997-04-17	2011-10-31
	Water Temperature	2004-09-01	2011-10-31
S06 - Mills Creek at Highway 63	Discharge	1997-04-16	2011-10-31
	Water Level	1997-04-16	2011-10-31
	Water Temperature	2010-09-19	2011-10-31
S07 - Muskeg River near Fort McKay (07DA008)	Discharge ¹	1998-03-01	2011-10-31
	Water Level	2000-01-01	2011-10-31
	Water Temperature	2010-06-22	2011-10-31
S08 - Stanley Creek near the mouth	Water Level	1999-09-14	2003-10-14
S09 - Kearl Lake Outlet	Discharge	1989-01-18	2011-10-31
	Water Level	1989-01-18	2011-10-31
	Station Pressure	1999-04-07	2001-04-20
	Water Temperature	2011-04-26	2011-10-31
S10 - Wapasu Creek at Canterra Road	Discharge	1997-05-08	2011-10-31
	Water Level	1997-05-08	2011-10-31
	Water Temperature	2008-01-01	2011-10-31

Historic Discharge Data available from Water Survey of Canada for RAMP Stations in similar locations.

¹ S07 – Muskeg River near Fort McKay (07DA008) 1974 – present

² S11 – Poplar Creek at Highway 63 (Poplar Creek near Fort McMurray 07DA007) 1972 – 1986

³ S14/S14A – Eils River above Joslyn Creek/Eils River at CNRL Bridge (Eils River near the mouth 07DA017) 1975 – 1986

⁴ S15/S15A – Tar River near the mouth (Tar River near Fort MacKay 07DA015) 1975 – 1977

⁵ S16/CR1/S16A – Calumet River near the mouth (Calumet River near Fort MacKay 07DA014) 1975 – 1977

⁶ S26 – MacKay River near Fort McKay (07DB001) 1972 – present

⁷ S27 – Firebag River near the mouth (07DC001) 1971 – present

⁸ S29 – Christina River near Chard (07CE002) 1982 – present

⁹ S38 – Steepbank River near Fort McMurray (07DA006) 1972 – present

¹⁰ S39 – Beaver River above Syncrude (07DA018) 1975 – present

¹¹ S42 – Clearwater River above Christina River (07CD005) 1966 – present

¹² S44 – Pierre River near Fort McKay (07DA013) 1975-1977

¹³ S46 – Athabasca River near Embarras Airport (Athabasca River at Embarras Airport 07DD011) 1971 – 1984

Table C.6-1 (Cont'd.)

Hydrometric Station	Data Type	From	To
S11 - Poplar Creek at Highway 63 (07DA007)	Discharge ²	1996-04-20	2011-10-31
	Water Level	1995-05-05	2011-10-31
	Water Temperature	2008-05-14	2011-10-31
S12 - Fort Creek at Highway 63	Discharge	2000-04-02	2011-10-31
	Water Level	2000-04-02	2011-10-31
	Water Temperature	2011-08-08	2011-10-31
S13 - Shell Pond 3 Outlet	Discharge	2000-03-02	2002-12-07
	Water Level	2000-03-02	2002-12-07
S14 - Ells River above Joslyn Creek	Discharge ³	2001-03-15	2007-10-24
	Water Level	2001-05-13	2007-10-24
S14A - Ells River at CNRL Bridge	Discharge ³	2004-10-30	2011-10-31
	Water Level	2004-10-30	2011-10-31
	Water Temperature	2005-07-14	2011-10-31
S15 - Tar River near the mouth (07DA015)	Discharge ⁴	2001-05-09	2006-10-28
	Water Level	2001-05-09	2006-10-28
S15A - Tar River near the mouth	Discharge ⁴	2007-05-01	2011-10-31
	Water Level	2007-05-01	2011-10-31
	Water Temperature	2007-09-21	2011-10-31
S16 - Calumet River near the mouth	Daily Maximum Temperature	2001-06-11	2005-10-11
	Daily Minimum Temperature	2001-06-11	2005-10-11
	Daily Mean Temperature	2001-06-11	2005-10-11
	Total Rainfall	2001-06-11	2005-05-02
	Total Snowfall	2001-06-11	2005-03-23
	Total Precipitation	2001-06-11	2005-05-02
	Discharge ⁵	2001-05-12	2004-10-31
	Water Level	2001-05-12	2004-10-31
	Water Temperature	2003-05-27	2004-10-31
S16A - Calumet River near the mouth	Discharge ⁵	2010-04-12	2011-10-29
	Water Level	2010-05-12	2011-10-29
	Water Temperature	2011-07-27	2011-10-29
S17 - Tar River Upland Tributary	Discharge	2001-05-12	2003-06-24
	Water Level	2001-05-12	2004-10-31

Historic Discharge Data available from Water Survey of Canada for RAMP Stations in similar locations.

¹ S07 – Muskeg River near Fort McKay (07DA008) 1974 – present

² S11 – Poplar Creek at Highway 63 (Poplar Creek near Fort McMurray 07DA007) 1972 – 1986

³ S14/S14A – Ells River above Joslyn Creek/Ells River at CNRL Bridge (Ells River near the mouth 07DA017) 1975 – 1986

⁴ S15/S15A – Tar River near the mouth (Tar River near Fort MacKay 07DA015) 1975 – 1977

⁵ S16/CR1/S16A – Calumet River near the mouth (Calumet River near Fort MacKay 07DA014) 1975 – 1977

⁶ S26 – MacKay River near Fort McKay (07DB001) 1972 – present

⁷ S27 – Firebag River near the mouth (07DC001) 1971 – present

⁸ S29 – Christina River near Chard (07CE002) 1982 – present

⁹ S38 – Steepbank River near Fort McMurray (07DA006) 1972 – present

¹⁰ S39 – Beaver River above Syncrude (07DA018) 1975 – present

¹¹ S42 – Clearwater River above Christina River (07CD005) 1966 – present

¹² S44 – Pierre River near Fort McKay (07DA013) 1975-1977

¹³ S46 – Athabasca River near Embarras Airport (Athabasca River at Embarras Airport 07DD011) 1971 – 1984

Table C.6-1 (Cont'd.)

Hydrometric Station	Data Type	From	To
S18A - Calumet River Upland Tributary	Discharge	2002-06-10	2009-10-25
	Water Level	2002-06-10	2009-10-25
S19 - Tar River Lowland Tributary near the mouth	Total Rainfall	2002-06-13	2005-12-31
	Total Precipitation	2006-01-01	2009-10-22
	Total Rainfall	2010-04-22	2011-10-31
	Discharge	2001-05-09	2010-10-26
	Water Level	2001-05-09	2010-10-26
S20 - Muskeg River Upland	Discharge	2001-05-08	2011-10-31
	Water Level	2001-05-08	2011-10-31
S21 - Shelley Creek near the mouth	Water Level	2001-05-14	2003-10-14
S22 - Muskeg Creek near the mouth	Discharge	1989-01-17	2011-10-31
	Water Level	1989-01-17	2011-10-31
S23 - Aurora Boundary Weir	Discharge	2001-01-01	2002-12-31
	Water Level	2001-01-01	2002-12-31
S24 - Athabasca River below Eymundson Creek	Discharge	2001-06-20	2011-10-31
	Water Level	2001-06-20	2011-10-31
	Water Temperature	2010-08-11	2011-10-31
S25 - Susan Lake Outlet	Discharge	2002-06-11	2011-10-25
	Water Level	2002-06-11	2011-10-25
S26 - MacKay River near Fort McKay (07DB001)	Discharge ⁶	2001-03-01	2011-10-31
S27 - Firebag River near the mouth (07DC001)	Discharge ⁷	2002-01-01	2011-10-31
	Water Level	2002-01-01	2010-02-28
S28 - Khahago Creek below Blackfly Creek	Discharge	1989-01-19	2007-10-25
	Water Level	1989-01-19	2007-10-25
S29 - Christina River near Chard (07CE002)	Discharge ⁸	2002-01-13	2010-10-31
	Total Rainfall	2002-07-08	2003-10-10
S31 - Hangingstone Creek at North Star Road	Discharge	2002-04-10	2011-10-31
	Water Level	2002-04-10	2011-10-31
	Total Rainfall	2010-04-23	2011-10-31
S32 - Surmount Creek at Highway 881	Discharge	2002-05-18	2011-10-31
	Water Level	2002-01-14	2011-10-31
	Water Temperature	2008-06-24	2011-10-31

Historic Discharge Data available from Water Survey of Canada for RAMP Stations in similar locations.

¹ S07 – Muskeg River near Fort McKay (07DA008) 1974 – present

² S11 – Poplar Creek at Highway 63 (Poplar Creek near Fort McMurray 07DA007) 1972 – 1986

³ S14/S14A – Ells River above Joslyn Creek/Ells River at CNRL Bridge (Ells River near the mouth 07DA017) 1975 – 1986

⁴ S15/S15A – Tar River near the mouth (Tar River near Fort MacKay 07DA015) 1975 – 1977

⁵ S16/CR1/S16A – Calumet River near the mouth (Calumet River near Fort MacKay 07DA014) 1975 – 1977

⁶ S26 – MacKay River near Fort McKay (07DB001) 1972 – present

⁷ S27 – Firebag River near the mouth (07DC001) 1971 – present

⁸ S29 – Christina River near Chard (07CE002) 1982 – present

⁹ S38 – Steepbank River near Fort McMurray (07DA006) 1972 – present

¹⁰ S39 – Beaver River above Syncrude (07DA018) 1975 – present

¹¹ S42 – Clearwater River above Christina River (07CD005) 1966 – present

¹² S44 – Pierre River near Fort McKay (07DA013) 1975-1977

¹³ S46 – Athabasca River near Embarras Airport (Athabasca River at Embarras Airport 07DD011) 1971 – 1984

Table C.6-1 (Cont'd.)

Hydrometric Station	Data Type	From	To
S33 - Muskeg River at Aurora/Shell Boundary	Discharge	2003-01-29	2011-10-31
	Water Level	2003-04-30	2011-10-31
	Water Temperature	2009-11-01	2011-10-31
S34 - Tar River above CNRL Lake	Discharge	2005-04-26	2011-10-31
	Water Level	2005-04-26	2011-10-31
	Water Temperature	2008-04-08	2011-10-31
S35 - McClelland Lake Outlet	Water Level	2008-06-29	2008-10-08
S36 - McClelland Lake Outlet above Firebag River	Discharge	2008-05-14	2010-10-29
	Water Level	2008-05-14	2010-10-29
	Water Temperature	2011-07-27	2011-10-29
S37 - East Jackpine Creek near the 1300 m Contour	Discharge	2007-09-22	2011-10-29
	Water Level	2007-09-22	2011-10-29
S38 - Steepbank River near Fort McMurray (07DA006)	Discharge ⁹	2009-01-01	2011-10-31
S39 - Beaver River above Syncrude (07DA018)	Discharge ¹⁰	2009-01-01	2011-10-31
S40 - MacKay River at Petro-Canada Bridge	Discharge	2008-01-01	2011-10-31
	Water Level	2008-01-01	2011-10-31
	Total Rainfall	2010-04-23	2011-10-31
	Water Temperature	2008-09-19	2011-10-31
S42 - Clearwater River above Christina River (07CD005)	Discharge ¹¹	2009-01-01	2011-10-31
S43 - Firebag River above Suncor Firebag	Discharge	2009-05-01	2011-10-31
	Water Level	2009-05-01	2011-10-31
	Total Rainfall	2010-04-12	2011-10-31
	Water Temperature	2009-09-18	2011-10-31
S44 - Pierre River near Fort McKay (07DA013)	Discharge ¹²	2009-05-01	2011-10-29
	Water Level	2009-05-01	2011-10-29
	Water Temperature	2011-07-27	2011-10-29
S45 - Ells River above Joslyn Creek Diversion	Discharge	2009-06-13	2011-10-31
	Water Level	2009-06-13	2011-10-31
	Water Temperature	2009-06-13	2011-10-31
S46 - Athabasca River near Embarras Airport	Discharge ¹³	2011-08-16	2011-10-31
	Water Level	2011-08-16	2011-10-31
	Water Temperature	2011-08-16	2011-10-31

Historic Discharge Data available from Water Survey of Canada for RAMP Stations in similar locations.

¹ S07 – Muskeg River near Fort McKay (07DA008) 1974 – present

² S11 – Poplar Creek at Highway 63 (Poplar Creek near Fort McMurray 07DA007) 1972 – 1986

³ S14/S14A – Ells River above Joslyn Creek/Ells River at CNRL Bridge (Ells River near the mouth 07DA017) 1975 – 1986

⁴ S15/S15A – Tar River near the mouth (Tar River near Fort MacKay 07DA015) 1975 – 1977

⁵ S16/CR1/S16A – Calumet River near the mouth (Calumet River near Fort MacKay 07DA014) 1975 – 1977

⁶ S26 – MacKay River near Fort McKay (07DB001) 1972 – present

⁷ S27 – Firebag River near the mouth (07DC001) 1971 – present

⁸ S29 – Christina River near Chard (07CE002) 1982 – present

⁹ S38 – Steepbank River near Fort McMurray (07DA006) 1972 – present

¹⁰ S39 – Beaver River above Syncrude (07DA018) 1975 – present

¹¹ S42 – Clearwater River above Christina River (07CD005) 1966 – present

¹² S44 – Pierre River near Fort McKay (07DA013) 1975-1977

¹³ S46 – Athabasca River near Embarras Airport (Athabasca River at Embarras Airport 07DD011) 1971 – 1984

Table C.6-1 (Cont'd.)

Hydrometric Station	Data Type	From	To
S47 - Christina River near the mouth	Discharge	2011-07-28	2011-10-31
	Water Level	2011-07-28	2011-10-31
	Water Temperature	2011-07-28	2011-10-31
S48 - Big Creek near the mouth	Discharge	2011-04-23	2011-10-29
	Water Level	2011-04-23	2011-10-29
	Water Temperature	2011-04-23	2011-10-29
S49 - Eymundson Creek near the mouth	Discharge	2011-07-27	2011-10-29
	Water Level	2011-07-27	2011-10-29
	Water Temperature	2011-07-27	2011-10-29
S50 - Red Clay Creek	Discharge	2011-04-23	2011-10-29
	Water Level	2011-04-23	2011-10-29
	Water Temperature	2011-04-23	2011-10-29
CR1 - Calumet River	Discharge ⁵	2005-05-04	2009-10-18
L1 - McClelland Lake	Daily Maximum Temperature	2007-03-29	2011-10-31
	Daily Minimum Temperature	2007-03-29	2011-10-31
	Daily Mean Temperature	2007-02-09	2011-10-31
	Total Rainfall	2002-08-09	2011-10-31
	Total Precipitation	2006-04-15	2011-10-31
	Relative Humidity	2006-09-06	2011-10-31
	Discharge	1997-06-22	2006-09-02
	Water Level	1997-06-22	2011-10-31
L2 - Kearl Lake	Water Temperature	2008-03-14	2011-10-31
	Daily Maximum Temperature	2008-01-01	2011-10-31
	Daily Minimum Temperature	2008-01-01	2011-10-31
	Daily Mean Temperature	2007-09-25	2011-10-31
	Total Precipitation	2008-01-01	2011-10-31
	Relative Humidity	2007-09-25	2011-10-31
	Discharge	2007-04-26	2007-10-17
	Water Level	1989-01-19	2011-10-31
L3 - Isadores Lake	Water Temperature	2007-09-25	2011-10-31
	Water Level	2000-02-22	2011-10-31

Historic Discharge Data available from Water Survey of Canada for RAMP Stations in similar locations.

¹ S07 – Muskeg River near Fort McKay (07DA008) 1974 – present

² S11 – Poplar Creek at Highway 63 (Poplar Creek near Fort McMurray 07DA007) 1972 – 1986

³ S14/S14A – Eills River above Joslyn Creek/Eills River at CNRL Bridge (Eills River near the mouth 07DA017) 1975 – 1986

⁴ S15/S15A – Tar River near the mouth (Tar River near Fort MacKay 07DA015) 1975 – 1977

⁵ S16/CR1/S16A – Calumet River near the mouth (Calumet River near Fort MacKay 07DA014) 1975 – 1977

⁶ S26 – MacKay River near Fort McKay (07DB001) 1972 – present

⁷ S27 – Firebag River near the mouth (07DC001) 1971 – present

⁸ S29 – Christina River near Chard (07CE002) 1982 – present

⁹ S38 – Steepbank River near Fort McMurray (07DA006) 1972 – present

¹⁰ S39 – Beaver River above Syncrude (07DA018) 1975 – present

¹¹ S42 – Clearwater River above Christina River (07CD005) 1966 – present

¹² S44 – Pierre River near Fort McKay (07DA013) 1975-1977

¹³ S46 – Athabasca River near Embarras Airport (Athabasca River at Embarras Airport 07DD011) 1971 – 1984

Table C.6-1 (Cont'd.)

Climate Station	Data Type	From Date	To Date
C1 - Aurora Climate Station	Daily Maximum Temperature	1995-05-10	2011-10-31
	Daily Minimum Temperature	1995-05-10	2011-10-31
	Daily Mean Temperature	1988-03-11	2011-10-31
	Total Rainfall	1995-05-10	2008-12-31
	Total Snowfall	1996-01-01	2008-12-31
	Total Precipitation	1988-03-10	2011-10-31
	Snow on the Ground	1995-10-26	2011-10-31
	Speed of Extreme Gust	1995-05-10	2011-10-31
	Global Solar Radiation (RF1)	1988-03-11	2011-10-31
	Relative Humidity	1995-05-10	2011-10-31
	Maximum 2-Minute Wind Speed	1995-05-10	2011-10-31
	Maximum 10-Minute Wind Speed	1995-05-10	2011-10-31
C2 - Horizon Climate Station	Daily Maximum Temperature	2008-10-16	2011-10-31
	Daily Minimum Temperature	2008-10-16	2011-10-31
	Daily Mean Temperature	2008-10-16	2011-10-31
	Snow on the Ground	2009-01-01	2011-10-31
	Speed of Extreme Gust	2008-10-16	2011-10-31
	Global Solar Radiation (RF1)	2008-10-16	2011-10-31
	Station pressure	2008-10-16	2011-10-31
	Relative Humidity	2008-10-16	2011-10-31
	Maximum 2-Minute Wind Speed	2008-10-16	2011-10-31
	Maximum 10-Minute Wind Speed	2008-10-16	2011-10-31
	Total Precipitation	2009-06-11	2011-10-31
	C3 - Steepbank Climate Station	Daily Maximum Temperature	2010-11-03
Daily Minimum Temperature		2010-11-03	2011-10-31
Daily Mean Temperature		2010-11-03	2011-10-31
Snow on the Ground		2010-11-03	2011-10-31
Speed of Extreme Gust		2010-11-03	2011-10-31
Global Solar Radiation (RF1)		2010-11-03	2011-10-31
Station pressure		2010-11-03	2011-10-31
Relative Humidity		2010-11-03	2011-10-31
Maximum 2-Minute Wind Speed		2010-11-03	2011-10-31
Maximum 10-Minute Wind Speed		2010-11-03	2011-10-31
Total Precipitation		2009-08-13	2011-10-31
C4 - Pierre Climate Station		Daily Maximum Temperature	2011-07-25
	Daily Minimum Temperature	2011-07-25	2011-10-31
	Daily Mean Temperature	2011-07-25	2011-10-31
	Snow on the Ground	2011-07-25	2011-10-31
	Speed of Extreme Gust	2011-07-25	2011-10-31
	Global Solar Radiation (RF1)	2011-07-25	2011-10-31
	Station pressure	2011-07-25	2011-10-31
	Relative Humidity	2011-07-25	2011-10-31
	Maximum 2-Minute Wind Speed	2011-07-25	2011-10-31
	Maximum 10-Minute Wind Speed	2011-07-25	2011-10-31
	Total Precipitation	2011-07-25	2011-10-31

C.7 STATION VISIT RECORDS AND MANUAL MEASUREMENTS

Records of the manual hydrometric measurements made during each station visit are provided on the following pages. The quality and expected precision of each manual discharge measurement was assessed considering the hydraulic conditions, at the measurement section, at the time of the measurement.

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station
 UTM Location: 475734E, 6343967 N

Site Visit Date: Jan. 16, 2011

<u>Datalogger Details:</u>	
Battery (Main):	13.7
Datalogger Clock:	12:40
Laptop Clock:	12:38
Air Temperature °C:	-30.9
RH (%):	72.4
Snow Depth (cm):	38.7
Wind Speed (m/s):	3.3
Wind Direction (deg):	8
Solar Radiation (kw/m ²):	0.010
Barometric Pressure (kpa):	141.3
Precipitation Before (mm):	-
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	12:30
End Time (MST):	-
Station Condition:	OK
Weather:	-

General Notes:

Snowdepth was reading 0.43m, checked manually, was OK.Changed battery.

<u>Field Personnel:</u>	JO, DB	<u>Trip Date:</u>	16-Jan-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	25-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station
 UTM Location: 475734E, 6343967 N

Site Visit Date: February 8, 2011

<u>Datalogger Details:</u>	
Battery (Main):	-
Datalogger Clock:	-
Laptop Clock:	-
Air Temperature °C:	-
RH (%):	-
Snow Depth (cm):	45.5
Wind Speed (m/s):	-
Wind Direction (deg):	-
Solar Radiation (kw/m ²):	-
Barometric Pressure (kpa):	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	16:18
End Time (MST):	16:21
Station Condition:	Good
Weather:	Clear

General Notes:

Checked snow depth. Collect 2 densities near sensor.

<u>Field Personnel:</u>	BF, SE	<u>Trip Date:</u>	8-Feb-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	24-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station
 UTM Location: 475734E, 6343967 N

Site Visit Date: March 7, 2011

<u>Datalogger Details:</u>	
Battery (Main):	14.2
Datalogger Clock:	14:34
Laptop Clock:	14:32
Air Temperature °C:	-8.5
RH (%):	42.0
Snow Depth (cm):	62.1
Wind Speed (m/s):	7.6
Wind Direction (deg):	238
Solar Radiation (kw/m ²):	0.340
Barometric Pressure (kpa):	-
Precipitation Before (mm):	168.5
Precipitation After (mm):	0.0
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	14:30
End Time (MST):	14:35
Station Condition:	Good
Weather:	Clear, -9 °C

General Notes:

<u>Field Personnel:</u>	BL, JO	<u>Trip Date:</u>	7-Mar-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	22-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station
 UTM Location: 475734E, 6343967 N

Site Visit Date: April 2, 2011

<u>Datalogger Details:</u>	
Battery (Main):	12.8
Datalogger Clock:	7:14
Laptop Clock:	7:12
Air Temperature °C:	-0.2
RH (%):	100.0
Snow Depth (cm):	34.9
Wind Speed (m/s):	1.3
Wind Direction (deg):	145
Solar Radiation (kw/m ²):	0.020
Barometric Pressure (kpa):	-
Precipitation Before (mm):	-
Precipitation After (mm):	175.4
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Dessicant changed.	

<u>Measurement Details:</u>	
Start Time (MST):	8:00
End Time (MST):	8:10
Station Condition:	Good
Weather:	Partly cloudy, -1°C

General Notes:

<u>Field Personnel:</u>	JO, BL	<u>Trip Date:</u>	2-Apr-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	7-Apr-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station
 UTM Location: 475734E, 6343967 N

Site Visit Date: April 21, 2011

<u>Datalogger Details:</u>	
Battery (Main):	14.0
Datalogger Clock:	7:48
Laptop Clock:	7:50
Air Temperature °C:	-3.2
RH (%):	62.2
Snow Depth (cm):	0.6
Wind Speed (m/s):	15.1
Wind Direction (deg):	32
Solar Radiation (kw/m ²):	0.310
Barometric Pressure (kpa):	-
Precipitation Before (mm):	0.0
Precipitation After (mm):	0.0
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	8:40
End Time (MST):	8:50
Station Condition:	Good
Weather:	Partly cloudy

General Notes:

178.1mm accumulated precip. Snow free since 10-Apr-11, last precipitation 12-Apr-11.

<u>Field Personnel:</u>	DB, BL	<u>Trip Date:</u>	21-Apr-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	5-May-11
<u>Data Check Personnel:</u>	JO	<u>Date:</u>	10-May-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station
 UTM Location: 475734E, 6343967 N

Site Visit Date: June 16, 2011

<u>Datalogger Details:</u>	
Battery (Main):	12.7
Datalogger Clock:	7:38
Laptop Clock:	7:36
Air Temperature °C:	13.1
RH (%):	89.9
Snow Depth (cm):	1.2
Wind Speed (m/s):	16.1
Wind Direction (deg):	39
Solar Radiation (kw/m ²):	0.040
Barometric Pressure (kpa):	-
Precipitation Before (mm):	-
Precipitation After (mm):	192.7
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
OS updated to v 22 0845 h: Checked: OK	

<u>Measurement Details:</u>	
Start Time (MST):	8:40
End Time (MST):	8:50
Station Condition:	Good
Weather:	Rain, 14 deg C

General Notes:

<u>Field Personnel:</u>	JO, SM	<u>Trip Date:</u>	16-Jun-11
<u>Data Entry Personnel:</u>	DB	<u>Date:</u>	30-Jun-11
<u>Data Check Personnel:</u>	CM	<u>Date:</u>	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station

UTM Location: 475734E, 6343967 N

Site Visit Date: August 11, 2011



<u>Datalogger Details:</u>	
Battery (Main):	13.2
Datalogger Clock:	12:33
Laptop Clock:	12:35
Air Temperature °C:	22.3
RH (%):	50.0
Snow Depth (cm):	-0.1
Wind Speed (m/s):	11.1
Wind Direction (deg):	21
Solar Radiation (kw/m ²):	0.850
Barometric Pressure (kpa):	-
Precipitation Before (mm):	113.3
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Snow depth was interfered by vegetation; now working well. Pluviol will need antifreeze and hydraulic fluid.	

<u>Measurement Details:</u>	
Start Time (MST):	12:30
End Time (MST):	12:50
Station Condition:	Good
Weather:	Sunny

<u>General Notes:</u>	

<u>Field Personnel:</u>	SM, SG	<u>Trip Date:</u>	11-Aug-11
<u>Data Entry Personnel:</u>	JP	<u>Date:</u>	29-Aug-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station

UTM Location: 475734E, 6343967 N

Site Visit Date: September 23, 2011

<u>Datalogger Details:</u>	
Battery (Main):	13.31
Datalogger Clock:	12:53
Laptop Clock:	12:54
Air Temperature °C:	21.22
RH (%):	45.09
Snow Depth (cm):	-187.42
Wind Speed (m/s):	1.55
Wind Direction (deg):	134.20
Solar Radiation (kw/m ²):	0.35
Barometric Pressure (kpa):	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
SK 50 data very noisy - sensor is functional	

<u>Measurement Details:</u>	
Start Time (MST):	12:54
End Time (MST):	13:10
Station Condition:	good
Weather:	clean

<u>General Notes:</u>	
Added antifreeze to precipitation gauge	

<u>Field Personnel:</u>	SM, GB	<u>Trip Date:</u>	23-Sep-11
<u>Data Entry Personnel:</u>	tk	<u>Date:</u>	28-Sep-11
<u>Data Check Personnel:</u>	DW	<u>Date:</u>	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station

UTM Location: 475734E, 6343967 N

Site Visit Date: October 27, 2011

<u>Datalogger Details:</u>	
Battery (Main):	13.8
Datalogger Clock:	2:09
Laptop Clock:	2:11
Air Temperature °C:	8.2
RH (%):	43.2
Snow Depth (cm):	0.8
Wind Speed (m/s):	20.7
Wind Direction (deg):	257
Solar Radiation (kw/m ²):	0.239
Barometric Pressure (kpa):	-
Precipitation Before (mm):	0.00
Precipitation After (mm):	0.00
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
SR50 is operational, antifreeze level in pluviol is good	

<u>Measurement Details:</u>	
Start Time (MST):	15:09
End Time (MST):	15:30
Station Condition:	ok
Weather:	clear, 7 °C

<u>General Notes:</u>	

<u>Field Personnel:</u>	SM, DW	<u>Trip Date:</u>	27-Oct-11
<u>Data Entry Personnel:</u>	DW	<u>Date:</u>	8-Nov-11
<u>Data Check Personnel:</u>	VS	<u>Date:</u>	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C1 - Aurora Climate Station

UTM Location: 475734E, 6343967 N

Site Visit Date: 28-Nov-11



Datalogger Details:	
Battery (Main):	12.40
Datalogger Clock:	8:08
Laptop Clock:	8:10
Air Temperature °C:	-15.70
RH (%):	79.50
Snow Depth (cm):	11.5
Wind Speed (m/s):	1.98
Wind Direction (deg):	170.00
Solar Radiation (kw/m ²):	0.00
Barometric Pressure (kpa):	-
Precipitation Before (mm):	189.56 (Total)
Precipitation After (mm):	189.56 (Total)
Logger# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	8:05
End Time (MST):	8:20
Station Condition:	good
Weather:	clear, calm

General Notes:
 Pay attention to battery voltage over the next week. May need to be replaced. Precip antifreeze level is good

Field Personnel:	SM, DB	Trip Date:	28-Nov-11
Data Entry Personnel:	DW	Date:	18-Jan-12
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: Jan.17, 2011

<u>Datalogger Details:</u>	
Battery (Main):	12.2
Datalogger Clock:	9:52
Laptop Clock:	9:49
Air Temperature °C:	-31.8
RH (%):	72.7
Snow Depth (cm):	43.1
Wind Speed (m/s):	0.6
Wind Direction (deg):	303
Solar Radiation (kw/m ²):	0.000
Barometric Pressure (kpa):	96.8
Precipitation Before (mm):	230.5
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	9:45
End Time (MST):	10:05
Station Condition:	Heavy rime ice
Weather:	Partly cloudy

General Notes:

All sensors heavily iced.

<u>Field Personnel:</u>	DB, JO	<u>Trip Date:</u>	17-Jan-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	25-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: February 8, 2011

<u>Datalogger Details:</u>	
Battery (Main):	-
Datalogger Clock:	-
Laptop Clock:	-
Air Temperature °C:	-
RH (%):	-
Snow Depth (cm):	45.00
Wind Speed (m/s):	-
Wind Direction (deg):	-
Solar Radiation (kw/m ²):	-
Barometric Pressure (kpa):	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Changed snowdepth sensor. Depth taken with ruler.	

<u>Measurement Details:</u>	
Start Time (MST):	12:45
End Time (MST):	13:15
Station Condition:	Good
Weather:	Clear, -21°C

General Notes:

Snow depth was taken under sensor and two snow density measurements were taken in an undisturbed area outside of the staked area but inside the chain link climate station fence.

<u>Field Personnel:</u>	BL, SE	<u>Trip Date:</u>	8-Feb-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	24-Mar-11
<u>Data Check Personnel:</u>		<u>Date:</u>	

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: March 7, 2011

<u>Datalogger Details:</u>	
Battery (Main):	13.2
Datalogger Clock:	8:58
Laptop Clock:	8:54
Air Temperature °C:	-18.6
RH (%):	67.7
Snow Depth (cm):	60.0
Wind Speed (m/s):	0.3
Wind Direction (deg):	12
Solar Radiation (kw/m ²):	0.200
Barometric Pressure (kpa):	98.7
Precipitation Before (mm):	0.0
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Manual snow depth 54.5cm, dessicant changed.	

<u>Measurement Details:</u>	
Start Time (MST):	8:45
End Time (MST):	9:00
Station Condition:	Good
Weather:	Clear, -23.0 °C

General Notes:

<u>Field Personnel:</u>	BL, JO	<u>Trip Date:</u>	7-Mar-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	22-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: April 3, 2011

Datalogger Details:	
Battery (Main):	13.17
Datalogger Clock:	7:56
Laptop Clock:	7:52
Air Temperature °C:	-1.28
RH (%):	75.60
Snow Depth (cm):	28.21
Wind Speed (m/s):	1.45
Wind Direction (deg):	208
Solar Radiation (kw/m ²):	0.07
Barometric Pressure (kpa):	96.70
Precipitation Before (mm):	-
Precipitation After (mm):	0.00
Logger# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	8:45
End Time (MST):	8:52
Station Condition:	Good
Weather:	Overcast

General Notes:

Snow depth: 30.5cm (manual measurement).

Field Personnel:	JO, BI	Trip Date:	3-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: April 18, 2011

Datalogger Details:	
Battery (Main):	13.4
Datalogger Clock:	7:55
Laptop Clock:	7:51
Air Temperature °C:	-6.0
RH (%):	78.0
Snow Depth (cm):	0.1
Wind Speed (m/s):	1.7
Wind Direction (deg):	65
Solar Radiation (kw/m ²):	0.230
Barometric Pressure (kpa):	96.7
Precipitation Before (mm):	0.0
Precipitation After (mm):	0.0
Logger# (if Δ):	Changed
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	8:45
End Time (MST):	9:50
Station Condition:	Good
Weather:	Light snow, overcast, -6°C

General Notes:

Field Personnel:	JO, BL	Trip Date:	18-Apr-11
Data Entry Personnel:	CM	Date:	5-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: June 22, 2011

Datalogger Details:	
Battery (Main):	13.6
Datalogger Clock:	13:42
Laptop Clock:	13:42
Air Temperature °C:	24.8
RH (%):	34.2
Snow Depth (cm):	17.6
Wind Speed (m/s):	0.7
Wind Direction (deg):	275
Solar Radiation (kw/m ²):	0.813
Barometric Pressure (kpa):	96.2
Precipitation Before (mm):	0.0
Precipitation After (mm):	-
Logger# (if Δ):	
Datalogger / Station Notes:	
Wind, solar radiation, air temp/RH, barometric pressure sensors replaced after lowering tower.	

Measurement Details:	
Start Time (MST):	13:50
End Time (MST):	16:30
Station Condition:	Sensors changed
Weather:	Sunny

General Notes:

Problems obtaining real time precip data after new program installed, but sensor came online after 1hr of leaving the site. C2 now transmitting data daily as before.

Field Personnel:	DB SM	Trip Date:	22-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: August 12, 2011

Datalogger Details:	
Battery (Main):	13.5
Datalogger Clock:	7:45
Laptop Clock:	7:43
Air Temperature °C:	13.4
RH (%):	85.2
Snow Depth (cm):	-0.4
Wind Speed (m/s):	1.9
Wind Direction (deg):	88
Solar Radiation (kw/m ²):	0.149
Barometric Pressure (kpa):	96.4
Precipitation Before (mm):	-474.0
Precipitation After (mm):	-474.0
Logger# (if Δ):	
Datalogger / Station Notes:	
precip bucket was emptied	

Measurement Details:	
Start Time (MST):	7:30
End Time (MST):	8:15
Station Condition:	OK
Weather:	Showers

General Notes:

Field Personnel:	DB, SM	Trip Date:	12-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	31-Aug-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: September 12, 2011

Datalogger Details:	
Battery (Main):	13.92
Datalogger Clock:	8:00
Laptop Clock:	7:58
Air Temperature °C:	9.20
RH (%):	76.20
Snow Depth (cm):	-1.00
Wind Speed (m/s):	1.40
Wind Direction (deg):	25.50
Solar Radiation (kw/m ²):	0.16
Barometric Pressure (kpa):	96.83
Precipitation Before (mm):	0.27
Precipitation After (mm):	86.49
Logger# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	8:45
End Time (MST):	9:10
Station Condition:	ok
Weather:	Overcast, 7C

General Notes:

- Station not operating upon arrival.
- Power cable was disconnected
- blue wire of pressure sensor was disconnected
- both were fixed and system is operational
- antifreeze added to the precip gauge

Field Personnel:	DB, SM	Trip Date:	12-Sep-11
Data Entry Personnel:	CM	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: October 13, 2011

Datalogger Details:	
Battery (Main):	12.6
Datalogger Clock:	7:45
Laptop Clock:	7:41
Air Temperature °C:	-2.3
RH (%):	81.2
Snow Depth (cm):	-1.3
Wind Speed (m/s):	1.8
Wind Direction (deg):	331
Solar Radiation (kw/m ²):	0.205
Barometric Pressure (kpa):	95.1
Precipitation Before (mm):	0.0
Precipitation After (mm):	0.0
Logger# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	7:35
End Time (MST):	8:00
Station Condition:	good
Weather:	overcast, calm, -2°C

General Notes:

- antifreeze level is ok
- SR50 tested and working fine

Field Personnel:	SM, GB	Trip Date:	3-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C2 - Horizon (CNRL) Climate Station

UTM Location: 443364 E, 6360515 N

Site Visit Date: November 29, 2011



<u>Datalogger Details:</u>	
Battery (Main):	12.70
Datalogger Clock:	8:55
Laptop Clock:	8:53
Air Temperature °C:	-0.30
RH (%):	-
Snow Depth (cm):	5.90
Wind Speed (m/s):	3.80
Wind Direction (deg):	16.40
Solar Radiation (kw/m ²):	0.05
Barometric Pressure (kpa):	95.75
Precipitation Before (mm):	166.70
Precipitation After (mm):	169.40
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Ignor precipitation value (2.696) at 9:00 on November 29, 2011	

<u>Measurement Details:</u>	
Start Time (MST):	8:45
End Time (MST):	9:05
Station Condition:	Good
Weather:	Partly Cloudy, 0C

General Notes:
 -Cleaned area surrounding SR50, Snow depth reasonable anyway. Checked leveling of precip gauge, is ok. Added water.
 -Max Batts 18V. Also noticed at 56 + Aurora. Shane says loggers can take 20V. S-panel regulator suspect? Added controler

<u>Field Personnel:</u>			
	SM, DB	Trip Date:	29-Nov-11
Data Entry Personnel:	DW	Date:	3-Jan-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: Jan. 13, 2011

<u>Datalogger Details:</u>	
Battery (Main):	15.5
Datalogger Clock:	10:03
Laptop Clock:	10:03
Air Temperature °C:	-27.4
RH (%):	73.7
Snow Depth (cm):	41.8
Wind Speed (m/s):	7.6
Wind Direction (deg):	350
Solar Radiation (kw/m ²):	0.060
Barometric Pressure (kpa):	99.0
Precipitation Before (mm):	-
Precipitation After (mm):	6.0
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	10:00
End Time (MST):	10:25
Station Condition:	Good
Weather:	Cold, -30°C

General Notes:

Snow depth 50cm, Tare: 0.4oz, Weight 1.35oz
 Snow depth 52cm, Tare: 0.4oz, Weight 1.52oz

<u>Field Personnel:</u>	DB JO	<u>Trip Date:</u>	13-Jan-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	24-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: February 8, 2011

<u>Datalogger Details:</u>	
Battery (Main):	-
Datalogger Clock:	10:05
Laptop Clock:	10:05
Air Temperature °C:	-21.37
RH (%):	82.60
Snow Depth (cm):	46.77
Wind Speed (m/s):	2.06
Wind Direction (deg):	342
Solar Radiation (kw/m ²):	0.15
Barometric Pressure (kpa):	99.40
Precipitation Before (mm):	0.00
Precipitation After (mm):	0.00
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Snow depth 47 cm taken with ruler.	

<u>Measurement Details:</u>	
Start Time (MST):	10:02
End Time (MST):	10:07
Station Condition:	Good
Weather:	Clear

General Notes:

Snow depth measured under sensor. Density measured outside of fence.

<u>Field Personnel:</u>	BL, SE	<u>Trip Date:</u>	8-Feb-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	24-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: March 7, 2011

<u>Datalogger Details:</u>	
Battery (Main):	15.1
Datalogger Clock:	12:58
Laptop Clock:	12:58
Air Temperature °C:	-10.8
RH (%):	56.7
Snow Depth (cm):	60.7
Wind Speed (m/s):	11.7
Wind Direction (deg):	179
Solar Radiation (kw/m ²):	0.450
Barometric Pressure (kpa):	97.7
Precipitation Before (mm):	0.0
Precipitation After (mm):	0.0
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Manual snow depth 0.60m, dessicant changed.	

<u>Measurement Details:</u>	
Start Time (MST):	12:45
End Time (MST):	12:50
Station Condition:	Good
Weather:	Clear, -14°C

General Notes:

<u>Field Personnel:</u>	BL, JO	<u>Trip Date:</u>	7-Mar-11
<u>Data Entry Personnel:</u>	CM	<u>Date:</u>	22-Mar-11
<u>Data Check Personnel:</u>	DB	<u>Date:</u>	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: April 4, 2011

Datalogger Details:	
Battery (Main):	14.6
Datalogger Clock:	11:48
Laptop Clock:	11:47
Air Temperature °C:	9.1
RH (%):	42.0
Snow Depth (cm):	15.6
Wind Speed (m/s):	3.4
Wind Direction (deg):	164
Solar Radiation (kw/m ²):	0.600
Barometric Pressure (kpa):	96.0
Precipitation Before (mm):	-
Precipitation After (mm):	0.0
Logger# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	12:40
End Time (MST):	12:50
Station Condition:	Good
Weather:	Partly cloudy

General Notes:

Manual snow depth: 16.5cm. Road and drainage ditch leading to station under construction.

Field Personnel:	JO, BL	Trip Date:	4-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: April 19, 2011

Datalogger Details:	
Battery (Main):	14.8
Datalogger Clock:	8:10
Laptop Clock:	8:09
Air Temperature °C:	-0.7
RH (%):	52.7
Snow Depth (cm):	1.6
Wind Speed (m/s):	3.0
Wind Direction (deg):	180
Solar Radiation (kw/m ²):	0.270
Barometric Pressure (kpa):	97.5
Precipitation Before (mm):	0.0
Precipitation After (mm):	-
Logger# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	9:10
End Time (MST):	9:15
Station Condition:	Good
Weather:	Clear, -2°C

General Notes:

Field Personnel:	JO, BL	Trip Date:	19-Apr-11
Data Entry Personnel:	CM	Date:	5-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: June 14, 2011

Datalogger Details:	
Battery (Main):	14.3
Datalogger Clock:	8:19
Laptop Clock:	8:21
Air Temperature °C:	19.6
RH (%):	43.9
Snow Depth (cm):	0.5
Wind Speed (m/s):	3.70
Wind Direction (deg):	14
Solar Radiation (kw/m ²):	0.310
Barometric Pressure (kpa):	96.9
Precipitation Before (mm):	-
Precipitation After (mm):	0.0
Logger# (if Δ):	
Datalogger / Station Notes:	
Logger OS updated to v 22: Checked: OK	

Measurement Details:	
Start Time (MST):	9:00
End Time (MST):	9:40
Station Condition:	Good
Weather:	Smoke, 19 deg C

General Notes:

Field Personnel:	JO, SM	Trip Date:	14-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: C3 - Steepbank (Suncor) Climate Station

UTM Location: 473950 E, 6320500 N

Site Visit Date: December 6, 2011



<u>Datalogger Details:</u>	
Battery (Main):	13.29
Datalogger Clock:	9:56
Laptop Clock:	9:59
Air Temperature °C:	-2.37
RH (%):	71.1
Snow Depth (cm):	7.84
Wind Speed (m/s):	5.36
Wind Direction (deg):	249
Solar Radiation (kw/m ²):	0.032
Barometric Pressure (kpa):	96.9
Precipitation Before (mm):	0 (15min)
Precipitation After (mm):	-
Logger# (if Δ):	changed
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	9:54
End Time (MST):	10:25
Station Condition:	Good
Weather:	Partly Cloudy

<u>General Notes:</u>
Installed signal isolator Pakbusa= 13

<u>Field Personnel:</u>	SM, BL	<u>Trip Date:</u>	6-Dec-11
<u>Data Entry Personnel:</u>	DW	<u>Date:</u>	30-Dec-11
<u>Data Check Personnel:</u>	MY	<u>Date:</u>	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: C4 - Pierre Climate Station
 UTM Location: 460853 E, 6378740 N

Site Visit Date: August 14, 2011

Datalogger Details:	
Battery (Main):	13.90
Datalogger Clock:	14:05
Laptop Clock:	14:04
Air Temperature °C:	19.60
RH (%):	83.80
Snow Depth (cm):	-0.42
Wind Speed (m/s):	6.77
Wind Direction (deg):	91.90
Solar Radiation (kw/m ²):	0.66
Barometric Pressure (kpa):	97.30
Precipitation Before (mm):	61.80
Precipitation After (mm):	61.80
Logger# (if Δ):	
Datalogger / Station Notes:	
Geonor was checked, almost empty. (Recent rain was measured OK)	

Measurement Details:	
Start Time (MST):	13:50
End Time (MST):	14:10
Station Condition:	Good
Weather:	Partly Cloudy

General Notes:

Field Personnel:	DB KW	Trip Date:	14-Aug-11
Data Entry Personnel:	JP	Date:	28-Aug-11
Data Check Personnel:	DB	Date:	31-Aug-11

Hydrometric Measurement / Site Visit Record

Site: C4 - Pierre Climate Station
 UTM Location: 460853 E, 6378740 N

Site Visit Date: September 12, 2011

Datalogger Details:	
Battery (Main):	14.57
Datalogger Clock:	10:08
Laptop Clock:	10:08
Air Temperature °C:	11.14
RH (%):	75.70
Snow Depth (cm):	9.20
Wind Speed (m/s):	3.37
Wind Direction (deg):	0.56
Solar Radiation (kw/m ²):	0.15
Barometric Pressure (kpa):	96.25
Precipitation Before (mm):	87.00
Precipitation After (mm):	96.25
Logger# (if Δ):	
Datalogger / Station Notes:	
Explore SR50 Data. Looks noisy. Ground isn't perfectly level. Bring a plate. The offset is correct	

Measurement Details:	
Start Time (MST):	9:50
End Time (MST):	10:15
Station Condition:	Good
Weather:	Drizzle

General Notes:

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	CM	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C4 - Pierre Climate Station
 UTM Location: 460853 E, 6378740 N

Site Visit Date: October 28, 2011

Datalogger Details:	
Battery (Main):	14.26
Datalogger Clock:	12:54
Laptop Clock:	12:54
Air Temperature °C:	2.08
RH (%):	65
Snow Depth (cm):	0.98
Wind Speed (m/s):	0.00
Wind Direction (deg):	N/A
Solar Radiation (kw/m ²):	0.19
Barometric Pressure (kpa):	97.35
Precipitation Before (mm):	5.86
Precipitation After (mm):	5.86
Logger# (if Δ):	
Datalogger / Station Notes:	
Geonor was checked, almost empty. (Recent rain was measured OK)	

Measurement Details:	
Start Time (MST):	13:45
End Time (MST):	14:05
Station Condition:	good
Weather:	clear, calm

General Notes:

antifreeze level is good
 SR50 is operational

Field Personnel:	SM, DW	Trip Date:	28-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C4 - Pierre Climate Station

UTM Location: 460853 E, 6378740 N

Site Visit Date: December 3, 2011



<u>Datalogger Details:</u>	
Battery (Main):	14.57
Datalogger Clock:	12:35
Laptop Clock:	12:55
Air Temperature °C:	-7.50
RH (%):	80.79
Snow Depth (cm):	5.98
Wind Speed (m/s):	5.08
Wind Direction (deg):	67.20
Solar Radiation (kw/m ²):	0.11
Barometric Pressure (kpa):	98.10
Precipitation Before (mm):	-
Precipitation After (mm):	-
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	12:30
End Time (MST):	12:40
Station Condition:	good
Weather:	clear, light breeze

<u>General Notes:</u>

<u>Field Personnel:</u>	SM, SG	<u>Trip Date:</u>	3-Dec-11
<u>Data Entry Personnel:</u>	DW	<u>Date:</u>	18-Jan-12
<u>Data Check Personnel:</u>	MY	<u>Date:</u>	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: C5 Surmount Climate Station

UTM Location: 502,542 E, 6,230,964 N

Site Visit Date: November 8, 2011

<u>Datalogger Details:</u>	
Battery (Main):	14.22
Datalogger Clock:	10:54
Laptop Clock:	10:54
Air Temperature °C:	-0.05
RH (%):	76.6
Snow Depth (cm):	-10.14
Wind Speed (m/s):	8.96
Wind Direction (deg):	301
Solar Radiation (kw/m ²):	0.07
Barometric Pressure (kpa):	94.43
Precipitation Before (mm):	0.00
Precipitation After (mm):	0.00
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	

<u>Measurement Details:</u>	
Start Time (MST):	10:45
End Time (MST):	11:00
Station Condition:	good
Weather:	overcast, light snow, light breeze

General Notes:

-SR50 sensor is still showing -10 cm offset
- program was updated to compensate for the -10 cm offset without success

<u>Field Personnel:</u>	SM, MW	<u>Trip Date:</u>	8-Nov-11
<u>Data Entry Personnel:</u>	DW	<u>Date:</u>	16-Nov-11
<u>Data Check Personnel:</u>	VS	<u>Date:</u>	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: C5 Surmount Climate Station

UTM Location: 502,542 E, 6,230,964 N

Site Visit Date: December 1, 2011

<u>Datalogger Details:</u>	
Battery (Main):	14.50
Datalogger Clock:	11:24
Laptop Clock:	11:24
Air Temperature °C:	-2.40
RH (%):	63.20
Snow Depth (cm):	-8.60
Wind Speed (m/s):	8.40
Wind Direction (deg):	187.00
Solar Radiation (kw/m ²):	0.09
Barometric Pressure (kpa):	94.40
Precipitation Before (mm):	14.79
Precipitation After (mm):	14.79
Logger# (if Δ):	
<u>Datalogger / Station Notes:</u>	
Checked Precip gauge is ok, Actual snow is a few mm, added water - changed real time but not instintaneous data	

<u>Measurement Details:</u>	
Start Time (MST):	11:20
End Time (MST):	11:40
Station Condition:	Good
Weather:	Partly Cloudy

General Notes:

<u>Field Personnel:</u>	SM, DB	<u>Trip Date:</u>	1-Dec-11
<u>Data Entry Personnel:</u>	DW	<u>Date:</u>	18-Jan-12
<u>Data Check Personnel:</u>	MY	<u>Date:</u>	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
UTM Location: 483430 E, 6371950 N

Site Visit Date: January 14, 2011



Datalogger Details:	
Transducer Reading:	0.439
Air Temperature °C:	-28.80
RH (%):	72.80%
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	14.62
Datalogger Clock:	11:55
Laptop Clock:	11:56
Dessicant:	OK
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	
Downloaded to L2 by mistake - check L2.	

Measurement Details:	
Start Time (MST):	11:45
End Time (MST):	12:10
Lake Condition:	Fozen
Weather:	-30°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rod near pluvio etc.	1.238	294.865	1.228	294.865	-
Bench Mark 2:	Pipe near old logger	1.068	294.865	1.055	294.865	-
Top of Ice:		1.622	294.481	1.607	294.486	294.484
Water Level:		1.615	294.488	1.602	294.491	294.490
Transducer Reading:		0.439	294.049	0.439	294.052	294.051
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	14-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
UTM Location: 483430 E, 6371950 N

Site Visit Date: February 12, 2011

Datalogger Details:	
Transducer Reading:	0.711
Air Temperature °C:	-9.78
RH (%):	81.84%
Water Temperature °C:	-0.80
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	14.52
Datalogger Clock:	10:36
Laptop Clock:	10:37
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	10:35
End Time (MST):	10:50
Lake Condition:	Ice
Weather:	Overcast

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rod near pluvio etc.	1.250	294.865	1.230	294.865	-
Bench Mark 2:	Pipe near old logger	1.090	294.865	1.070	294.865	-
Top of Ice:		1.619	294.496	1.597	294.498	294.497
Water Level:		1.594	294.521	1.572	294.523	294.522
Transducer Reading:		0.711	293.810	0.711	293.812	293.811
Other:						

General Notes:

Field Personnel:	BL, SG	Trip Date:	12-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
UTM Location: 483430 E, 6371950 N

Site Visit Date: March 8, 2011

Datalogger Details:	
Transducer Reading:	0.349
Air Temperature °C:	-20.14
RH (%):	84.37%
Water Temperature °C:	-2.70
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	12.92
Datalogger Clock:	7:47
Laptop Clock:	7:48
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	7:40
End Time (MST):	8:40
Lake Condition:	Ice
Weather:	Light Snow

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rod near pluvio etc.	1.385	294.865	1.381	294.865	-
Bench Mark 2:	Pipe near old logger	1.532	294.865	1.528	294.865	-
Top of Ice:		1.720	294.530	1.718	294.528	294.529
Water Level:		1.711	294.539	1.710	294.536	294.538
Transducer Reading:		0.349	294.190	0.349	294.187	294.189
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	8-Mar-11
Data Entry Personnel:	CM	Date:	23-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
 UTM Location: 483430 E, 6371950 N

Site Visit Date: March 31, 2011



Datalogger Details:	
Transducer Reading:	0.721
Air Temperature °C:	8.28
RH (%):	48.50%
Water Temperature °C:	-0.50
Precipitation Before (mm):	0.00
Precipitation After (mm):	0.00
Battery (Main):	14.59
Datalogger Clock:	14:33
Laptop Clock:	14:35
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	15:30
End Time (MST):	16:00
Lake Condition:	Frozen
Weather:	Rain, 8°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	1.235	294.865	1.211	294.865	-
Bench Mark 2:	Pipe near old logger	1.062	294.865	1.042	294.865	-
Top of Ice:		1.549	294.551	1.528	294.548	294.550
Water Level:		1.552	294.548	1.528	294.548	294.548
Transducer Reading:		0.721	293.827	0.721	293.827	293.827
Other:						

Datalogger / Station Notes:
 [Empty box for notes]

General Notes:
 [Empty box for general notes]

Field Personnel:	JO, SG	Trip Date:	31-Mar-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
 UTM Location: 483430 E, 6371950 N

Site Visit Date: April 22, 2011

Datalogger Details:	
Transducer Reading:	0.609
Air Temperature °C:	-0.29
RH (%):	69.58%
Water Temperature °C:	0.00
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	14.85
Datalogger Clock:	10:05
Laptop Clock:	10:05
Dessicant:	OK
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	10:00
End Time (MST):	10:15
Lake Condition:	Frozen
Weather:	Partly cloudy

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	1.174	294.865	1.164	294.865	-
Bench Mark 2:	Pipe near old logger	1.002	294.865	0.991	294.865	-
Top of Ice:						
Water Level:		1.462	294.577	1.452	294.577	294.577
Transducer Reading:		0.609	293.968	0.609	293.968	293.968
Other:						

Datalogger / Station Notes:
 656.7 total accumulation.

General Notes:
 Pluvio = 1/3 full

Field Personnel:	SG, DB	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	5-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
 UTM Location: 483430 E, 6371950 N

Site Visit Date: July 27, 2011

Datalogger Details:	
Transducer Reading:	0.364
Air Temperature °C:	19.89
RH (%):	79.23%
Water Temperature °C:	21.30
Precipitation Before (mm):	742.2mm
Precipitation After (mm):	742.6mm
Battery (Main):	13.67
Datalogger Clock:	14:15
Laptop Clock:	14:17
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	14:30
End Time (MST):	15:30
Lake Condition:	Open
Weather:	Rain

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	1.157	294.865	1.146	294.865	-
Bench Mark 2:	Pipe near old logger	0.986	294.865	0.977	294.865	-
Top of Ice:						
Water Level:		1.561	294.461	1.545	294.466	294.464
Transducer Reading:		0.364	294.097	0.364	294.102	294.100
Other:						

Datalogger / Station Notes:
 New PLS depth: 0.216; replaced HMP

General Notes:
 Added water 15:30; 742.2 --- 742.6mm. Replaced HMP. Storms and rain present during afternoon.

Field Personnel:	DB, SM	Trip Date:	27-Jul-11
Data Entry Personnel:	JP	Date:	5-Aug-11
Data Check Personnel:	DB	Date:	25-Aug-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
 UTM Location: 483430 E, 6371950 N

Site Visit Date: August 13, 2011



Datalogger Details:	
Transducer Reading:	0.328
Air Temperature °C:	24.95
RH (%):	52.05%
Water Temperature °C:	20.6
Precipitation Before (mm):	791.3
Precipitation After (mm):	791.3
Battery (Main):	13.9
Datalogger Clock:	16:05
Laptop Clock:	16:07
Dessiccant:	Replaced
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	17:05
End Time (MST):	-
Lake Condition:	Calm
Weather:	Partly cloudy, light breeze

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	0.960	294.865	0.916	294.865	-
Bench Mark 2:	Pipe near old logger	0.788	294.865	0.746	294.865	-
Top of Ice:						
Water Level:		1.395	294.430	1.350	294.431	294.431
Transducer Reading:		0.328	294.102	0.328	294.103	294.103
Other:						

Datalogger / Station Notes:

General Notes:
 Replaced stilling well. New PLS reading 0.554

Field Personnel:	DB, SM	Trip Date:	13-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	29-Aug-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
 UTM Location: 483430 E, 6371950 N

Site Visit Date: September 15, 2011

Datalogger Details:	
Transducer Reading:	0.448
Air Temperature °C:	12.50
RH (%):	47.50%
Water Temperature °C:	11.90
Precipitation Before (mm):	814.00
Precipitation After (mm):	1009.00
Battery (Main):	14.60
Datalogger Clock:	10:29
Laptop Clock:	10:27
Dessiccant:	replaced
Logger# (if Δ):	-
PT# (if Δ):	-

Measurement Details:	
Start Time (MST):	10:20
End Time (MST):	10:50
Lake Condition:	open
Weather:	partly cloudy

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	0.998	294.865	0.987	294.865	-
Bench Mark 2:	Pipe near old logger	0.827	294.865	0.815	294.865	-
Top of Ice:						
Water Level:		1.529	294.334	1.517	294.335	294.335
Transducer Reading:		0.448	293.886	0.448	293.887	293.887
Other:						

Datalogger / Station Notes:

General Notes:
 Antifreeze was added
 Ignor 10:45-11:00 september 15 data

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	CM	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake
 UTM Location: 483430 E, 6371950 N

Site Visit Date: October 28, 2011

Datalogger Details:	
Transducer Reading:	0.420
Air Temperature °C:	-0.23
RH (%):	78
Water Temperature °C:	4.60
Precipitation Before (mm):	1090
Precipitation After (mm):	1090
Battery (Main):	14.23
Datalogger Clock:	10:30
Laptop Clock:	10:31
Dessiccant:	replaced
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	11:10
End Time (MST):	11:55
Lake Condition:	open, some ice
Weather:	clear, -5°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	0.885	294.865	0.867	294.865	-
Bench Mark 2:	Pipe near old logger	0.717	294.865	0.699	294.865	-
Top of Ice:						
Water Level:		1.444	294.306	1.425	294.307	294.307
Transducer Reading:		0.420	293.886	0.420	293.887	293.887
Other:						

Datalogger / Station Notes:

General Notes:
 Atifreeze level is ok

Field Personnel:	DW, SM	Trip Date:	28-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: L1 - McClelland Lake

UTM Location: 483430 E, 6371950 N

Site Visit Date: December 4, 2011



Datalogger Details:	
Transducer Reading:	0.384
Air Temperature °C:	-9.76
RH (%):	85.46%
Water Temperature °C:	0.8
Precipitation Before (mm):	1100.6
Precipitation After (mm):	-
Battery (Main):	12.66
Datalogger Clock:	10:25
Laptop Clock:	10:27
Dessicant:	good
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	10:20
End Time (MST):	10:40
Lake Condition:	Ice Covered
Weather:	Overcast -10°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rod near pluvio etc.	1.167	294.865	1.152	294.865	-
Bench Mark 2:	Pipe near old logger	1.000	294.865	0.986	294.865	-
Top of Ice:		1.713	294.319	1.703	294.314	294.317
Water Level:		1.727	294.305	1.717	294.300	294.303
Transducer Reading:		0.384	293.921	0.384	293.916	293.919
Other:						

Datalogger / Station Notes:

General Notes:

Field Personnel:	SM, SG	Trip Date:	4-Dec-11
Data Entry Personnel:	SG	Date:	12-Jan-12
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: L2 Kearn Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: January 15, 2011



Datalogger Details:	
Transducer Reading:	0.8850
Air Temperature °C:	-31.20
RH (%):	76.15%
Water Temperature °C:	2.70
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	13.04
Datalogger Clock:	10:40
Laptop Clock:	10:38
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	10:37
End Time (MST):	12:00
Lake Condition:	Frozen
Weather:	-30.0°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.521	333.324	0.512	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.402	332.424	1.398	332.424	-
Top of Ice:		1.975	331.870	1.970	331.866	331.868
Water Level:		1.960	331.885	1.955	331.881	331.883
Transducer Reading:		0.885	331.000	0.885	330.996	330.998
Other:						

General Notes:	
Stadia rod offset by ca 15mm if ≥ 2.10m.	

Field Personnel:	DB, JO	Trip Date:	15-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kearn Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: February 9, 2011

Datalogger Details:	
Transducer Reading:	0.886
Air Temperature °C:	-
RH (%):	60.73%
Water Temperature °C:	2.40
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	15.15
Datalogger Clock:	12:34
Laptop Clock:	12:33
Dessicant:	Good
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	12:30
End Time (MST):	13:00
Lake Condition:	Ice
Weather:	Clear

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.711	333.324	0.685	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.601	332.424	1.573	332.424	-
Top of Ice:		2.167	331.868	2.140	331.869	331.869
Water Level:		2.163	331.872	2.136	331.873	331.873
Transducer Reading:		0.886	330.986	0.886	330.987	330.987
Other:						

General Notes:	
Precipitation bucket frozen.	

Field Personnel:	BL, GB	Trip Date:	9-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kearn Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: March 7, 2011

Datalogger Details:	
Transducer Reading:	0.871
Air Temperature °C:	-8.31
RH (%):	47.60%
Water Temperature °C:	2.20
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	14.99
Datalogger Clock:	15:31
Laptop Clock:	15:29
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	15:30
End Time (MST):	17:30
Lake Condition:	Frozen
Weather:	Clear, -7°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.762	333.324	0.758	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.654	332.424	1.650	332.424	-
Top of Ice:		2.301	331.785	2.298	331.784	331.785
Water Level:		2.241	331.845	2.232	331.850	331.848
Transducer Reading:		0.871	330.974	0.871	330.979	330.977
Other:						

General Notes:	
Areal replaced with 3db yagi pointed ESE towards cell tower.	

Field Personnel:	JO, BL	Trip Date:	7-Mar-11
Data Entry Personnel:	CM	Date:	23-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kears Lake
 UTM Location: 484839 E, 6351065 N

Site Visit Date: April 2, 2011



Datalogger Details:	
Transducer Reading:	0.840
Air Temperature°C:	0.55
RH (%):	93.48%
Water Temperature°C:	2.00
Precipitation Before (mm):	--
Precipitation After (mm):	142
Battery (Main):	14.77
Datalogger Clock:	9:14
Laptop Clock:	9:11
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	--
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	10:15
End Time (MST):	11:00
Lake Condition:	Ice
Weather:	Cloudy

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.799	333.324	0.753	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.650	332.424	1.643	332.424	-
Top of Ice:		2.210	331.873	2.205	331.872	331.873
Water Level:		2.260	331.814	2.253	331.824	331.819
Transducer Reading:		0.840	330.974	0.840	330.984	330.979
Other:						

General Notes:	
HMP 45c (air temp) changed	

Field Personnel:	JO, BL	Trip Date:	2-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	JO	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kears Lake
 UTM Location: 484839 E, 6351065 N

Site Visit Date: April 26, 2011

Datalogger Details:	
Transducer Reading:	0.817
Air Temperature°C:	12.62
RH (%):	31.20%
Water Temperature°C:	2.10
Precipitation Before (mm):	--
Precipitation After (mm):	--
Battery (Main):	14.39
Datalogger Clock:	10:14
Laptop Clock:	10:14
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	--
Datalogger / Station Notes:	
OS installed v 22: Checked: OK	

Measurement Details:	
Start Time (MST):	10:10
End Time (MST):	10:35
Lake Condition:	Frozen
Weather:	Sunny, 10°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.726	333.324	0.711	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.600	332.424	1.585	332.424	-
Top of Ice:		2.220	331.830	2.203	331.832	331.831
Water Level:		0.817	331.013	0.817	331.015	331.014
Transducer Reading:						
Other:						

General Notes:	
No ice measurements, likely due to thin ice. Antenna replaced and moved RSSI -51	

Field Personnel:	OB, SG	Trip Date:	26-Apr-11
Data Entry Personnel:	CM	Date:	5-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kears Lake
 UTM Location: 484839 E, 6351065 N

Site Visit Date: June 24, 2011

Datalogger Details:	
Transducer Reading:	0.729
Air Temperature°C:	19.28
RH (%):	66.10%
Water Temperature°C:	14.10
Precipitation Before (mm):	1.98
Precipitation After (mm):	6.55
Battery (Main):	14.20
Datalogger Clock:	14:42
Laptop Clock:	14:42
Dessicant:	OK
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	
Precipitation before was 1.98mm, then water added to test data output, new reading 6.545 mm	

Measurement Details:	
Start Time (MST):	14:30
End Time (MST):	14:50
Lake Condition:	Open
Weather:	Overcast

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail					
Bench Mark 2:	Rebar in PVC pipe near trees					
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:	
Trip carried out to re-wire in Geonor Precip gauge, and flag-tape benchmarks for possible use by Imperial. No carried out. Data written in field notebook page 9.	

Field Personnel:	DB, SM	Trip Date:	24-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:		Date:	

Hydrometric Measurement / Site Visit Record

Site: L2 Kears Lake
 UTM Location: 484839 E, 6351065 N

Site Visit Date: June 17, 2011

Datalogger Details:	
Transducer Reading:	0.733
Air Temperature°C:	15.9
RH (%):	77%
Water Temperature°C:	13.40
Precipitation Before (mm):	--
Precipitation After (mm):	--
Battery (Main):	14.32
Datalogger Clock:	11:14
Laptop Clock:	11:12
Dessicant:	Good
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	12:00
End Time (MST):	13:30
Lake Condition:	Open
Weather:	Breezy, overcast

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.202	333.324	0.197	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.075	332.424	1.068	332.424	-
Top of Ice:		1.768	331.731	1.758	331.734	331.733
Water Level:		0.733	330.998	0.733	331.001	331.000
Transducer Reading:						
Other:						

General Notes:	

Field Personnel:	JO, SM	Trip Date:	17-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kearsal Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: August 10, 2011



Datalogger Details:	
Transducer Reading:	0.641 0.455
Air Temperature °C:	20.44
RH (%):	58.6%
Water Temperature °C:	15.90
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	14.22
Datalogger Clock:	11:55
Laptop Clock:	11:57
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	11:50
End Time (MST):	12:45
Lake Condition:	Open
Weather:	Sunny

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.374	333.324	0.360	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.245	332.424	1.230	332.424	-
Top of Ice:						
Water Level:		2.020	331.649	2.000	331.654	331.652
Transducer Reading:		0.641	331.008	0.641	331.013	331.011
Other:						

General Notes:	
Exchanged pressure transducer for calibration. Geonor 1/4 full	

Field Personnel:	SM, SG	Trip Date:	10-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kearsal Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: September 14, 2011

Datalogger Details:	
Transducer Reading:	1.000
Air Temperature °C:	15.40
RH (%):	25.90%
Water Temperature °C:	13.20
Precipitation Before (mm):	0.00
Precipitation After (mm):	-100.30
Battery (Main):	14.24
Datalogger Clock:	13.36
Laptop Clock:	13:37
Dessicant:	replaced
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	13:30
End Time (MST):	14:10
Lake Condition:	Open
Weather:	sunny, 10°C, Windy

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.540	333.324	0.530	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.379	332.424	1.370	332.424	-
Top of Ice:						
Water Level:		2.243	331.621	2.238	331.616	331.619
Transducer Reading:		1.000	330.621	1.000	330.616	330.619
Other:						

General Notes:	
GPS setup next to BM2 Antifreeze and Oil added to Geonor for winterization	

Field Personnel:	DB, SM	Trip Date:	14-Sep-11
Data Entry Personnel:	SG	Date:	18-Nov-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kearsal Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: November 5, 2011

Datalogger Details:	
Transducer Reading:	0.927
Air Temperature °C:	-4.08
RH (%):	63.2
Water Temperature °C:	
Precipitation Before (mm):	0.04
Precipitation After (mm):	-
Battery (Main):	14.92
Datalogger Clock:	11:02
Laptop Clock:	11:04
Dessicant:	replaced
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	11:00
End Time (MST):	11:35
Lake Condition:	Ice Cover
Weather:	Clear, Light Breeze

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.330	333.324	0.314	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.205	332.424	1.189	332.424	-
Top of Ice:						
Water Level:		2.070	331.584	2.053	331.585	331.585
Transducer Reading:		0.927	330.657	0.927	330.658	330.658
Other:						

General Notes:	
Pluvio antifreeze level ok BM1 Height 0.31 m BM2 Height 0.47m	

Field Personnel:	SM, GB	Trip Date:	5-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: L2 Kearsal Lake

UTM Location: 484839 E, 6351065 N

Site Visit Date: November 27, 2011

Datalogger Details:	
Transducer Reading:	0.992
Air Temperature °C:	6.12
RH (%):	60.7%
Water Temperature °C:	6.30
Precipitation Before (mm):	0.03
Precipitation After (mm):	-
Battery (Main):	13.03
Datalogger Clock:	10:36
Laptop Clock:	10:38
Dessicant:	replaced
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	10:15
End Time (MST):	11:15
Lake Condition:	Ice, Snow Cover
Weather:	5C, Windy

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar w/flagging by trail	0.262	333.324	0.229	333.324	-
Bench Mark 2:	Rebar in PVC pipe near trees	1.127	332.424	1.104	332.424	-
Top of Ice:						
Water Level:		1.974	331.602	1.951	331.602	331.602
Transducer Reading:		1.984	331.567	1.961	331.567	331.567
Other: Pipe near PVC						

General Notes:	
pH pen water temp 0.0-0.1 C	

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake
 UTM Location: 463305 E, 6342967 N

Site Visit Date: January 18, 2011



Datalogger Details:	
Transducer Reading:	1.150
Air Temperature °C:	-
RH (%):	-
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	-
Datalogger Clock:	15:31
Laptop Clock:	15:46
Dessicant:	OK
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	15:35
End Time (MST):	16:35
Lake Condition:	Frozen
Weather:	Clear, -25°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging		235.903		235.903	-
Bench Mark 2:	Rebar in PVC pipe	0.995	234.506	1.003	234.506	-
Top of Ice:		1.695	233.806	1.700	233.809	233.808
Water Level:		1.688	233.813	1.692	233.817	233.815
Transducer Reading:		1.150	232.663	1.150	232.667	232.665
Other:						

General Notes:	

Field Personnel:	JO, DB	Trip Date:	18-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake
 UTM Location: 463305 E, 6342967 N

Site Visit Date: February 12, 2011

Datalogger Details:	
Transducer Reading:	1.144
Air Temperature °C:	-
RH (%):	-
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	11.34
Datalogger Clock:	13:26
Laptop Clock:	14:06
Dessicant:	Good
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	14:00
End Time (MST):	14:30
Lake Condition:	Ice
Weather:	Partly cloudy

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging	0.577	235.903	0.549	235.903	-
Bench Mark 2:	Rebar in PVC pipe	-	234.506	-	234.506	-
Top of Ice:		2.711	233.769	2.683	233.769	233.769
Water Level:		2.713	233.767	2.687	233.765	233.766
Transducer Reading:		1.144	232.623	1.144	232.621	232.622
Other:						

General Notes:	
Benchmark 2 destroyed, could not use.	

Field Personnel:	BL, SG	Trip Date:	12-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake
 UTM Location: 463305 E, 6342967 N

Site Visit Date: March 9, 2011

Datalogger Details:	
Transducer Reading:	1.099
Air Temperature °C:	-
RH (%):	60.00%
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	11.34
Datalogger Clock:	8:22
Laptop Clock:	8:42
Dessicant:	-
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	8:30
End Time (MST):	9:15
Lake Condition:	Frozen
Weather:	Partly cloudy, -20°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging	0.660	235.903	0.652	235.903	-
Bench Mark 2:	Rebar in PVC pipe	-	234.506	-	234.506	-
Top of Ice:		2.762	233.801	2.760	233.795	233.798
Water Level:		2.788	233.775	2.783	233.772	233.774
Transducer Reading:		1.099	232.677	1.099	232.674	232.675
Other:						

General Notes:	

Field Personnel:	JO, BL	Trip Date:	9-Mar-11
Data Entry Personnel:	CM	Date:	23-Mar-11
Data Check Personnel:	DB	Date:	26-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake
 UTM Location: 463305 E, 6342967 N

Site Visit Date: March 31, 2011



Datalogger Details:	
Transducer Reading:	
Air Temperature °C:	-
RH (%):	-
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	-
Datalogger Clock:	-
Laptop Clock:	-
Dessicant:	-
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	15:00
End Time (MST):	15:00
Lake Condition:	Frozen, water on top
Weather:	

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging		235.903		235.903	-
Bench Mark 2:	Rebar in PVC pipe		234.506		234.506	-
Top of Ice:			234.506		234.506	234.506
Water Level:			234.506		234.506	234.506
Transducer Reading:						
Other:						

Datalogger / Station Notes:

General Notes:
 Sampling aborted due to water on lake and unknown muskeg conditions.

Field Personnel:	JO, SG	Trip Date:	31-Mar-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake
 UTM Location: 463305 E, 6342967 N

Site Visit Date: June 18, 2011

Datalogger Details:	
Transducer Reading:	1.112
Air Temperature °C:	-
RH (%):	-
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	76%
Datalogger Clock:	16:03
Laptop Clock:	16:25
Dessicant:	Changed
Logger# (if Δ):	
PT# (if Δ):	

Measurement Details:	
Start Time (MST):	15:55
End Time (MST):	16:45
Lake Condition:	Open
Weather:	Overcast

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging	0.313	235.903	0.307	235.903	-
Bench Mark 2:	Rebar in PVC pipe	1.708	234.506	1.701	234.506	-
Top of Ice:						
Water Level:		2.435	233.781	2.430	233.780	233.781
Transducer Reading:		1.112	232.669	1.112	232.668	232.669
Other:						

Datalogger / Station Notes:

General Notes:

Field Personnel:	DB, SM	Trip Date:	18-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake
 UTM Location: 463305 E, 6342967 N

Site Visit Date: September 20, 2011

Datalogger Details:		
Transducer Reading:	CR800	lakewood
Air Temperature °C:	-	1.125
RH (%):	-	
Water Temperature °C:	-	
Precipitation Before (mm):	-	
Precipitation After (mm):	-	
Battery (Main):	12.81	11.34
Datalogger Clock:	10:38	8:38
Laptop Clock:	10:38	9:03
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Measurement Details:	
Start Time (MST):	8:50
End Time (MST):	12:10
Lake Condition:	-
Weather:	clear

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging	0.415	235.903	0.393	235.903	-
Bench Mark 2:	Rebar in PVC pipe	1.808	234.506	1.788	234.506	-
Top of Ice:						
Water Level:		2.494	233.820	2.475	233.819	233.820
Transducer Reading:		1.125	232.695	1.125	232.694	232.695
Other:		0.485		0.464		

Datalogger / Station Notes:
 Installed CR800 and 30 m PLS. New logger # 18204

General Notes:
 New BM installed both in tree 1.5 m East of BM1, 12 m SE of logger box.

Field Personnel:	SM, GB	Trip Date:	20-Sep-11
Data Entry Personnel:	tk	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake

UTM Location: 463305 E, 6342967 N

Site Visit Date: October 25, 2011



Datalogger Details:	
Transducer Reading:	1.211
Air Temperature °C:	9.20
RH (%):	-
Water Temperature °C:	-
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	14.35
Datalogger Clock:	14:47
Laptop Clock:	14:47
Dessicant:	replaced
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	15:40
End Time (MST):	16:30
Lake Condition:	thin ice cover
Weather:	clear, 1°C

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging	0.022	235.903	0.057	235.903	-
Bench Mark 2:	Rebar in PVC pipe	1.417	234.506	1.457	234.506	-
Top of Ice:						
Water Level:		2.113	233.812	2.149	233.814	233.813
Transducer Reading:		1.211	232.601	1.211	232.603	232.602
Other:	BM3	0.091		0.127		

General Notes:

re-oriented the solar panel eastward

BM2 Height: 0.04m

Field Personnel:	DW, SM	Trip Date:	25-Oct-11
Data Entry Personnel:	DW, SM	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: L3 - Isadore's Lake

UTM Location: 463305 E, 6342967 N

Site Visit Date: December 7, 2011

Datalogger Details:	
Transducer Reading:	1.166
Air Temperature °C:	-
RH (%):	-
Water Temperature °C:	5.10
Precipitation Before (mm):	-
Precipitation After (mm):	-
Battery (Main):	13.18
Datalogger Clock:	11:50
Laptop Clock:	11:50
Dessicant:	replaced
Logger# (if Δ):	
PT# (if Δ):	
Datalogger / Station Notes:	

Measurement Details:	
Start Time (MST):	11:45
End Time (MST):	12:00
Lake Condition:	Ice
Weather:	Clear, windy -14

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree root w/orange flagging		235.903		235.903	-
Bench Mark 2:	Rebar in PVC pipe	1.444	234.506	1.432	234.506	-
Top of Ice:		2.153	233.750	2.142	233.761	233.756
Water Level:		2.175	233.728	2.163	233.740	233.734
Transducer Reading:		1.166	232.562	1.166	232.574	232.568
Other:	bolt in tree	0.117		0.106		

General Notes:

Field Personnel:	SM, BL	Trip Date:	7-Dec-11
Data Entry Personnel:	DW	Date:	30-Dec-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: January 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0.00	0.00	0.00	0.000	0.000	0.000	0.9	0.00	0.68	0.67	0.10	0.013	0.011	0.07	0.001	1%
1	1.35	0.65	0.25	0.050			0.9	0.68	1.58	0.90	0.40	0.050	0.045	0.36	0.016	22%
2	1.80	0.72	0.25	0.022			0.9	1.58	2.05	0.48	0.47	0.022	0.020	0.22	0.004	6%
3	2.30	0.78	0.20	0.019			0.9	2.05	2.60	0.55	0.58	0.019	0.017	0.32	0.005	7%
4	2.90	0.90	0.30	0.025			0.9	2.90	3.15	0.55	0.60	0.025	0.023	0.33	0.007	10%
5	3.40	0.92	0.31	0.031			0.9	3.15	3.60	0.45	0.61	0.031	0.028	0.27	0.008	10%
6	3.80	0.88	0.33	0.023			0.9	3.60	4.00	0.40	0.55	0.023	0.021	0.22	0.005	6%
7	4.20	0.82	0.35	0.025			0.9	4.00	4.38	0.38	0.47	0.025	0.023	0.18	0.004	5%
8	4.55	0.00	0.00	0.000			1.0	4.38	4.78	0.40	0.12	0.000	0.000	0.05	0.000	0%
9	5.00	0.72	0.33	0.025			0.9	4.78	5.28	0.50	0.39	0.025	0.023	0.20	0.004	6%
10	5.55	0.73	0.33	0.013			0.9	5.28	5.78	0.50	0.40	0.013	0.012	0.20	0.002	3%
11	6.00	0.70	0.32	0.011			0.9	5.78	6.20	0.43	0.38	0.011	0.010	0.16	0.002	2%
12	6.40	0.68	0.35	0.017			0.9	6.20	6.60	0.40	0.33	0.017	0.015	0.13	0.002	3%
13	6.80	0.60	0.30	0.026			0.9	6.60	6.98	0.38	0.30	0.026	0.023	0.11	0.003	4%
14	7.15	0.55	0.30	0.036			0.9	6.98	7.35	0.38	0.25	0.036	0.032	0.09	0.003	4%
15	7.55	0.50	0.30	0.031			0.9	7.35	7.78	0.43	0.20	0.031	0.028	0.09	0.002	3%
16	8.00	0.45	0.20	0.031			0.9	7.78	8.50	0.73	0.25	0.031	0.028	0.18	0.005	7%
Right	9.00	0.00	0.00	0.000	0.000	0.000	1.0	8.50	9.00	0.50	0.06	0.008	0.008	0.03	0.000	0%
Total Flow															0.074	

Measurement Details:

Start Time (MST):	14:20
End Time (MST):	15:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	-31°C Overcast

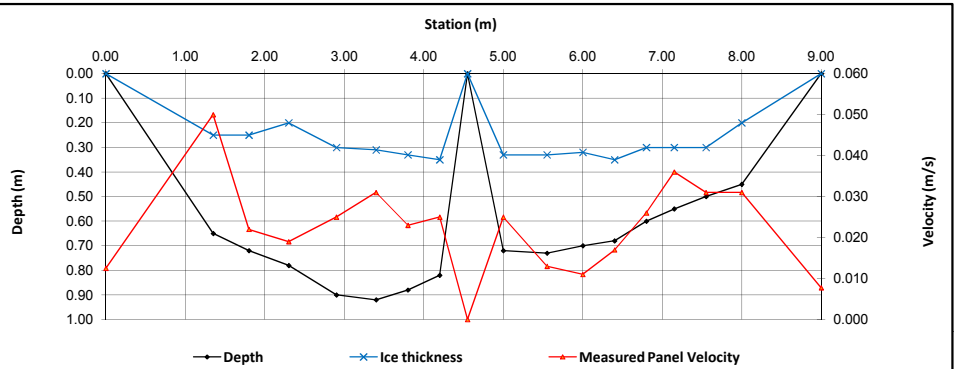
Flow characteristics:

Total Flow:	0.074	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	3.21	(m ²)
Wetted Width:	9.00	(m)
Hydraulic Depth:	0.357	(m)
Mean Velocity:	0.023	(m/s)
Froude Number:	0.012	

Datalogger Details:

	Before	After
Transducer Reading:		0.431
Battery (Main):	14.4	
Battery (Local):	4.61	
Datalogger Clock:	14:21	
Laptop Clock:	14:30	
Air Temperature °C:	-31.00	
Air Pressure:	-	
RH:	-	
Water °C:	0.08	
Memory Used:	31%	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	1.750	297.990	1.732	297.990	-
Bench Mark 2:	T-post w/pink flagging	1.002	298.069	0.988	298.069	-
Top of Ice:		1.920	297.151	1.909	297.148	297.150
Water Level:		2.003	297.068	1.982	297.075	297.072
Transducer Reading:		0.431	296.637	0.431	296.644	296.641
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	15-Jan-11
Data Entry Personnel:	SG	Date:	24-Jan-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: February 9, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	1.90	0.00	0.00	0.000	0.000	0.000	0.9	1.90	2.08	0.18	0.03	0.000	0.000	0.00	0.000	0%
1	2.25	0.50	0.40	0.001			0.9	2.08	2.45	0.38	0.10	0.001	0.001	0.04	0.000	0%
2	2.65	0.60	0.45	0.009			0.9	2.45	2.83	0.38	0.15	0.009	0.008	0.06	0.000	1%
3	3.00	0.70	0.40	0.017			0.9	2.83	3.20	0.38	0.30	0.017	0.015	0.11	0.002	4%
4	3.40	0.80	0.50	0.010			0.9	3.20	3.60	0.40	0.30	0.010	0.009	0.12	0.001	3%
5	3.80	0.90	0.45	0.010			0.9	3.60	3.95	0.35	0.45	0.010	0.009	0.16	0.001	3%
6	4.10	0.95	0.45	0.015			0.9	3.95	4.18	0.23	0.50	0.015	0.014	0.11	0.002	4%
7	4.25	0.95	0.45	0.014			0.9	4.18	4.35	0.18	0.50	0.014	0.013	0.09	0.001	3%
8	4.45	1.00	0.45	0.015			0.9	4.35	4.55	0.20	0.55	0.015	0.014	0.11	0.001	4%
9	4.65	1.00	0.45	0.015			0.9	4.55	4.78	0.23	0.55	0.015	0.014	0.12	0.002	4%
10	4.90	1.10	0.40	0.012			0.9	4.78	4.98	0.20	0.70	0.012	0.011	0.14	0.002	4%
11	5.05	1.00	0.40	0.016			0.9	4.98	5.18	0.20	0.60	0.016	0.014	0.12	0.002	4%
12	5.30	1.10	0.45	0.018			0.9	5.18	5.35	0.18	0.65	0.018	0.016	0.11	0.002	4%
13	5.40	1.15	0.45	0.025			0.9	5.35	5.50	0.15	0.70	0.025	0.023	0.11	0.002	6%
14	5.60	1.10	0.40	0.021			0.9	5.50	5.70	0.20	0.70	0.021	0.019	0.14	0.003	6%
15	5.80	1.10	0.40	0.022			0.9	5.70	5.93	0.23	0.70	0.022	0.020	0.16	0.003	8%
16	6.05	1.10	0.40	0.030			0.9	5.93	6.15	0.23	0.70	0.030	0.027	0.16	0.004	10%
17	6.25	1.05	0.40	0.020			0.9	6.15	6.38	0.23	0.65	0.020	0.018	0.15	0.003	6%
18	6.50	1.00	0.45	0.019			0.9	6.38	6.58	0.20	0.55	0.019	0.017	0.11	0.002	5%
19	6.65	1.00	0.45	0.031			0.9	6.58	6.83	0.25	0.55	0.031	0.028	0.14	0.004	9%
20	7.00	0.90	0.50	0.030			0.9	6.83	7.18	0.35	0.40	0.030	0.027	0.14	0.004	9%
21	7.35	0.80	0.45	0.002			0.9	7.18	7.55	0.38	0.35	0.002	0.002	0.13	0.000	1%
22	7.75	0.60	0.45	0.002			0.9	7.55	7.93	0.38	0.15	0.002	0.002	0.06	0.000	0%
23	8.10	0.70	0.50	0.019			0.9	7.93	8.30	0.38	0.20	0.019	0.017	0.08	0.001	3%
24	8.50	0.40	0.50	0.016			0.9	8.30	8.65	0.35	-0.10	0.016	0.014	-0.04	-0.001	-1%
25	8.80	0.50	0.50	0.012			0.9	8.65	9.00	0.35	0.00	0.012	0.011	0.00	0.000	0%
26	9.20	0.50	0.50	0.029			0.9	9.00	9.45	0.45	0.00	0.029	0.026	0.00	0.000	0%
27	9.70	0.50	0.40	0.000			1.0	9.45	10.10	0.65	0.10	0.000	0.000	0.07	0.000	0%
Right	10.50	0.00	0.00	0.000	0.000	0.000	1.0	10.10	10.50	0.40	0.03	0.000	0.000	0.01	0.000	0%
Total Flow															0.041	

Measurement Details:

Start Time (MST):	16:20
End Time (MST):	17:20
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	-27°C Clear

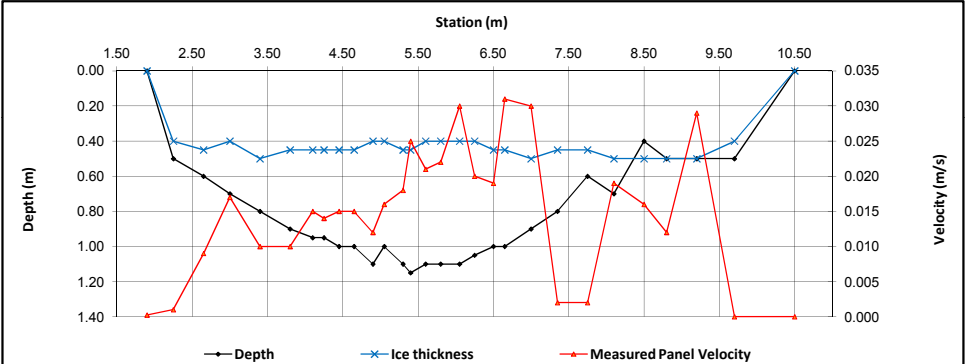
Flow characteristics:

Total Flow:	0.041	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	2.69	(m ²)
Wetted Width:	8.60	(m)
Hydraulic Depth:	0.313	(m)
Mean Velocity:	0.015	(m/s)
Froude Number:	0.009	

Datalogger Details:

	Before	After
Transducer Reading:		0.390
Battery (Main):	13.72	
Battery (Aux):	4.65	
Datalogger Clock:	16:25	
Laptop Clock:	16:37	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.06	
Memory Used:	35%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar in PVC Pipe	1.039	297.990	1.011	297.990	-
Bench Mark 2:	T-post w/pink flagging	0.939	298.069	0.911	298.069	-
Top of Ice:		1.895	297.113	1.870	297.110	297.112
Water Level:		1.972	297.036	1.948	297.032	297.034
Transducer Reading:		0.390	296.646	0.390	296.642	296.644
Other:						

General Notes:

Field Personnel:	BL, GB	Trip Date:	9-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	31-Mar-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: March 12, 2011



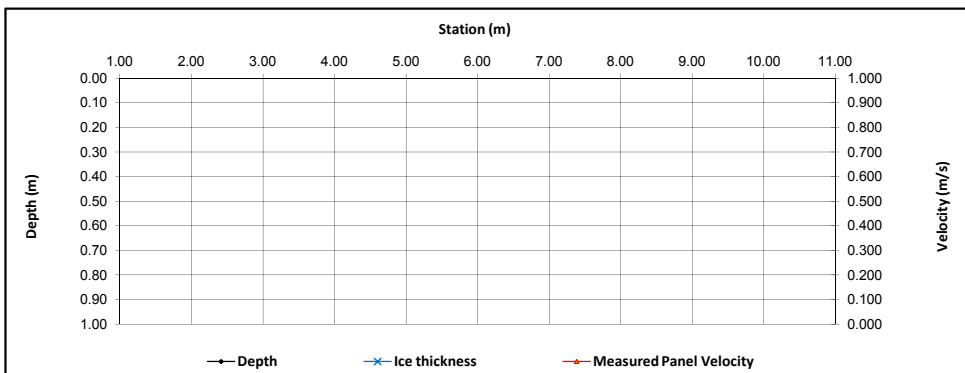
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	12:25
End Time (MST):	13:25
Equipment:	ADV
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	-6°C, Partly Sunny

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		0.351
Battery (Main):	4.71	
Battery (Aux):	14.09	
Datalogger Clock:	12:14	
Laptop Clock:	12:29	
Air Temperature °C:	-6	
Air Pressure:	-	
RH:	-	
Water °C:	0.06	
Memory Used:	41%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	1.132	297.990	1.127	297.990	-
Bench Mark 2:	T-post w/pink flagging	1.030	298.069	1.024	298.069	-
Top of Ice:		1.812	297.287	1.806	297.287	297.287
Water Level:		2.100	296.999	2.095	296.998	296.999
Transducer Reading:		0.351	296.648	0.351	296.647	296.648
Other:						

General Notes:
 4 holes drilled upstream (now under bridge) of last transect, but 3 were dry. 1 filled up with water but water depth was less than 10cm deep under ice. No reliable velocity possible in this hole (three attempts were all negative). Tried another hole in river centre, downstream of previous transects and towards station, but this was also dry. Similar observations to March 18 2006, also effectively dry.

Field Personnel:	DB, GB	Trip Date:	12-Mar-11
Data Entry Personnel:	DB	Date:	17-Mar-11
Data Check Personnel:	CM	Date:	7-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: April 2, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	15:10
End Time (MST):	15:30
Equipment:	ADV
Method:	-
River Condition:	Open/Ice
Quality/Error (see reverse):	-
Weather:	3°C, snow showers

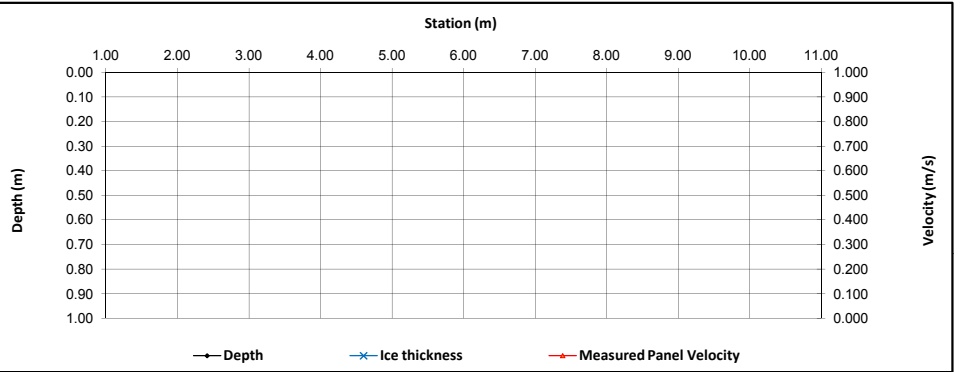
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.399
Battery (Main):	13.99	
Battery (Aux):	4.71	
Datalogger Clock:	14:02	
Laptop Clock:	14:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.14	
Memory Used:	44%	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	1.212	297.990	1.180	297.990	-
Bench Mark 2:	T-post w/pink flagging	1.108	298.069	1.075	298.069	-
Top of Ice:		2.132	297.045	2.102	297.042	297.044
Water Level:		2.118	297.059	2.082	297.062	297.061
Transducer Reading:		0.399	296.660	0.399	296.663	296.662
Other:						

General Notes:

Flow measurements not conducted due to poor ice conditions and open leads upstream and downstream of site.

Field Personnel:	JO, BL	Trip Date:	2-Apr-11
Data Entry Personnel:	CM	Date:	6-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: April 21, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
27							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	10:50
End Time (MST):	11:10
Equipment:	ADV
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Partly sunny, 3°C

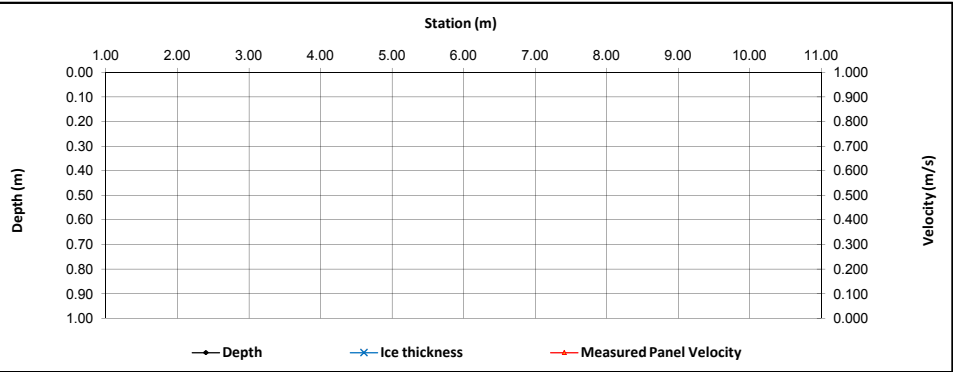
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:		

Datalogger Details:

	Before	After
Transducer Reading:		0.675
Battery (Main):	14.07	
Battery (Aux):	-	
Datalogger Clock:	10:58	
Laptop Clock:	11:12	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.14	
Memory Used:	48%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	1.135	297.990	1.128	297.990	-
Bench Mark 2:	T-post w/pink flagging	1.038	298.069	1.029	298.069	-
Top of Ice:						
Water Level:		1.763	297.362	1.751	297.367	297.365
Transducer Reading:		0.675	296.687	0.675	296.692	296.689
Other:						

General Notes:

No flow measurements, no open spots available for cross section.

Field Personnel:	DB, BL	Trip Date:	21-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: June 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	0.03	0.02	0.04	0.033	0.033	0.00	0.000	0%
1	0.05	0.16		0.132			1.0	0.03	0.28	0.25	0.16	0.132	0.132	0.04	0.005	2%
2	0.50	0.16		0.127			1.0	0.28	0.75	0.48	0.16	0.127	0.127	0.08	0.010	4%
3	1.00	0.14		0.100			1.0	0.75	1.25	0.50	0.14	0.100	0.100	0.07	0.007	3%
4	1.50	0.22		0.164			1.0	1.25	1.75	0.50	0.22	0.164	0.164	0.11	0.018	8%
5	2.00	0.26		0.136			1.0	1.75	2.25	0.50	0.26	0.136	0.136	0.13	0.018	8%
6	2.50	0.34		0.063			1.0	2.25	2.75	0.50	0.34	0.063	0.063	0.17	0.011	5%
7	3.00	0.39		0.062			1.0	2.75	3.25	0.50	0.39	0.062	0.062	0.20	0.012	5%
8	3.50	0.42		0.091			1.0	3.25	3.75	0.50	0.42	0.091	0.091	0.21	0.019	9%
9	4.00	0.39		0.116			1.0	3.75	4.25	0.50	0.39	0.116	0.116	0.20	0.023	10%
10	4.50	0.49		0.101			1.0	4.25	4.75	0.50	0.49	0.101	0.101	0.25	0.025	11%
11	5.00	0.50		0.093			1.0	4.75	5.25	0.50	0.50	0.093	0.093	0.25	0.023	10%
12	5.50	0.50		0.067			1.0	5.25	5.75	0.50	0.50	0.067	0.067	0.25	0.017	8%
13	6.00	0.56		0.052			1.0	5.75	6.25	0.50	0.56	0.052	0.052	0.28	0.015	7%
14	6.50	0.54		0.034			1.0	6.25	6.75	0.50	0.54	0.034	0.034	0.27	0.009	4%
15	7.00	0.42		0.030			1.0	6.75	7.25	0.50	0.42	0.030	0.030	0.21	0.006	3%
16	7.50	0.36		0.019			1.0	7.25	7.75	0.50	0.36	0.019	0.019	0.18	0.003	2%
17	8.00	0.30		0.018			1.0	7.75	8.25	0.50	0.30	0.018	0.018	0.15	0.003	1%
18	8.50	0.22		-0.001			1.0	8.25	8.75	0.50	0.22	-0.001	-0.001	0.11	0.000	0%
19	9.00	0.17		-0.001			1.0	8.75	9.25	0.50	0.17	-0.001	-0.001	0.09	0.000	0%
LB	9.50	0.00	0.00	0.000	0.000	0.000	1.0	9.25	9.50	0.25	0.04	0.000	0.000	0.01	0.000	0%
Total Flow															0.223	

Measurement Details:

Start Time (MST):	13:30
End Time (MST):	14:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Rain, 14 deg C

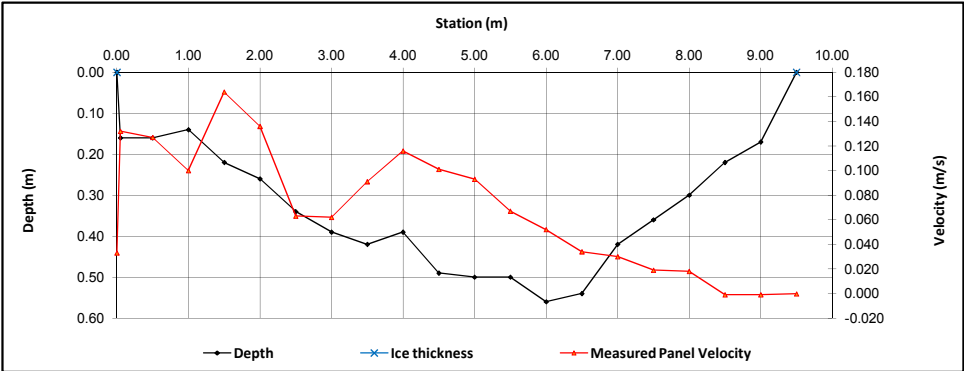
Flow characteristics:

Total Flow:	0.223	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.24	(m ²)
Wetted Width:	9.50	(m)
Hydraulic Depth:	0.341	(m)
Mean Velocity:	0.069	(m/s)
Froude Number:	0.038	

Datalogger Details:

	Before	After
Transducer Reading:		0.080
Battery (Main):	13.84	
Battery (Aux):	-	
Datalogger Clock:	12:17	
Laptop Clock:	12:28	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	16.36	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	0.758	297.990	0.750	297.990	-
Bench Mark 2:	T-post w/pink flagging	0.661	298.069	0.651	298.069	-
Top of Ice:						
Water Level:		1.885	296.845	1.880	296.840	296.843
Transducer Reading:		0.080	296.765	0.080	296.760	296.763
Other:						

General Notes:

Field Personnel:	JO, SM	Trip Date:	16-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	27-Jun-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: August 11, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	6.20	0.00	0.00	0.000	0.000	0.000	1.0	6.20	6.60	0.40	0.02	0.000	0.000	0.01	0.000	0%
1	7.00	0.08		0.000			1.0	6.60	7.25	0.65	0.08	0.000	0.000	0.05	0.000	0%
2	7.50	0.14		0.007			1.0	7.25	7.75	0.50	0.14	0.007	0.007	0.07	0.000	1%
3	8.00	0.14		0.024			1.0	7.75	8.10	0.35	0.14	0.024	0.024	0.05	0.001	3%
4	8.20	0.12		0.068			1.0	8.10	8.30	0.20	0.12	0.068	0.068	0.02	0.002	5%
5	8.40	0.16		0.052			1.0	8.30	8.50	0.20	0.16	0.052	0.052	0.03	0.002	5%
6	8.60	0.19		0.092			1.0	8.50	8.70	0.20	0.19	0.092	0.092	0.04	0.003	10%
7	8.80	0.16		0.049			1.0	8.70	8.90	0.20	0.16	0.049	0.049	0.03	0.002	5%
8	9.00	0.16		0.031			1.0	8.90	9.10	0.20	0.16	0.031	0.031	0.03	0.001	3%
9	9.20	0.16		0.058			1.0	9.10	9.30	0.20	0.16	0.058	0.058	0.03	0.002	5%
10	9.40	0.15		0.121			1.0	9.30	9.50	0.20	0.15	0.121	0.121	0.03	0.004	11%
11	9.60	0.15		0.142			1.0	9.50	9.70	0.20	0.15	0.142	0.142	0.03	0.004	12%
12	9.80	0.15		0.070			1.0	9.70	9.90	0.20	0.15	0.070	0.070	0.03	0.002	6%
13	10.00	0.16		0.001			1.0	9.90	10.10	0.20	0.16	0.001	0.001	0.03	0.000	0%
14	10.20	0.12		0.099			1.0	10.10	10.30	0.20	0.12	0.099	0.099	0.02	0.002	7%
15	10.40	0.12		0.106			1.0	10.30	10.50	0.20	0.12	0.106	0.106	0.02	0.003	7%
16	10.60	0.15		0.101			1.0	10.50	10.70	0.20	0.15	0.101	0.101	0.03	0.003	9%
17	10.80	0.13		0.002			1.0	10.70	10.90	0.20	0.13	0.002	0.002	0.03	0.000	0%
18	11.00	0.10		0.082			1.0	10.90	11.15	0.25	0.10	0.082	0.082	0.03	0.002	6%
19	11.30	0.12		0.034			1.0	11.15	11.45	0.30	0.12	0.034	0.034	0.04	0.001	4%
20	11.60	0.11		0.001			1.0	11.45	11.85	0.40	0.11	0.001	0.001	0.04	0.000	0%
RB	12.10	0.00	0.00	0.000	0.000	0.000	1.0	11.70	12.10	0.40	0.03	0.000	0.000	0.01	0.000	0%
Total Flow														0.034		

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	14:15
Equipment:	ADV
Method:	Wading
River Condition:	Open, Low
Quality/Error (see reverse):	Good
Weather:	Sunny, 20°C

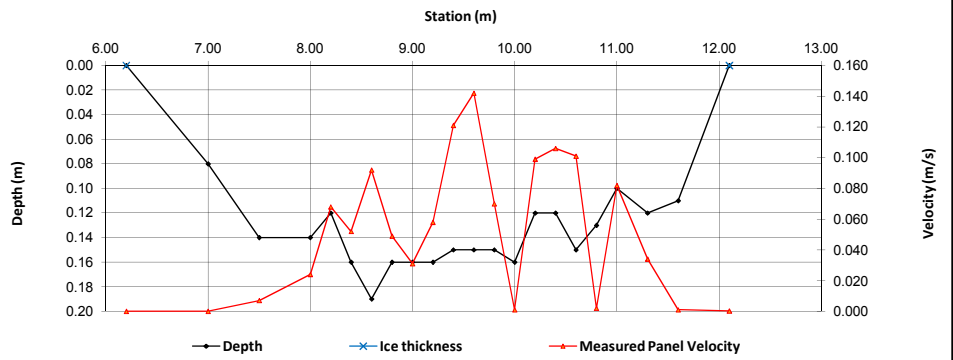
Flow characteristics:

Total Flow:	0.034	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.71	(m ²)
Wetted Width:	5.90	(m)
Hydraulic Depth:	0.121	(m)
Mean Velocity:	0.048	(m/s)
Froude Number:	0.044	

Datalogger Details:

	Before	After
Transducer Reading:	0.026	0.485
Battery (Main):	13.34	13.98
Battery (Aux):	4.78	-
Datalogger Clock:	12:48	14:09
Laptop Clock:	13:04	14:09
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	18.3	19.0
Memory Used:	68%	0%
Dessicant:	Changed	New
Logger# (if Δ):	14568	
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	0.727	297.990	0.706	297.990	-
Bench Mark 2:	T-post w/pink flagging	0.629	298.069	0.609	298.069	-
Top of Ice:						
Water Level:		1.999	296.718	1.978	296.718	296.718
Transducer Reading:		0.026	296.692	0.026	296.692	296.692
Other:						

General Notes:

New CR800 datalogger installed.

Field Personnel:	SM SG	Trip Date:	11-Aug-11
Data Entry Personnel:	DB	Date:	23-Aug-11
Data Check Personnel:	JP	Date:	29-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: September 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	6.60	0.00	0.00	0.000	0.000	0.000	1.0	6.60	6.90	0.30	0.03	-0.001	-0.001	0.01	0.000	0%
1	7.20	0.11		-0.005			1.0	6.90	7.40	0.50	0.11	-0.005	-0.005	0.06	0.000	0%
2	7.60	0.14		0.024			1.0	7.40	7.80	0.40	0.14	0.024	0.024	0.06	0.001	2%
3	8.00	0.12		0.043			1.0	7.80	8.20	0.40	0.12	0.043	0.043	0.05	0.002	4%
4	8.40	0.15		0.090			1.0	8.20	8.50	0.30	0.15	0.090	0.090	0.05	0.004	7%
5	8.60	0.13		0.131			1.0	8.50	8.70	0.20	0.13	0.131	0.131	0.03	0.003	6%
6	8.80	0.14		0.116			1.0	8.70	8.90	0.20	0.14	0.116	0.116	0.03	0.003	6%
7	9.00	0.16		0.093			1.0	8.90	9.10	0.20	0.16	0.093	0.093	0.03	0.003	5%
8	9.20	0.19		0.066			1.0	9.10	9.30	0.20	0.19	0.066	0.066	0.04	0.003	4%
9	9.40	0.15		0.084			1.0	9.30	9.50	0.20	0.15	0.084	0.084	0.03	0.003	4%
10	9.60	0.16		0.124			1.0	9.50	9.70	0.20	0.16	0.124	0.124	0.03	0.004	7%
11	9.80	0.15		0.131			1.0	9.70	9.90	0.20	0.15	0.131	0.131	0.03	0.004	7%
12	10.00	0.13		0.118			1.0	9.90	10.10	0.20	0.13	0.118	0.118	0.03	0.003	5%
13	10.20	0.16		0.065			1.0	10.10	10.30	0.20	0.16	0.065	0.065	0.03	0.002	4%
14	10.40	0.17		0.129			1.0	10.30	10.50	0.20	0.17	0.129	0.129	0.03	0.004	8%
15	10.60	0.17		0.086			1.0	10.50	10.70	0.20	0.17	0.086	0.086	0.03	0.003	5%
16	10.80	0.16		0.131			1.0	10.70	10.90	0.20	0.16	0.131	0.131	0.03	0.004	7%
17	11.00	0.15		0.084			1.0	10.90	11.10	0.20	0.15	0.084	0.084	0.03	0.003	4%
18	11.20	0.18		0.079			1.0	11.10	11.40	0.30	0.18	0.079	0.079	0.05	0.004	8%
19	11.60	0.15		0.049			1.0	11.40	11.80	0.40	0.15	0.049	0.049	0.06	0.003	5%
20	12.00	0.14		0.010			1.0	11.80	12.25	0.45	0.14	0.010	0.010	0.06	0.001	1%
RB	12.50	0.00	0.00	0.000	0.000	0.000	1.0	12.00	12.50	0.50	0.04	0.003	0.003	0.02	0.000	0%
Total Flow														0.057		

Measurement Details:

Start Time (MST):	14:45
End Time (MST):	15:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	-

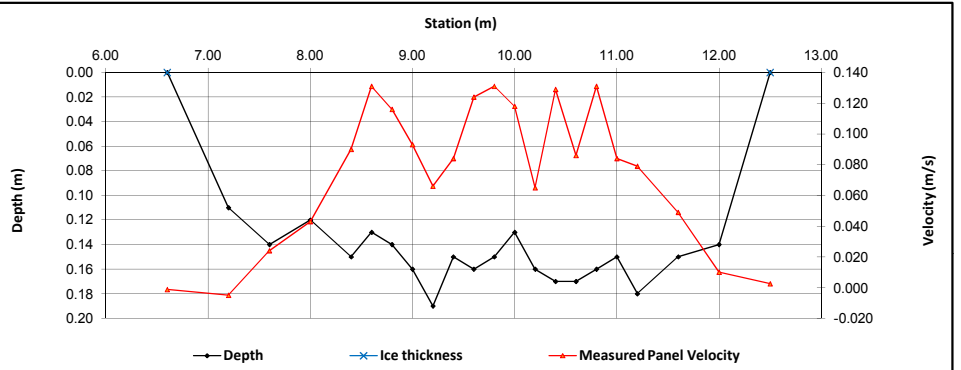
Flow characteristics:

Total Flow:	0.057	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.81	(m ²)
Wetted Width:	5.90	(m)
Hydraulic Depth:	0.138	(m)
Mean Velocity:	0.070	(m/s)
Froude Number:	0.060	

Datalogger Details:

	Before	After
Transducer Reading:	0.506	
Battery (Main):	14.19	
Battery (Aux):	-	
Datalogger Clock:	13:47	
Laptop Clock:	13:47	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	12.10	
Memory Used:	-	
Dessicant:	Replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	0.657	297.990	0.642	297.990	-
Bench Mark 2:	T-post w/pink flagging	0.557	298.069	0.546	298.069	-
Top of Ice:						
Water Level:		1.930	296.717	1.915	296.717	296.717
Transducer Reading:		0.506	296.211	0.506	296.211	296.211
Other:						

General Notes:

Field Personnel:	SM GB	Trip Date:	22-Sep-11
Data Entry Personnel:	DB	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: October 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	3.10	0.00	0.00	0.000	0.000	0.000	1.0	3.10	3.30	0.20	0.06	0.000	0.000	0.01	0.000	0%
1	3.50	0.22		-0.001			1.0	3.30	3.75	0.45	0.22	-0.001	-0.001	0.10	0.000	0%
2	4.00	0.25		0.000			1.0	3.75	4.25	0.50	0.25	0.000	0.000	0.13	0.000	0%
3	4.50	0.21		0.008			1.0	4.25	4.75	0.50	0.21	0.008	0.008	0.11	0.001	1%
4	5.00	0.17		0.014			1.0	4.75	5.25	0.50	0.17	0.014	0.014	0.09	0.001	1%
5	5.50	0.36		0.014			1.0	5.25	5.75	0.50	0.36	0.014	0.014	0.18	0.003	2%
6	6.00	0.36		0.023			1.0	5.75	6.25	0.50	0.36	0.023	0.023	0.18	0.004	4%
7	6.50	0.33		0.025			1.0	6.25	6.75	0.50	0.33	0.025	0.025	0.17	0.004	4%
8	7.00	0.33		0.025			1.0	6.75	7.25	0.50	0.33	0.025	0.025	0.17	0.004	4%
9	7.50	0.35		0.028			1.0	7.25	7.75	0.50	0.35	0.028	0.028	0.18	0.005	4%
10	8.00	0.25		0.028			1.0	7.75	8.25	0.50	0.25	0.028	0.028	0.13	0.004	3%
11	8.50	0.22		0.061			1.0	8.25	8.75	0.50	0.22	0.061	0.061	0.11	0.007	6%
12	9.00	0.22		0.072			1.0	8.75	9.13	0.38	0.22	0.072	0.072	0.08	0.006	5%
13	9.25	0.27		0.058			1.0	9.13	9.38	0.25	0.27	0.058	0.058	0.07	0.004	3%
14	9.50	0.27		0.089			1.0	9.38	9.63	0.25	0.27	0.089	0.089	0.07	0.006	5%
15	9.75	0.27		0.117			1.0	9.63	9.88	0.25	0.27	0.117	0.117	0.07	0.008	7%
16	10.00	0.22		0.093			1.0	9.88	10.25	0.38	0.22	0.093	0.093	0.08	0.008	7%
18	10.50	0.15		0.082			1.0	10.25	10.63	0.38	0.15	0.082	0.082	0.06	0.005	4%
19	10.75	0.15		0.146			1.0	10.63	10.88	0.25	0.15	0.146	0.146	0.04	0.005	5%
20	11.00	0.14		0.210			1.0	10.88	11.13	0.25	0.14	0.210	0.210	0.04	0.007	6%
21	11.25	0.15		0.166			1.0	11.13	11.38	0.25	0.15	0.166	0.166	0.04	0.006	5%
22	11.50	0.13		0.186			1.0	11.38	11.75	0.38	0.13	0.186	0.186	0.05	0.009	8%
23	12.00	0.18		0.189			1.0	11.75	12.25	0.50	0.18	0.189	0.189	0.09	0.017	15%
RB	12.50	0.00	0.00	0.000	0.000	0.000	1.0	11.63	12.50	0.88	0.04	0.047	0.047	0.03	0.002	1%
Total Flow															0.115	

Measurement Details:

Start Time (MST):	15:30
End Time (MST):	16:38
Equipment:	ADV
Method:	Wading
River Condition:	Open, low
Quality/Error (see reverse):	Good
Weather:	Sunny, 8°C

Flow Characteristics:

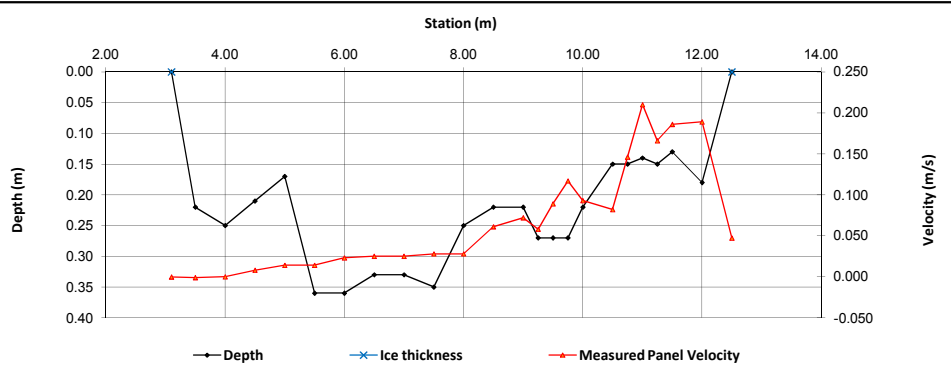
Total Flow:	0.115	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	2.23	(m ²)
Wetted Width:	9.40	(m)
Hydraulic Depth:	0.237	(m)
Mean Velocity:	0.051	(m/s)
Froude Number:	0.034	

Datalogger Details:

	Before	After
Transducer Reading:		0.525
Battery (Main):	14.49	
Battery (Aux):	-	
Datalogger Clock:	14:41	
Laptop Clock:	14:41	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	2.10	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Time was set



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar in PVC Pipe	1.026	297.990	1.044	297.990	-
Bench Mark 2:	T-post w/pink flagging	0.929	298.069	0.946	298.069	-
Top of Ice:						
Water Level:		2.282	296.734	2.292	296.742	296.738
Transducer Reading:		0.525	296.209	0.525	296.217	296.213
Other:						

General Notes:

BMI1 0.74 m
BMI2 0.87 m

Field Personnel:	SM DW	Trip Date:	27-Oct-11
Data Entry Personnel:	DB	Date:	28-Oct-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S2 Jackpine Creek at Canterra Road

UTM Location: 474961 E, 6344087 N

Site Visit Date: November 28, 2011



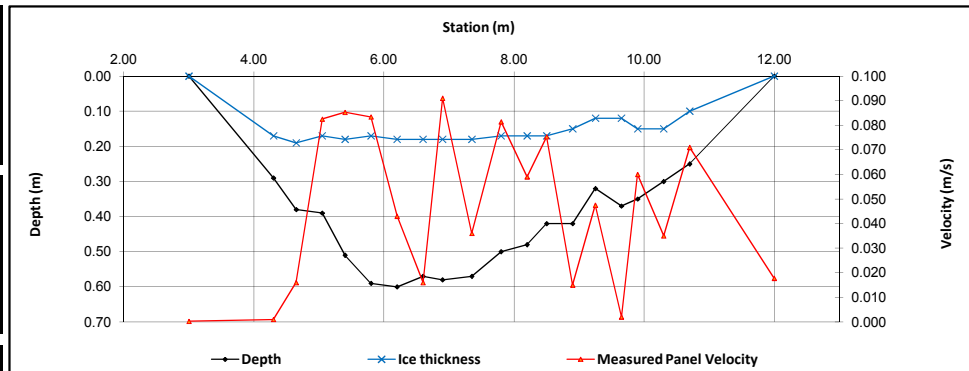
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	3.00	0.00	0.00	0.000	0.000	0.000	0.9	3.00	3.65	0.65	0.03	0.000	0.000	0.02	0.000	0%
1	4.30	0.29	0.17	0.001			0.9	3.65	4.48	0.83	0.12	0.001	0.001	0.10	0.000	0%
2	4.65	0.38	0.19	0.016			0.9	4.48	4.85	0.38	0.19	0.016	0.014	0.07	0.001	1%
3	5.05	0.39	0.17	0.083			0.9	4.85	5.23	0.38	0.22	0.083	0.074	0.08	0.006	6%
4	5.40	0.51	0.18	0.085			0.9	5.23	5.60	0.38	0.33	0.085	0.077	0.12	0.009	10%
5	5.80	0.59	0.17	0.083			0.9	5.60	6.00	0.40	0.42	0.083	0.075	0.17	0.013	13%
6	6.20	0.60	0.18	0.043			0.9	6.00	6.40	0.40	0.42	0.043	0.039	0.17	0.007	7%
7	6.60	0.57	0.18	0.016			0.9	6.40	6.75	0.35	0.39	0.016	0.014	0.14	0.002	2%
8	6.90	0.58	0.18	0.091			0.9	6.75	7.13	0.38	0.40	0.091	0.082	0.15	0.012	13%
9	7.35	0.57	0.18	0.036			0.9	7.13	7.58	0.45	0.39	0.036	0.032	0.18	0.006	6%
10	7.80	0.50	0.17	0.081			0.9	7.58	8.00	0.43	0.33	0.081	0.073	0.14	0.010	11%
11	8.20	0.48	0.17	0.059			0.9	8.00	8.35	0.35	0.31	0.059	0.053	0.11	0.006	6%
12	8.50	0.42	0.17	0.075			0.9	8.35	8.70	0.35	0.25	0.075	0.068	0.09	0.006	6%
13	8.90	0.42	0.15	0.015			0.9	8.70	9.08	0.38	0.27	0.015	0.014	0.10	0.001	1%
14	9.25	0.32	0.12	0.048			0.9	9.08	9.45	0.38	0.20	0.048	0.043	0.08	0.003	3%
15	9.65	0.37	0.12	0.002			0.9	9.45	9.78	0.33	0.25	0.002	0.002	0.08	0.000	0%
16	9.90	0.35	0.15	0.060			0.9	9.78	10.10	0.33	0.20	0.060	0.054	0.07	0.004	4%
17	10.30	0.30	0.15	0.035			0.9	10.10	10.50	0.40	0.15	0.035	0.032	0.06	0.002	2%
18	10.70	0.25	0.10	0.071			0.9	10.50	11.35	0.85	0.15	0.071	0.064	0.13	0.008	8%
R	12.00	0.00	0.00	0.000	0.000	0.000	1.0	10.70	12.00	1.30	0.04	0.018	0.018	0.05	0.001	1%
Total Flow															0.097	

Measurement Details:	
Start Time (MST):	8:40
End Time (MST):	10:05
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	clear, calm, -15C

Flow characteristics:		
Total Flow:	0.097	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	2.09	(m ²)
Wetted Width:	9.00	(m)
Hydraulic Depth:	0.232	(m)
Mean Velocity:	0.046	(m/s)
Froude Number:	0.031	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	12.75	0.528
Battery (Aux):	-	
Datalogger Clock:	8:43	
Laptop Clock:	8:43	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.10	
Memory Used:	-	
Dessicant:	good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC Pipe	0.813	297.990	0.800	297.990	-
Bench Mark 2:	T-post w/pink flagging	0.714	298.069	0.702	298.069	-
Top of Ice:		2.032	296.771	2.020	296.770	296.771
Water Level:		2.055	296.748	2.043	296.748	296.748
Transducer Reading:		0.528	296.220	0.528	296.219	296.220
Other:						

General Notes:
Low SNR values, low water/rocks/ice/ground water. Some Velocity measurements with high error messages were adjusted.

Field Personnel:	DB, SM	Trip Date:	28-Nov-11
Data Entry Personnel:	DW	Date:	9-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S3 - Iyininim Creek above Kears Lake

UTM Location: 489491 E, 6345029 N

Site Visit Date: April 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	2.30	0.00		0.000	0.000	0.000	0.9	2.30	2.20	0.10	0.20	0.043	0.039	0.02	0.001	1%
1	2.10	0.78		0.173			0.9	2.20	2.05	0.15	0.78	0.173	0.156	0.12	0.018	18%
2	2.00	0.84		0.193			0.9	2.05	1.95	0.10	0.84	0.193	0.174	0.08	0.015	14%
3	1.90	0.81		0.180			0.9	1.95	1.85	0.10	0.81	0.180	0.162	0.08	0.013	13%
4	1.80	0.78		0.187			0.9	1.85	1.75	0.10	0.78	0.187	0.168	0.08	0.013	13%
5	1.70	0.80		0.203			0.9	1.75	1.65	0.10	0.80	0.203	0.183	0.08	0.015	14%
6	1.60	0.82		0.163			0.9	1.65	1.55	0.10	0.82	0.163	0.147	0.08	0.012	12%
7	1.50	0.83		0.120			0.9	1.55	1.45	0.10	0.83	0.120	0.108	0.08	0.009	9%
8	1.40	0.70		0.063			0.9	1.45	1.35	0.10	0.70	0.063	0.057	0.07	0.004	4%
9	1.30	0.38		-0.019			0.9	1.35	1.25	0.10	0.38	-0.019	-0.017	0.04	-0.001	-1%
10	1.20	0.38		-0.056			0.9	1.25	1.15	0.10	0.38	-0.056	-0.050	0.04	-0.002	-2%
11	1.10	0.40		0.111			0.9	1.15	1.05	0.10	0.40	0.111	0.100	0.04	0.004	4%
12	1.00	0.39		-0.116			0.9	1.05	0.95	0.10	0.39	-0.116	-0.104	0.04	-0.004	-4%
13	0.90	0.38		0.121			0.9	0.95	0.85	0.10	0.38	0.121	0.109	0.04	0.004	4%
14	0.80	0.32		0.000			1.0	0.85	0.75	0.10	0.32	0.000	0.000	0.03	0.000	0%
15	0.70	0.38		0.000			1.0	0.75	0.60	0.15	0.38	0.000	0.000	0.06	0.000	0%
Left	0.50	0.00		0.000	0.000	0.000	1.0	0.60	0.50	0.10	0.10	0.000	0.000	0.01	0.000	0%
Total Flow														0.101		

Measurement Details:

Start Time (MST):	12:40
End Time (MST):	13:40
Equipment:	ADV
Method:	Wading
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Sunny, 5°C

Flow characteristics:

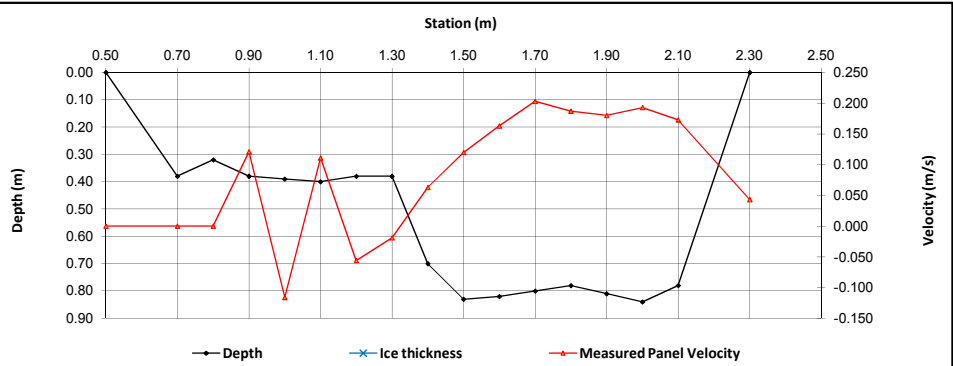
Total Flow:	0.101	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.99	(m ²)
Wetted Width:	1.60	(m)
Hydraulic Depth:	0.616	(m)
Mean Velocity:	0.102	(m/s)
Froude Number:	0.042	

Datalogger Details:

	Before	After
Transducer Reading:		0.74
Battery (Main):	14.90	
Battery (Aux):	4.68	
Datalogger Clock:	12:48	
Laptop Clock:	12:48	
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	0%	
Dessicant:	changed	
Logger# (if Δ):	274	
PT# (if Δ):	104638	

Datalogger / Station Notes:

m=1.412017, b=-0.083509



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar in PVC pipe	2.038	360.610	2.017	360.610	-
Bench Mark 2:	Rebar with pink flagging	1.394	361.201	1.372	361.201	-
Top of Ice:						
Water Level:		3.262	359.386	3.245	359.382	359.384
Transducer Reading:		0.740	358.646	0.740	358.642	358.644
Other:						

General Notes:

Poor flow measurements. Broke ice to access water, causing substantial error, therefore went to 60% depth measurements. Ice too thin to sample.

Field Personnel:	DB, SG	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S3 - Iyininim Creek above Kears Lake

UTM Location: 489491 E, 6345029 N

Site Visit Date: August 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.60	0.40	0.02	0.003	0.003	0.01	0.000	0%
1	1.00	0.06		0.012			1.0	0.60	1.10	0.50	0.06	0.012	0.012	0.03	0.000	1%
2	1.20	0.14		0.001			1.0	1.10	1.25	0.15	0.14	0.001	0.001	0.02	0.000	0%
3	1.30	0.17		0.004			1.0	1.25	1.35	0.10	0.17	0.004	0.004	0.02	0.000	0%
4	1.40	0.19		0.009			1.0	1.35	1.45	0.10	0.19	0.009	0.009	0.02	0.000	1%
5	1.50	0.19		0.015			1.0	1.45	1.55	0.10	0.19	0.015	0.015	0.02	0.000	1%
6	1.60	0.18		0.011			1.0	1.55	1.65	0.10	0.18	0.011	0.011	0.02	0.000	1%
7	1.70	0.22		0.019			1.0	1.65	1.75	0.10	0.22	0.019	0.019	0.02	0.000	2%
8	1.80	0.20		0.017			1.0	1.75	1.85	0.10	0.20	0.017	0.017	0.02	0.000	1%
9	1.90	0.25		0.041			1.0	1.85	1.95	0.10	0.25	0.041	0.041	0.03	0.001	4%
10	2.00	0.26		0.037			1.0	1.95	2.05	0.10	0.26	0.037	0.037	0.03	0.001	4%
11	2.10	0.28		0.040			1.0	2.05	2.15	0.10	0.28	0.040	0.040	0.03	0.001	4%
12	2.20	0.25		0.041			1.0	2.15	2.23	0.07	0.25	0.041	0.041	0.02	0.001	3%
13	2.25	0.32		0.069			1.0	2.23	2.28	0.05	0.32	0.069	0.069	0.02	0.001	4%
14	2.30	0.32		0.106			1.0	2.28	2.33	0.05	0.32	0.106	0.106	0.02	0.002	7%
15	2.35	0.30		0.131			1.0	2.33	2.38	0.05	0.30	0.131	0.131	0.01	0.002	8%
16	2.40	0.30		0.144			1.0	2.38	2.43	0.05	0.30	0.144	0.144	0.01	0.002	8%
17	2.45	0.27		0.135			1.0	2.43	2.48	0.05	0.27	0.135	0.135	0.01	0.002	7%
18	2.50	0.27		0.170			1.0	2.48	2.53	0.05	0.27	0.170	0.170	0.01	0.002	9%
19	2.55	0.25		0.157			1.0	2.53	2.58	0.05	0.25	0.157	0.157	0.01	0.002	8%
20	2.60	0.24		0.153			1.0	2.58	2.65	0.08	0.24	0.153	0.153	0.02	0.003	11%
21	2.70	0.22		0.103			1.0	2.65	2.75	0.10	0.22	0.103	0.103	0.02	0.002	9%
22	2.80	0.20		0.050			1.0	2.75	2.90	0.15	0.20	0.050	0.050	0.03	0.002	6%
23	3.00	0.12		0.017			1.0	2.90	3.10	0.20	0.12	0.017	0.017	0.02	0.000	2%
RB	3.20	0.00	0.00	0.000	0.000	0.000	1.0	3.10	3.20	0.10	0.03	0.004	0.004	0.00	0.000	1%
Total Flow															0.026	

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	14:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast, 20°C

Flow characteristics:

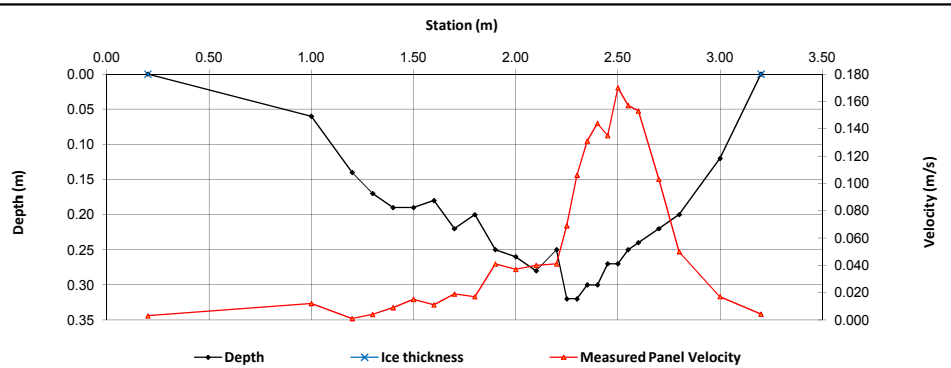
Total Flow:	0.026	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.47	(m ²)
Wetted Width:	3.00	(m)
Hydraulic Depth:	0.156	(m)
Mean Velocity:	0.055	(m/s)
Froude Number:	0.044	

Datalogger Details:

	Before	After
Transducer Reading:	0.207	0.21
Battery (Main):	13.95	14.10
Battery (Aux):	4.81	
Datalogger Clock:	12:25	14:41
Laptop Clock:	12:27	14:41
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	14.1
Memory Used:	20%	
Dessicant:	-	Changed
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Station converted from Optimum to CR 800



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar in PVC pipe		360.610		360.610	-
Bench Mark 2:	Rebar with pink flagging	1.156	361.201	1.149	361.201	-
Top of Ice:						
Water Level:		3.529	358.828	3.518	358.832	358.830
Transducer Reading:		0.207	358.621	0.207	358.625	358.623
Other:	3/4" pipe 3m to E of station	0.976	361.381	0.965	361.385	

General Notes:

Field Personnel:	DB, KW	Trip Date:	15-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	29-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S3 - Iyininim Creek above Kearl Lake

UTM Location: 489491 E, 6345029 N

Site Visit Date: September 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.30	0.00	0.00	0.000	0.000	0.000	1.0	0.30	0.40	0.10	0.03	0.008	0.008	0.00	0.000	0%
1	0.45	0.12		0.028			1.0	1.23	0.50	0.73	0.12	0.028	0.028	0.09	0.002	6%
2	0.50	0.11		0.032			1.0	1.35	0.55	0.80	0.11	0.032	0.032	0.09	0.003	7%
3	0.55	0.13		0.044			1.0	0.28	0.60	0.33	0.13	0.044	0.044	0.04	0.002	4%
4	0.60	0.14		0.075			1.0	0.30	0.65	0.35	0.14	0.075	0.075	0.05	0.004	9%
5	0.65	0.15		0.084			1.0	0.33	0.70	0.38	0.15	0.084	0.084	0.06	0.005	11%
6	0.70	0.16		0.068			1.0	0.35	0.75	0.40	0.16	0.068	0.068	0.06	0.004	10%
7	0.75	0.17		0.064			1.0	0.38	0.80	0.43	0.17	0.064	0.064	0.07	0.005	11%
8	0.80	0.18		0.073			1.0	0.40	0.85	0.45	0.18	0.073	0.073	0.08	0.006	14%
9	0.85	0.20		0.049			1.0	0.43	0.90	0.48	0.20	0.049	0.049	0.10	0.005	11%
10	0.90	0.20		0.035			1.0	0.45	0.95	0.50	0.20	0.035	0.035	0.10	0.004	8%
11	0.95	0.21		0.034			1.0	0.48	1.00	0.53	0.21	0.034	0.034	0.11	0.004	9%
12	1.00	0.22		0.025			1.0	0.50	1.05	0.55	0.22	0.025	0.025	0.12	0.003	7%
13	1.05	0.24		0.004			1.0	0.53	1.13	0.60	0.24	0.004	0.004	0.14	0.001	1%
14	1.10	0.25		0.009			1.0	0.55	1.20	0.65	0.25	0.009	0.009	0.16	0.001	4%
15	1.20	0.26		-0.006			1.0	0.60	1.30	0.70	0.26	-0.006	-0.006	0.18	-0.001	-3%
16	1.30	0.23		0.006			1.0	0.65	1.45	0.80	0.23	0.006	0.006	0.18	0.001	3%
17	1.40	0.20		-0.013			1.0	0.70	1.60	0.90	0.20	-0.013	-0.013	0.18	-0.002	-6%
18	1.60	0.14		-0.007			1.0	0.80	1.80	1.00	0.14	-0.007	-0.007	0.14	-0.001	-2%
19	1.80	0.10		-0.015			1.0	0.90	2.00	1.10	0.10	-0.015	-0.015	0.11	-0.002	-4%
20	2.00	0.07		-0.010			1.0	1.00	2.00	1.00	0.07	-0.010	-0.010	0.07	-0.001	-2%
LB	2.20	0.00		0.000	0.000	0.000	1.0	2.10	2.20	0.10	0.02	-0.003	-0.003	0.00	0.000	0%
Total Flow														0.042		

Measurement Details:

Start Time (MST):	13:45
End Time (MST):	14:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Rain, ~10°C

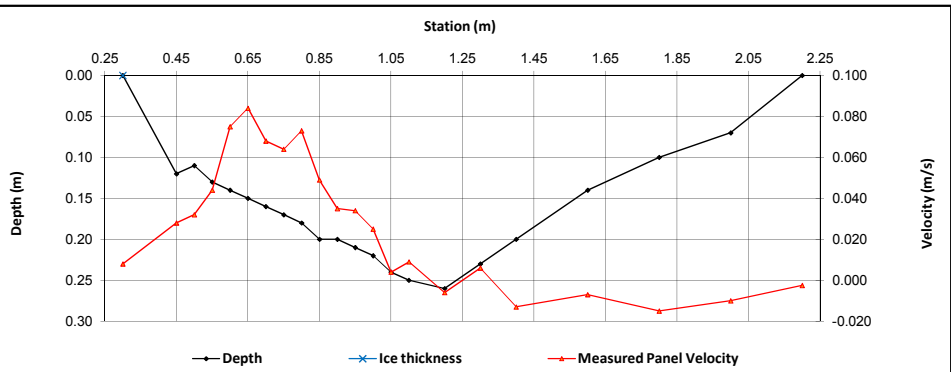
Flow characteristics:

Total Flow:	0.042	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	2.14	(m ²)
Wetted Width:	1.93	(m)
Hydraulic Depth:	1.113	(m)
Mean Velocity:	0.019	(m/s)
Froude Number:	0.006	

Datalogger Details:

	Before	After
Transducer Reading:		0.135
Battery (Main):	13.50	
Battery (Aux):	-	
Datalogger Clock:	13:50	
Laptop Clock:	13:50	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	other	1.058	360.610	1.022	360.610	-
Bench Mark 2:	Rebar with pink flagging	1.238	361.201	1.203	361.201	-
Top of Ice:						
Water Level:		3.684	358.755	3.650	358.754	358.755
Transducer Reading:		0.135	358.620	0.135	358.619	358.620
Other:	3/4" pipe 3m to E of station	1.050	361.389	1.022	361.382	

General Notes:

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	TK	Date:	22-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S3 - Iyininim Creek Above Kearl Lake

UTM Location: 489491 E, 6345029 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.25	0.05	0.02	0.000	0.000	0.00	0.000	0%
1	0.30	0.06		-0.001			1.0	0.25	0.35	0.10	0.06	-0.001	-0.001	0.01	0.000	0%
2	0.40	0.05		-0.002			1.0	0.35	0.45	0.10	0.05	-0.002	-0.002	0.01	0.000	0%
3	0.50	0.14		-0.001			1.0	0.45	0.55	0.10	0.14	-0.001	-0.001	0.01	0.000	0%
4	0.60	0.16		-0.005			1.0	0.55	0.65	0.10	0.16	-0.005	-0.005	0.02	0.000	0%
5	0.70	0.19		0.001			1.0	0.65	0.75	0.10	0.19	0.001	0.001	0.02	0.000	0%
6	0.80	0.19		0.001			1.0	0.75	0.85	0.10	0.19	0.001	0.001	0.02	0.000	0%
7	0.90	0.20		0.003			1.0	0.85	0.95	0.10	0.20	0.003	0.003	0.02	0.000	0%
8	1.00	0.27		0.014			1.0	0.95	1.05	0.10	0.27	0.014	0.014	0.03	0.000	2%
9	1.10	0.28		0.009			1.0	1.05	1.15	0.10	0.28	0.009	0.009	0.03	0.000	1%
10	1.20	0.28		-0.002			1.0	1.15	1.25	0.10	0.28	-0.002	-0.002	0.03	0.000	0%
11	1.30	0.26		0.045			1.0	1.25	1.35	0.10	0.26	0.045	0.045	0.03	0.001	7%
12	1.40	0.26		0.099			1.0	1.35	1.45	0.10	0.26	0.099	0.099	0.03	0.003	15%
13	1.50	0.25		0.130			1.0	1.45	1.53	0.08	0.25	0.130	0.130	0.02	0.002	14%
14	1.55	0.25		0.157			1.0	1.53	1.58	0.05	0.25	0.157	0.157	0.01	0.002	11%
15	1.60	0.23		0.189			1.0	1.58	1.63	0.05	0.23	0.189	0.189	0.01	0.002	12%
16	1.65	0.22		0.194			1.0	1.63	1.68	0.05	0.22	0.194	0.194	0.01	0.002	12%
17	1.70	0.22		0.151			1.0	1.68	1.75	0.08	0.22	0.151	0.151	0.02	0.002	14%
18	1.80	0.20		0.063			1.0	1.75	1.85	0.10	0.20	0.063	0.063	0.02	0.001	7%
19	1.90	0.16		0.028			1.0	1.85	1.95	0.10	0.16	0.028	0.028	0.02	0.000	3%
20	2.00	0.12		0.027			1.0	1.95	2.05	0.10	0.12	0.027	0.027	0.01	0.000	2%
21	2.10	0.06		0.017			1.0	2.05	2.20	0.15	0.06	0.017	0.017	0.01	0.000	1%
RB	2.30	0.00	0.00	0.000	0.000	0.000	1.0	2.20	2.30	0.10	0.02	0.004	0.004	0.00	0.000	0%
Total Flow															0.018	

Measurement Details:

Start Time (MST):	14:56
End Time (MST):	15:42
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	5°, Overcast

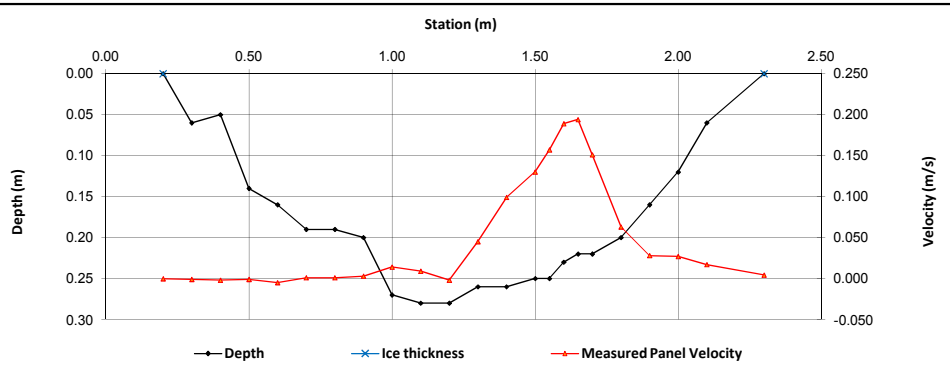
Flow characteristics:

Total Flow:	0.018	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.36	(m ²)
Wetted Width:	2.10	(m)
Hydraulic Depth:	0.173	(m)
Mean Velocity:	0.049	(m/s)
Froude Number:	0.037	

Datalogger Details:

Transducer Reading:	Before	After
Battery (Main):	13.31	0.167
Battery (Aux):	-	-
Datalogger Clock:	15:02	-
Laptop Clock:	15:02	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	1.60	-
Memory Used:	-	-
Dessicant:	replaced	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar in PVC Pipe	0.335	360.610	0.325	360.610	-
Bench Mark 2:	Rebar w pink/ flagging	1.089	361.201	1.078	361.201	-
Top of Ice:						
Water Level:		3.504	358.786	3.495	358.784	358.785
Transducer Reading:		0.167	358.619	0.167	358.617	358.618
Other:	BM3	0.908	361.382	0.898	361.381	

General Notes:

BM Heights: BM1 0.40 m, BM2 0.95 m
 PLS, CR800, battery removed PLS
 Weight left at base, marked with orange

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	11-Jan-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek

UTM Location: 479760 E, 6356755 N

Site Visit Date: January 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.75	0.25	0.22	0.011	0.011	0.06	0.001	0%
1	1.00	1.50	0.62		-0.047	0.136	1.0	0.75	1.40	0.65	0.88	0.045	0.045	0.57	0.025	9%
2	1.80	1.65	0.45		0.016	0.026	1.0	1.40	2.10	0.70	1.20	0.021	0.021	0.84	0.018	6%
3	2.40	1.80	0.42		0.024	0.021	1.0	2.10	2.65	0.55	1.38	0.023	0.023	0.76	0.017	6%
4	2.90	1.78	0.42		0.024	0.032	1.0	2.65	3.20	0.55	1.36	0.028	0.028	0.75	0.021	8%
5	3.50	1.75	0.40		0.072	0.071	1.0	3.20	3.73	0.53	1.35	0.071	0.071	0.71	0.051	19%
6	3.95	1.75	0.40		0.001	0.017	1.0	3.73	4.23	0.50	1.35	0.009	0.009	0.67	0.006	2%
7	4.50	1.75	0.40		0.037	0.025	1.0	4.23	4.70	0.48	1.35	0.031	0.031	0.64	0.020	7%
8	4.90	1.70	0.40		0.019	0.032	1.0	4.70	5.20	0.50	1.30	0.026	0.026	0.65	0.017	6%
9	5.50	1.60	0.43		0.021	0.027	1.0	5.20	5.70	0.50	1.17	0.024	0.024	0.59	0.014	5%
10	5.90	1.60	0.30		0.043	0.018	1.0	5.70	6.05	0.35	1.30	0.031	0.031	0.46	0.014	5%
11	6.20	1.55	0.30		0.023	0.023	1.0	6.05	6.50	0.45	1.25	0.023	0.023	0.56	0.013	5%
12	6.80	1.55	0.30		0.022	0.025	1.0	6.50	7.15	0.65	1.25	0.024	0.024	0.81	0.019	7%
13	7.50	1.45	0.30		0.018	0.017	1.0	7.15	7.85	0.70	1.15	0.018	0.018	0.80	0.014	5%
14	8.20	1.20	0.25		0.012	0.033	1.0	7.85	8.55	0.70	0.95	0.023	0.023	0.67	0.015	5%
15	8.90	0.90	0.23	0.023			0.9	8.55	9.20	0.65	0.67	0.023	0.021	0.44	0.009	3%
Right	9.50	0.00	0.00	0.000	0.000	0.000	1.0	9.20	9.50	0.30	0.17	0.006	0.006	0.05	0.000	0%
Total Flow														0.273		

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	14:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	-30°C partly cloudy

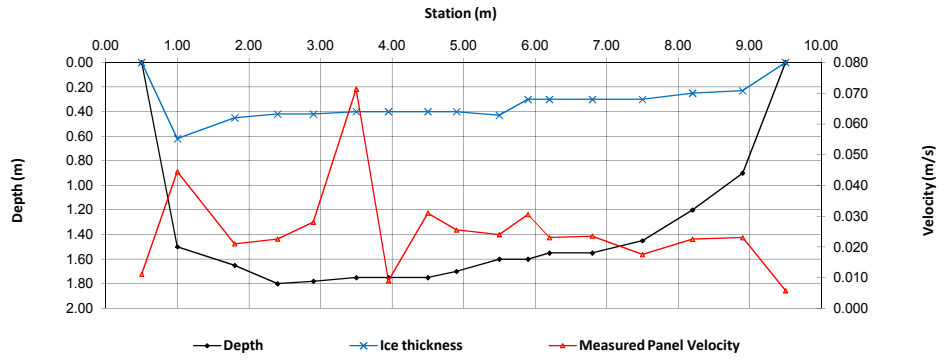
Flow characteristics:

Total Flow:	0.273	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	10.02	(m ²)
Wetted Width:	9.00	(m)
Hydraulic Depth:	1.113	(m)
Mean Velocity:	0.027	(m/s)
Froude Number:	0.008	

Datalogger Details:

	Before	After
Transducer Reading:		1.263
Battery (Main):	15.42	
Battery (Aux):	-	
Datalogger Clock:	13:06	
Laptop Clock:	13:07	
Air Temperature °C:	-30	
Air Pressure:	-	
RH:	-	
Water °C:	0.20	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.200	98.250	1.181	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.157	98.369	1.138	98.369	-
Top of Ice:		2.156	97.370	2.142	97.365	97.368
Water Level:		2.170	97.280	2.150	97.281	97.281
Transducer Reading:	PLS	1.263	96.017	1.263	96.018	96.018
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	14-Jan-11
Data Entry Personnel:	SG	Date:	23-Feb-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek

UTM Location: 479760 E, 6356755 N

Site Visit Date: February 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	-0.30	0.00	0.00	0.000	0.000	0.000	0.9	-0.30	-0.10	0.20	0.08	0.002	0.002	0.02	0.000	0%
1	0.10	0.49	0.17	0.008			0.9	-0.10	0.28	0.38	0.32	0.008	0.007	0.12	0.001	0%
2	0.45	0.68	0.22	0.015			0.9	0.28	0.68	0.40	0.46	0.015	0.014	0.18	0.002	1%
3	0.90	1.03	0.28		0.000	0.018	1.0	0.68	1.08	0.40	0.75	0.000	0.000	0.30	0.000	0%
4	1.25	1.12	0.25		0.012	0.021	1.0	1.08	1.43	0.35	0.87	0.017	0.017	0.30	0.005	2%
5	1.60	1.22	0.26		0.015	0.022	1.0	1.43	1.80	0.38	0.96	0.019	0.019	0.36	0.007	3%
6	2.00	1.27	0.27		0.013	0.024	1.0	1.80	2.20	0.40	1.00	0.019	0.019	0.40	0.007	3%
7	2.40	1.36	0.27		0.022	0.021	1.0	2.20	2.58	0.38	1.09	0.022	0.022	0.41	0.009	4%
8	2.75	1.39	0.30		0.019	0.024	1.0	2.58	2.98	0.40	1.09	0.022	0.022	0.44	0.009	4%
9	3.20	1.50	0.29		0.022	0.018	1.0	2.98	3.40	0.43	1.21	0.020	0.020	0.51	0.010	5%
10	3.60	1.59	0.32		0.019	0.023	1.0	3.40	3.80	0.40	1.27	0.021	0.021	0.51	0.011	5%
11	4.00	1.68	0.32		0.023	0.018	1.0	3.80	4.18	0.38	1.36	0.021	0.021	0.51	0.010	5%
12	4.35	1.73	0.33		0.026	0.028	1.0	4.18	4.63	0.45	1.40	0.027	0.027	0.63	0.017	8%
13	4.90	1.81	0.33		0.034	0.031	1.0	4.63	5.13	0.50	1.48	0.033	0.033	0.74	0.024	11%
14	5.35	1.90	0.31		0.022	0.022	1.0	5.13	5.58	0.45	1.59	0.022	0.022	0.72	0.016	7%
15	5.80	1.87	0.28		0.030	0.028	1.0	5.58	6.00	0.43	1.59	0.029	0.029	0.68	0.020	9%
16	6.20	1.86	0.24		0.008	0.027	1.0	6.00	6.43	0.43	1.62	0.018	0.018	0.69	0.012	6%
17	6.65	1.88	0.23		0.014	0.034	1.0	6.43	6.80	0.38	1.65	0.024	0.024	0.62	0.015	7%
18	6.95	1.91	0.23		0.062	0.026	1.0	6.80	7.15	0.35	1.68	0.044	0.044	0.59	0.026	12%
19	7.35	1.86	0.24		0.019	0.024	1.0	7.15	7.53	0.38	1.62	0.022	0.022	0.61	0.013	6%
20	7.70	0.33	0.23	0.000			1.0	7.53	7.85	0.32	0.10	0.000	0.000	0.03	0.000	0%
Left	8.00	0.00	0.00	0.000	0.000	0.000	1.0	7.85	8.00	0.15	0.03	0.000	0.000	0.00	0.000	0%
Total Flow														0.214		

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	13:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	-5°C partly cloudy

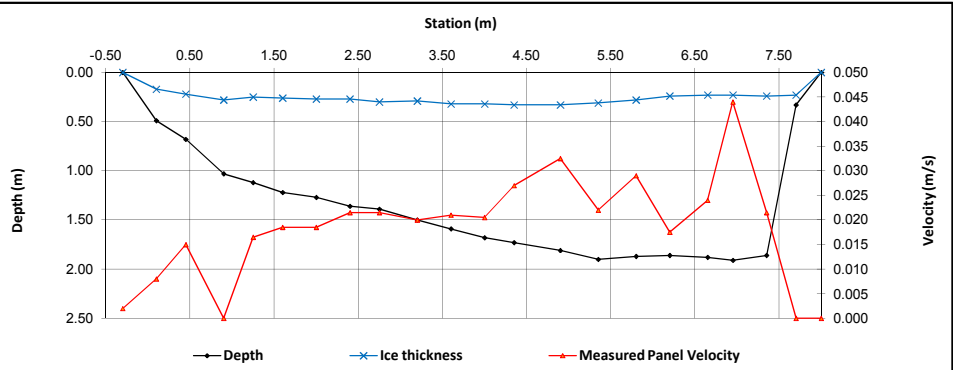
Flow characteristics:

Total Flow:	0.214	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	9.36	(m ²)
Wetted Width:	8.30	(m)
Hydraulic Depth:	1.128	(m)
Mean Velocity:	0.023	(m/s)
Froude Number:	0.007	

Datalogger Details:

	Before	After
Transducer Reading:		1.277
Battery (Main):	14.27	
Battery (Aux):	-	
Datalogger Clock:	12:48	
Laptop Clock:	12:45	
Air Temperature °C:	-5	
Air Pressure:	-	
RH:	-	
Water °C:	0.20	
Memory Used:	-	
Dessicant:	Good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.322	98.250	1.299	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.281	98.369	1.255	98.369	-
Top of Ice:		2.280	97.370	2.256	97.368	97.369
Water Level:		2.283	97.289	2.259	97.290	97.290
Transducer Reading:	PLS	1.277	96.012	1.277	96.013	96.013
Other:						

General Notes:

Field Personnel:	BL, SG	Trip Date:	12-Feb-11
Data Entry Personnel:	SG	Date:	23-Feb-11
Data Check Personnel:	DB	Date:	31-Mar-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek
 UTM Location: 479760 E, 6356755 N

Site Visit Date: March 9, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	2.50	0.00	0.00	0.000	0.000	0.000	1.0	2.50	2.85	0.35	0.34	0.010	0.010	0.12	0.001	1%
1	3.20	1.85	0.51		0.018	0.058	1.0	2.85	3.25	0.40	1.34	0.038	0.038	0.54	0.020	10%
2	3.30	1.80	0.51		0.041	0.052	1.0	3.25	3.40	0.15	1.29	0.047	0.047	0.19	0.009	4%
3	3.50	1.72	0.50		0.025	-0.031	1.0	3.40	3.60	0.20	1.22	-0.003	-0.003	0.24	-0.001	0%
4	3.70	1.72	0.50		0.038	0.023	1.0	3.60	3.80	0.20	1.22	0.031	0.031	0.24	0.007	3%
5	3.90	1.77	0.45		0.050	0.032	1.0	3.80	4.00	0.20	1.32	0.041	0.041	0.26	0.011	5%
6	4.10	1.75	0.45		0.050	0.050	1.0	4.00	4.25	0.25	1.30	0.050	0.050	0.33	0.016	8%
7	4.40	1.78	0.43		-0.063	0.050	1.0	4.25	4.50	0.25	1.35	-0.007	-0.007	0.34	-0.002	-1%
8	4.60	1.80	0.43		0.061	0.050	1.0	4.50	4.70	0.20	1.37	0.056	0.056	0.27	0.015	7%
9	4.80	1.79	0.42		0.055	0.005	1.0	4.70	4.90	0.20	1.37	0.030	0.030	0.27	0.008	4%
10	5.00	1.80	0.42		0.039	0.021	1.0	4.90	5.15	0.25	1.38	0.030	0.030	0.35	0.010	5%
11	5.30	1.78	0.42	0.094			0.9	5.15	5.40	0.25	1.36	0.094	0.085	0.34	0.029	13%
12	5.50	1.78	0.42	0.026			0.9	5.40	5.65	0.25	1.36	0.026	0.026	0.34	0.008	4%
13	5.80	1.79	0.43	0.050			0.9	5.65	6.00	0.35	1.36	0.050	0.045	0.48	0.021	10%
14	6.20	1.78	0.43	0.061			0.9	6.00	6.40	0.40	1.35	0.061	0.055	0.54	0.030	14%
15	6.60	1.67	0.35	0.072			0.9	6.40	6.80	0.40	1.32	0.072	0.065	0.53	0.034	16%
16	7.00	1.58	0.34	0.050			0.9	6.80	7.20	0.40	1.24	0.050	0.045	0.50	0.022	10%
17	7.40	1.50	0.33	0.008			0.9	7.20	7.60	0.40	1.17	0.008	0.007	0.47	0.003	2%
18	7.80	1.30	0.25	0.000			1.0	7.60	7.95	0.35	1.05	0.000	0.000	0.37	0.000	0%
19	8.10	1.20	0.25	0.043			0.9	7.95	8.35	0.40	0.95	0.043	0.039	0.38	0.015	7%
20	8.60	1.15	0.25	-0.117			0.9	8.35	8.80	0.45	0.90	-0.117	-0.105	0.41	-0.043	-20%
Right	9.00	0.00	0.00	0.000	0.000	0.000	1.0	8.80	9.00	0.20	0.23	-0.029	-0.029	0.04	-0.001	-1%
Total Flow														0.214		

Measurement Details:

Start Time (MST):	15:40
End Time (MST):	16:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Partly cloudy

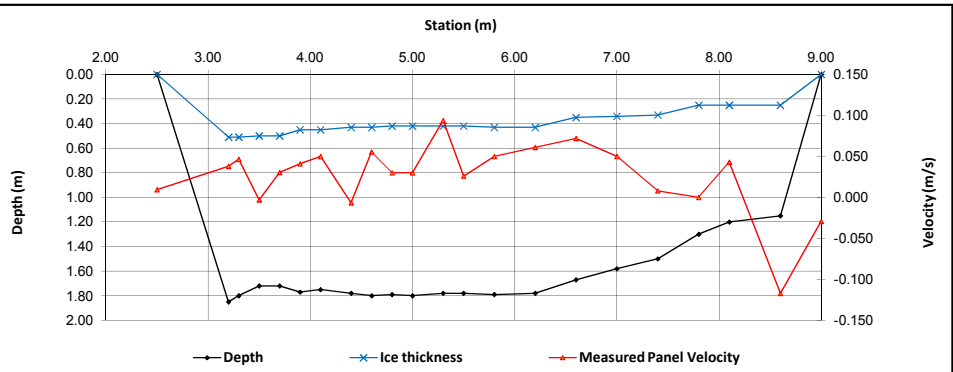
Flow characteristics:

Total Flow:	0.214	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	7.54	(m ²)
Wetted Width:	6.50	(m)
Hydraulic Depth:	1.160	(m)
Mean Velocity:	0.028	(m/s)
Froude Number:	0.008	

Datalogger Details:

	Before	After
Transducer Reading:		1.241
Battery (Main):	14.90	
Battery (Aux):	-	
Datalogger Clock:	15:43	
Laptop Clock:	15:41	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.20	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):	-	
PT# (if Δ):	-	

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.445	98.250	1.435	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.399	98.369	1.389	98.369	-
Top of Ice:		2.417	97.351	2.410	97.348	97.350
Water Level:		2.439	97.256	2.425	97.260	97.258
Transducer Reading:		1.241	96.015	1.241	96.019	96.017
Other:						

General Notes:

Post 5.3m, gauge depth switched to 0.6d due to erratic numbers at 0.2d and 0.8d likely due to slush throughout water column. One measurement per hole past 5.0m due to low flow.

Field Personnel:	JO, BL	Trip Date:	9-Mar-11
Data Entry Personnel:	CM	Date:	21-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek
 UTM Location: 479760 E, 6356755 N

Site Visit Date: April 1, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	2.40	0.00	0.00	0.000	0.000	0.000	1.0	2.40	2.70	0.30	0.25	0.003	0.003	0.08	0.000	0%
1	3.00	1.30	0.30		0.023	-0.001	1.0	2.70	3.30	0.60	1.00	0.011	0.011	0.60	0.007	3%
2	3.60	1.70	0.35		0.032	0.030	1.0	3.30	3.83	0.53	1.35	0.031	0.031	0.71	0.022	10%
3	4.05	1.78	0.45		0.011	0.026	1.0	3.83	4.30	0.48	1.33	0.019	0.019	0.63	0.012	5%
4	4.55	1.78	0.47		0.018	0.032	1.0	4.30	4.73	0.43	1.31	0.025	0.025	0.56	0.014	7%
5	4.90	1.72	0.55		0.011	0.016	1.0	4.73	5.10	0.38	1.17	0.014	0.014	0.44	0.006	3%
6	5.30	1.70	0.45		0.030	0.022	1.0	5.10	5.50	0.40	1.25	0.026	0.026	0.50	0.013	6%
7	5.70	1.70	0.53		0.027	0.013	1.0	5.50	5.95	0.45	1.17	0.020	0.020	0.53	0.011	5%
8	6.20	1.70	0.47		0.039	0.040	1.0	5.95	6.45	0.50	1.23	0.040	0.040	0.62	0.024	11%
9	6.70	1.62	0.53		0.033	0.038	1.0	6.45	6.93	0.48	1.09	0.036	0.036	0.52	0.018	9%
10	7.15	1.58	0.53		0.013	0.040	1.0	6.93	7.38	0.45	1.05	0.027	0.027	0.47	0.013	6%
11	7.60	1.55	0.45		0.025	0.042	1.0	7.38	7.80	0.43	1.10	0.034	0.034	0.47	0.016	7%
12	8.00	1.52	0.35		0.016	0.041	1.0	7.80	8.23	0.43	1.17	0.029	0.029	0.50	0.014	7%
13	8.45	1.45	0.35		0.020	0.026	1.0	8.23	8.68	0.45	1.10	0.023	0.023	0.50	0.011	5%
14	8.90	1.30	0.35		0.023	0.020	1.0	8.68	9.10	0.43	0.95	0.022	0.022	0.40	0.009	4%
15	9.30	1.28	0.35		0.028	0.021	1.0	9.10	9.53	0.42	0.93	0.025	0.025	0.40	0.010	5%
16	9.75	1.10	0.32		0.035	0.019	1.0	9.53	9.98	0.45	0.78	0.027	0.027	0.35	0.009	4%
17	10.20	1.00	0.30	0.012			0.9	9.98	10.60	0.63	0.70	0.012	0.011	0.44	0.005	2%
Right	11.00	0.00	0.00	0.000	0.000	0.000	1.0	10.60	11.00	0.40	0.18	0.003	0.003	0.07	0.000	0%
Total Flow															0.213	

Measurement Details:

Start Time (MST):	11:30
End Time (MST):	12:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Partly cloudy, 5°C

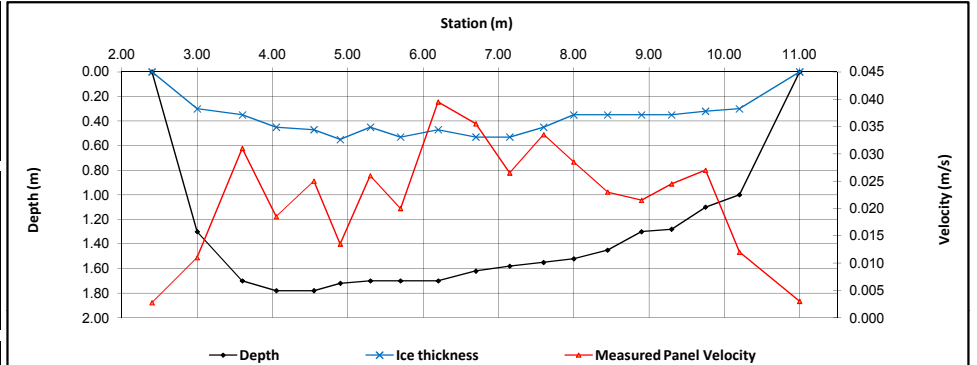
Flow characteristics:

Total Flow:	0.213	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	8.76	(m ²)
Wetted Width:	8.60	(m)
Hydraulic Depth:	1.019	(m)
Mean Velocity:	0.024	(m/s)
Froude Number:	0.008	

Datalogger Details:

	Before	After
Transducer Reading:		1.213
Battery (Main):	14.48	
Battery (Aux):	-	
Datalogger Clock:	10:36	
Laptop Clock:	10:38	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.20	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	0.999	98.250	0.990	98.250	-
Bench Mark 2:	Pipe w/pink flagging	0.958	98.369	0.950	98.369	-
Top of Ice:		2.005	97.322	1.999	97.320	97.321
Water Level:		2.030	97.219	2.025	97.215	97.217
Transducer Reading:		1.213	96.006	1.213	96.002	96.004
Other:						

General Notes:

Multiple Open leads in the ice

Field Personnel:	JO, SG	Trip Date:	1-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek

UTM Location: 479760 E, 6356755 N

Site Visit Date: April 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	13.00	0.00	0.00	0.000	0.000	0.000	1.0	13.00	12.75	0.25	0.41	0.001	0.001	0.10	0.000	0%
1	12.50	1.65		-0.019	0.024		1.0	12.75	12.30	0.45	1.65	0.003	0.003	0.74	0.002	0%
2	12.10	2.01		0.082	0.100		1.0	12.30	11.90	0.40	2.01	0.091	0.091	0.80	0.073	4%
3	11.70	2.10		0.085	0.142		1.0	11.90	11.50	0.40	2.10	0.114	0.114	0.84	0.095	5%
4	11.30	2.30		0.140	0.160		1.0	11.50	11.10	0.40	2.30	0.150	0.150	0.92	0.138	7%
5	10.90	2.15		0.127	0.155		1.0	11.10	10.70	0.40	2.15	0.141	0.141	0.86	0.121	6%
6	10.50	2.15		0.108	0.159		1.0	10.70	10.30	0.40	2.15	0.134	0.134	0.86	0.115	6%
7	10.10	2.10		0.122	0.182		1.0	10.30	9.90	0.40	2.10	0.152	0.152	0.84	0.128	7%
8	9.70	2.10		0.139	0.172		1.0	9.90	9.45	0.45	2.10	0.156	0.156	0.94	0.147	8%
9	9.20	2.05		0.115	0.157		1.0	9.45	9.05	0.40	2.05	0.136	0.136	0.82	0.112	6%
10	8.90	2.05		0.141	0.152		1.0	9.05	8.70	0.35	2.05	0.147	0.147	0.72	0.105	5%
11	8.50	2.05		0.195	0.152		1.0	8.70	8.30	0.40	2.05	0.174	0.174	0.82	0.142	7%
12	8.10	2.07		0.158	0.155		1.0	8.30	7.90	0.40	2.07	0.157	0.157	0.83	0.130	7%
13	7.70	2.01		0.149	0.136		1.0	7.90	7.50	0.40	2.01	0.143	0.143	0.80	0.115	6%
14	7.30	1.98		0.146	0.141		1.0	7.50	7.10	0.40	1.98	0.144	0.144	0.79	0.114	6%
15	6.90	1.85		0.096	0.160		1.0	7.10	6.70	0.40	1.85	0.128	0.128	0.74	0.095	5%
16	6.50	1.70		0.096	0.105		1.0	6.70	6.30	0.40	1.70	0.101	0.101	0.68	0.068	4%
17	6.10	1.44		0.125	0.128		1.0	6.30	5.90	0.40	1.44	0.127	0.127	0.58	0.073	4%
18	5.70	1.32		0.062	0.088		1.0	5.90	5.50	0.40	1.32	0.075	0.075	0.53	0.040	2%
19	5.30	1.26		0.064	0.075		1.0	5.50	5.10	0.40	1.26	0.070	0.070	0.50	0.035	2%
20	4.90	1.22		0.066	0.075		1.0	5.10	4.85	0.25	1.22	0.071	0.071	0.31	0.022	1%
21	4.80	1.24		0.035	0.074		1.0	4.85	4.20	0.65	1.24	0.055	0.055	0.81	0.044	2%
Right	3.60	0.00	0.00	0.000	0.000	0.000	1.0	4.20	3.60	0.60	0.31	0.014	0.014	0.19	0.003	0%
Total Flow															1.914	

Measurement Details:

Start Time (MST):	10:55
End Time (MST):	11:50
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

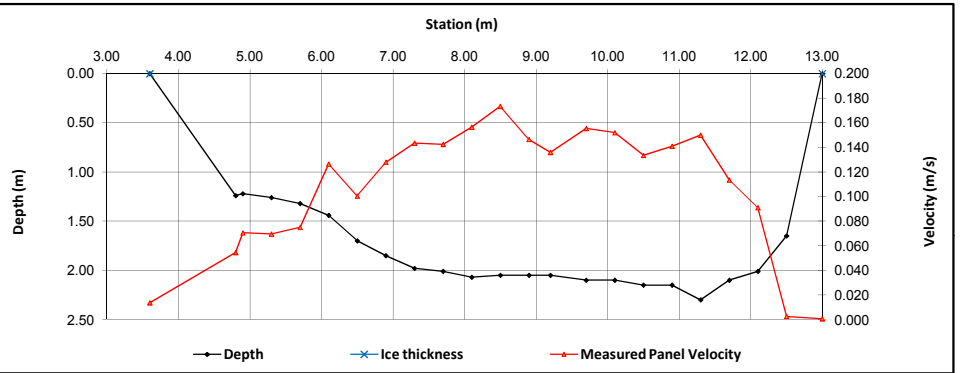
Flow characteristics:

Total Flow:	1.914	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	16.02	(m ²)
Wetted Width:	8.55	(m)
Hydraulic Depth:	1.874	(m)
Mean Velocity:	0.119	(m/s)
Froude Number:	0.028	

Datalogger Details:

	Before	After
Transducer Reading:	1.528	
Battery (Main):	14.69	
Battery (Aux):	-	
Datalogger Clock:	10:58	
Laptop Clock:	10:56	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.30	
Memory Used:	-	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.526	98.250	1.524	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.517	98.369	1.516	98.369	-
Top of Ice:						
Water Level:		2.225	97.661	2.228	97.657	97.659
Transducer Reading:		1.528	96.133	1.528	96.129	96.131
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek

UTM Location: 479760 E, 6356755 N

Site Visit Date: August 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.45	0.45	0.34	0.000	0.000	0.15	0.000	0%
1	3.90	1.36		0.000	0.009		1.0	3.45	4.20	0.75	1.36	0.000	0.000	1.02	0.000	0%
2	4.50	1.55		0.003	0.009		1.0	4.20	4.70	0.50	1.55	0.006	0.006	0.78	0.005	3%
3	4.90	1.56		0.010	0.016		1.0	4.70	5.10	0.40	1.56	0.013	0.013	0.62	0.008	5%
4	5.30	1.54		0.013	0.007		1.0	5.10	5.50	0.40	1.54	0.010	0.010	0.62	0.006	4%
5	5.70	1.54			0.019	0.017	1.0	5.50	5.90	0.40	1.54	0.018	0.018	0.62	0.011	7%
6	6.10	1.49		0.014	0.020		1.0	5.90	6.30	0.40	1.49	0.017	0.017	0.60	0.010	6%
7	6.50	1.50		0.013	0.018		1.0	6.30	6.70	0.40	1.50	0.016	0.016	0.60	0.009	6%
8	6.90	1.54		0.021	0.019		1.0	6.70	7.10	0.40	1.54	0.020	0.020	0.62	0.012	7%
9	7.30	1.50		0.022	0.018		1.0	7.10	7.50	0.40	1.50	0.020	0.020	0.60	0.012	7%
10	7.70	1.47		0.019	0.020		1.0	7.50	7.90	0.40	1.47	0.020	0.020	0.59	0.011	7%
11	8.10	1.47		0.016	0.015		1.0	7.90	8.30	0.40	1.47	0.016	0.016	0.59	0.009	5%
12	8.50	1.50		0.020	0.024		1.0	8.30	8.70	0.40	1.50	0.022	0.022	0.60	0.013	8%
13	8.90	1.46		0.023	0.026		1.0	8.70	9.10	0.40	1.46	0.025	0.025	0.58	0.014	9%
14	9.30	1.48		0.010	0.014		1.0	9.10	9.50	0.40	1.48	0.012	0.012	0.59	0.007	4%
15	9.70	1.52			0.009	0.019	1.0	9.50	9.90	0.40	1.52	0.014	0.014	0.61	0.009	5%
16	10.10	1.53		0.012	0.013		1.0	9.90	10.30	0.40	1.53	0.013	0.013	0.61	0.008	5%
17	10.50	1.51		0.013	0.011		1.0	10.30	10.70	0.40	1.51	0.012	0.012	0.60	0.007	4%
18	10.90	1.48		0.016	0.016		1.0	10.70	11.15	0.45	1.48	0.016	0.016	0.67	0.011	6%
19	11.40	1.40		0.006	0.004		1.0	11.15	11.70	0.55	1.40	0.005	0.005	0.77	0.004	2%
LB	12.00	0.00	0.00	0.000	0.000	0.000	1.0	11.70	12.00	0.30	0.35	0.001	0.001	0.11	0.000	0%
Total Flow															0.167	

Measurement Details:

Start Time (MST):	10:30
End Time (MST):	12:00
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

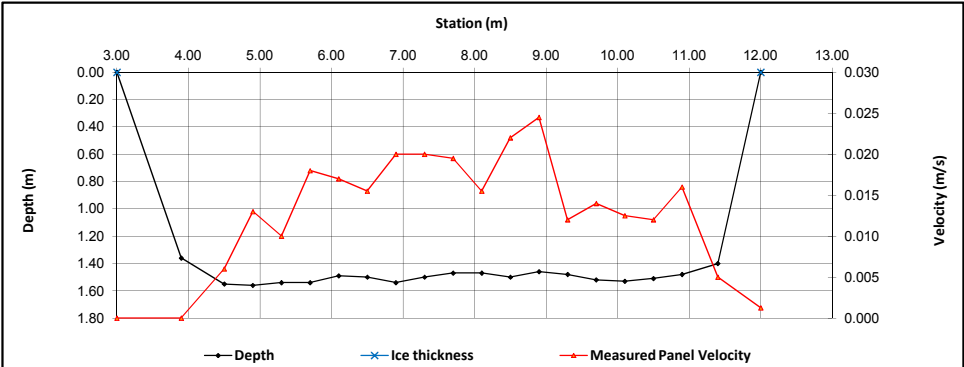
Flow characteristics:

Total Flow:	0.167	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	12.53	(m ²)
Wetted Width:	9.00	(m)
Hydraulic Depth:	1.393	(m)
Mean Velocity:	0.013	(m/s)
Froude Number:	0.004	

Datalogger Details:

	Before	After
Transducer Reading:		1.437
Battery (Main):	14.21	
Battery (Aux):	-	
Datalogger Clock:	10:37	
Laptop Clock:	10:36	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	15.50	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.200	98.250	1.169	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.188	98.369	1.154	98.369	-
Top of Ice:						
Water Level:		2.201	97.356	2.165	97.358	97.357
Transducer Reading:	PLS	1.437	95.919	1.437	95.921	95.920
Other:						

General Notes:

TSS @ 9.0m

Field Personnel:	DB, KW	Trip Date:	15-Aug-11
Data Entry Personnel:	JP	Date:	28-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek

UTM Location: 479760 E, 6356755 N

Site Visit Date: September 15, 2011



Flow Measurement:

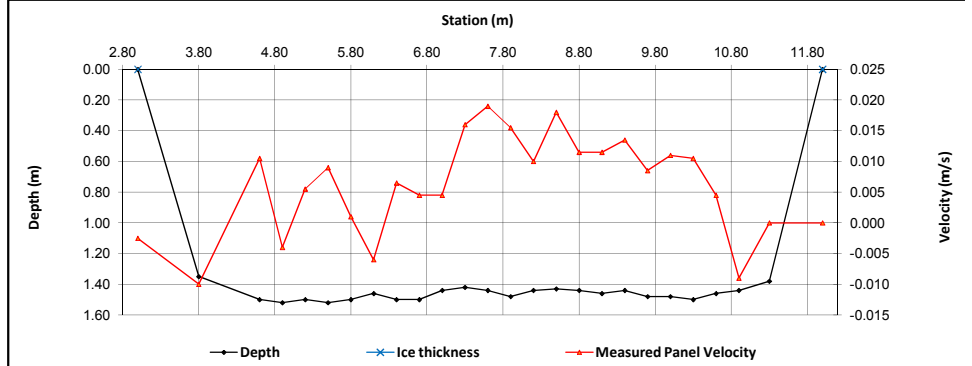
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
L	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.40	0.40	0.34	-0.003	-0.003	0.14	0.000	0%
1	3.80	1.35		-0.010			1.0	3.40	4.20	0.80	1.35	-0.010	-0.010	1.08	-0.011	-16%
2	4.60	1.50			0.013	0.008	1.0	4.20	4.75	0.55	1.50	0.011	0.011	0.83	0.009	13%
3	4.90	1.52		-0.007	-0.001		1.0	4.75	5.05	0.30	1.52	-0.004	-0.004	0.46	-0.002	-3%
4	5.20	1.50		0.009	0.002		1.0	5.05	5.35	0.30	1.50	0.006	0.006	0.45	0.002	4%
5	5.50	1.52			0.010	0.008	1.0	5.35	5.65	0.30	1.52	0.009	0.009	0.46	0.004	6%
6	5.80	1.50		0.011	-0.009		1.0	5.65	5.95	0.30	1.50	0.001	0.001	0.45	0.000	1%
7	6.10	1.46		0.001	-0.013		1.0	5.95	6.25	0.30	1.46	-0.006	-0.006	0.44	-0.003	-4%
8	6.40	1.50		0.009	0.004		1.0	6.25	6.55	0.30	1.50	0.007	0.007	0.45	0.003	4%
9	6.70	1.50		0.010	-0.001		1.0	6.55	6.85	0.30	1.50	0.005	0.005	0.45	0.002	3%
10	7.00	1.44		0.010	-0.001		1.0	6.85	7.15	0.30	1.44	0.005	0.005	0.43	0.002	3%
11	7.30	1.42		0.012	0.020		1.0	7.15	7.45	0.30	1.42	0.016	0.016	0.43	0.007	10%
12	7.60	1.44		0.019	0.019		1.0	7.45	7.75	0.30	1.44	0.019	0.019	0.43	0.008	12%
13	7.90	1.48		0.015	0.016		1.0	7.75	8.05	0.30	1.48	0.016	0.016	0.44	0.007	10%
14	8.20	1.44		0.016	0.004		1.0	8.05	8.35	0.30	1.44	0.010	0.010	0.43	0.004	6%
15	8.50	1.43		0.015	0.021		1.0	8.35	8.65	0.30	1.43	0.018	0.018	0.43	0.008	11%
16	8.80	1.44		0.013	0.010		1.0	8.65	8.95	0.30	1.44	0.012	0.012	0.43	0.005	7%
17	9.10	1.46		0.016	0.007		1.0	8.95	9.25	0.30	1.46	0.012	0.012	0.44	0.005	7%
18	9.40	1.44		0.010	0.017		1.0	9.25	9.55	0.30	1.44	0.014	0.014	0.43	0.006	9%
19	9.70	1.48		0.010	0.007		1.0	9.55	9.85	0.30	1.48	0.009	0.009	0.44	0.004	6%
20	10.00	1.48		0.014	0.008		1.0	9.85	10.15	0.30	1.48	0.011	0.011	0.44	0.005	7%
21	10.30	1.50		0.010	0.011		1.0	10.15	10.45	0.30	1.50	0.011	0.011	0.45	0.005	7%
22	10.60	1.46		0.006	0.003		1.0	10.45	10.75	0.30	1.46	0.005	0.005	0.44	0.002	3%
23	10.90	1.44		0.001	-0.019		1.0	10.75	11.10	0.35	1.44	-0.009	-0.009	0.50	-0.005	-7%
24	11.30	1.38		0.000	-0.007		1.0	11.10	11.65	0.55	1.38	0.000	0.000	0.76	0.000	0%
R	12.00	0.00	0.00	0.000	0.000	0.000	1.0	10.85	12.00	1.15	0.37	0.000	0.000	0.43	0.000	0%
Total Flow															0.068	

Measurement Details:	
Start Time (MST):	11:30
End Time (MST):	13:00
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Fair
Weather:	Sunny

Flow characteristics:		
Total Flow:	0.068	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	12.55	(m ²)
Wetted Width:	9.00	(m)
Hydraulic Depth:	1.395	(m)
Mean Velocity:	0.005	(m/s)
Froude Number:	0.001	

Datalogger Details:		
	Before	After
Transducer Reading:		1.437
Battery (Main):	14.30	
Battery (Aux):	-	
Datalogger Clock:	11:34	
Laptop Clock:	11:33	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	8.6	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.214	98.250	1.202	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.202	98.369	1.189	98.369	-
Top of Ice:						
Water Level:		2.236	97.335	2.224	97.334	97.335
Transducer Reading:	PLS	1.437	95.898	1.437	95.897	95.898
Other:						

General Notes:

TSS @ 9.0m

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	DB	Date:	21-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek
 UTM Location: 479760 E, 6356755 N

Site Visit Date: October 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	0.50	0.50	0.39	0.001	0.001	0.19	0.000	0%
1	1.00	1.56			0.003	0.008	1.0	0.50	1.30	0.80	1.56	0.006	0.006	1.25	0.007	4%
2	1.60	1.66			0.060	0.003	1.0	1.30	1.80	0.50	1.66	0.032	0.032	0.83	0.026	15%
3	2.00	1.68			0.000	0.006	1.0	1.80	2.10	0.30	1.68	0.000	0.000	0.50	0.000	0%
4	2.20	1.64			0.000	0.015	1.0	2.10	2.35	0.25	1.64	0.000	0.000	0.41	0.000	0%
5	2.50	1.65			0.001	0.013	1.0	2.35	2.75	0.40	1.65	0.007	0.007	0.66	0.005	3%
6	3.00	1.60			0.008	0.019	1.0	2.75	3.25	0.50	1.60	0.014	0.014	0.80	0.011	6%
7	3.50	1.62			0.021	0.059	1.0	3.25	3.63	0.38	1.62	0.040	0.040	0.61	0.024	14%
8	3.75	1.66			0.018	0.014	1.0	3.63	3.88	0.25	1.66	0.016	0.016	0.42	0.007	4%
9	4.00	1.62			0.005	0.029	1.0	3.88	4.25	0.38	1.62	0.017	0.017	0.61	0.010	6%
10	4.50	1.59			0.001	0.010	1.0	4.25	4.75	0.50	1.59	0.006	0.006	0.80	0.004	3%
11	5.00	1.57			0.013	0.013	1.0	4.75	5.25	0.50	1.57	0.013	0.013	0.79	0.010	6%
12	5.50	1.56			0.004	0.009	1.0	5.25	5.75	0.50	1.56	0.007	0.007	0.78	0.005	3%
13	6.00	1.58			0.044	0.014	1.0	5.75	6.25	0.50	1.58	0.029	0.029	0.79	0.023	13%
14	6.50	1.63			0.005	0.029	1.0	6.25	6.75	0.50	1.63	0.017	0.017	0.82	0.014	8%
15	7.00	1.65			0.016	0.004	1.0	6.75	7.25	0.50	1.65	0.010	0.010	0.83	0.008	5%
16	7.50	1.60			0.006	0.009	1.0	7.25	7.75	0.50	1.60	0.008	0.008	0.80	0.006	3%
17	8.00	1.54			0.007	0.013	1.0	7.75	8.25	0.50	1.54	0.010	0.010	0.77	0.008	4%
18	8.50	1.52			0.009	0.006	1.0	8.25	8.75	0.50	1.52	0.008	0.008	0.76	0.006	3%
LB	9.00	0.00	0.00	0.000	0.000	0.000	1.0	8.75	9.00	0.25	0.38	0.002	0.002	0.10	0.000	0%
Total Flow															0.174	

Measurement Details:

Start Time (MST):	12:12
End Time (MST):	13:20
Equipment:	ADV
Method:	Fishcat
River Condition:	ice cover
Quality/Error (see reverse):	Good
Weather:	clear, -2

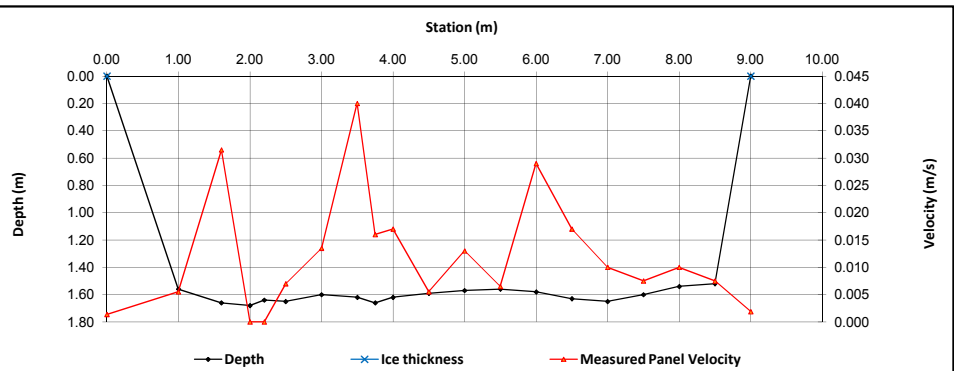
Flow characteristics:

Total Flow:	0.174	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	13.49	(m ²)
Wetted Width:	9.00	(m)
Hydraulic Depth:	1.499	(m)
Mean Velocity:	0.013	(m/s)
Froude Number:	0.003	

Datalogger Details:

	Before	After
Transducer Reading:		1.573
Battery (Main):	14.76	
Battery (Aux):	-	
Datalogger Clock:	11:15	
Laptop Clock:	11:13	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	2.30	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.062	98.250	1.050	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.049	98.369	1.037	98.369	-
Top of Ice:		1.955	97.463	1.944	97.462	97.463
Water Level:		1.952	97.466	1.939	97.467	97.467
Transducer Reading:	PLS	1.573	95.893	1.573	95.894	95.894
Other:						

General Notes:

- Beaver dam 50 m downstream
- Thin ice on river, measured flow with fishcat

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	7-Nov-11
Data Check Personnel:	VS	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S5 - Muskeg River above Stanley Creek
 UTM Location: 479760 E, 6356755 N

Site Visit Date: December 4, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	2.70	0.00	0.00	0.000	0.000	0.000	1.0	2.70	2.90	0.20	0.41	0.000	0.000	0.08	0.000	0%
1	3.10	1.80	0.15		0.000	0.000	1.0	2.90	3.30	0.40	1.65	0.000	0.000	0.66	0.000	0%
2	3.50	1.85	0.16		0.000	0.000	1.0	3.30	3.70	0.40	1.69	0.000	0.000	0.68	0.000	0%
3	3.90	1.81	0.16		0.010	0.010	1.0	3.70	4.10	0.40	1.65	0.010	0.010	0.66	0.007	8%
4	4.30	1.88	0.17		0.010	0.010	1.0	4.10	4.50	0.40	1.71	0.010	0.010	0.68	0.007	9%
5	4.70	1.85	0.16		0.000	0.010	1.0	4.50	4.90	0.40	1.69	0.000	0.000	0.68	0.000	0%
6	5.10	1.89	0.16		0.000	0.010	1.0	4.90	5.30	0.40	1.73	0.000	0.000	0.69	0.000	0%
7	5.50	1.85	0.17		0.010	0.010	1.0	5.30	5.70	0.40	1.68	0.010	0.010	0.67	0.007	9%
8	5.90	1.83	0.17		0.010	0.010	1.0	5.70	6.08	0.38	1.66	0.010	0.010	0.62	0.006	8%
9	6.25	1.85	0.16		0.010	0.010	1.0	6.08	6.45	0.38	1.69	0.010	0.010	0.63	0.006	8%
10	6.65	1.85	0.17		0.010	0.010	1.0	6.45	6.88	0.43	1.68	0.010	0.010	0.71	0.007	9%
11	7.10	1.85	0.16		0.010	0.010	1.0	6.88	7.30	0.43	1.69	0.010	0.010	0.72	0.007	9%
12	7.50	1.82	0.16		0.010	0.010	1.0	7.30	7.70	0.40	1.66	0.010	0.010	0.66	0.007	8%
13	7.90	1.75	0.17		0.010	0.010	1.0	7.70	8.13	0.43	1.58	0.010	0.010	0.67	0.007	9%
14	8.35	1.62	0.22		0.010	0.010	1.0	8.13	8.58	0.45	1.40	0.010	0.010	0.63	0.006	8%
15	8.80	1.51	0.20		0.000	0.010	1.0	8.58	9.03	0.45	1.31	0.000	0.000	0.59	0.000	0%
16	9.25	1.30	0.17		0.000	0.010	1.0	9.03	9.48	0.45	1.13	0.000	0.000	0.51	0.000	0%
17	9.70	1.12	0.17		0.010	0.010	1.0	9.48	9.93	0.45	0.95	0.010	0.010	0.43	0.004	5%
18	10.15	1.10	0.16		0.010	0.010	1.0	9.93	10.35	0.43	0.94	0.010	0.010	0.40	0.004	5%
19	10.55	0.97	0.16		0.010	0.010	1.0	10.35	10.78	0.42	0.81	0.010	0.010	0.34	0.003	4%
20	11.00	0.90	0.15		0.000	0.000	1.0	10.78	11.20	0.42	0.75	0.000	0.000	0.32	0.000	0%
21	11.40	0.88	0.15	0.000			1.0	11.20	11.65	0.45	0.73	0.000	0.000	0.33	0.000	0%
R	11.90	0.00	0.00	0.000	0.000	0.000	1.0	11.65	11.90	0.25	0.18	0.000	0.000	0.05	0.000	0%
Total Flow															0.078	

Measurement Details:

Start Time (MST):	11:05
End Time (MST):	12:05
Equipment:	MARSH
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, Calm, -9C

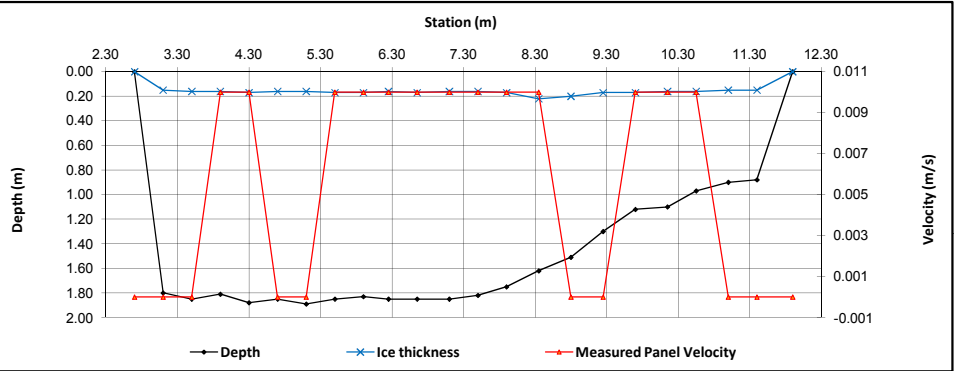
Flow characteristics:

Total Flow:	0.078	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	12.42	(m ²)
Wetted Width:	9.20	(m)
Hydraulic Depth:	1.350	(m)
Mean Velocity:	0.006	(m/s)
Froude Number:	0.002	

Datalogger Details:

	Before	After
Transducer Reading:		1.524
Battery (Main):	12.99	
Battery (Aux):	-	
Datalogger Clock:	11:08	
Laptop Clock:	11:09	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.80	
Memory Used:	-	
Dessicant:	good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.207	98.250	1.192	98.250	-
Bench Mark 2:	Pipe w/pink flagging	1.204	98.369	1.189	98.369	-
Top of Ice:		2.143	97.314	2.128	97.314	97.314
Water Level:		2.153	97.420	2.137	97.421	97.421
Transducer Reading:	PLS	1.524	95.896	1.524	95.897	95.897
Other:						

General Notes:

Beaver dam located 50m downstream of station and flow measurement site

Field Personnel:	SM, SG	Trip Date:	4-Dec-11
Data Entry Personnel:	DW	Date:	5-Dec-11
Data Check Personnel:	SG	Date:	12-Dec-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: January 17, 2011



Flow Measurement:

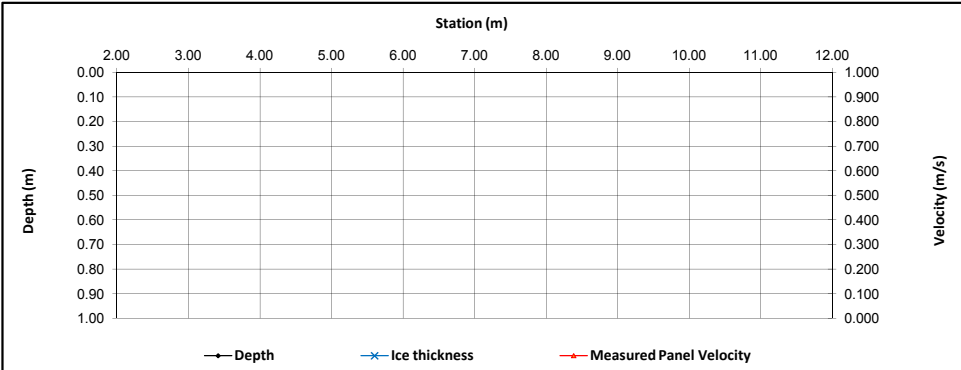
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:	
Start Time (MST):	1:30
End Time (MST):	1:45
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	Overcast, -30oC

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		1.41
Battery (Main):	12.88	13.25
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	0.40	-
Memory Used:	-	-
Dessicant:	Changed	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:
 Barometric pressure: 98.51 kpa



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger					
Bench Mark 2:	Pipe by trail before clearing					
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:
 No measurements taken due to possible unsupported ice (loud thuds heard).

Field Personnel:	DB, JO	Trip Date:	17-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: February 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	2.30	0.00	0.00	0.000	0.000	0.000	0.9	2.30	2.65	0.35	0.13	-0.003	-0.002	0.05	0.000	0%
1	3.00	0.79	0.27	-0.010			0.9	2.65	3.25	0.60	0.52	-0.010	-0.009	0.31	-0.003	-1%
2	3.50	0.91	0.30	0.010			0.9	3.25	3.75	0.50	0.61	0.010	0.009	0.31	0.003	1%
3	4.00	1.05	0.31	0.006			0.9	3.75	4.25	0.50	0.74	0.006	0.005	0.37	0.002	1%
4	4.50	1.15	0.34		0.029	0.024	1.0	4.25	4.80	0.55	0.81	0.027	0.027	0.45	0.012	4%
5	5.10	1.22	0.35		0.049	0.039	1.0	4.80	5.30	0.50	0.87	0.044	0.044	0.44	0.019	7%
6	5.50	1.35	0.35	0.040			0.9	5.30	5.75	0.45	1.00	0.040	0.036	0.45	0.016	6%
7	6.00	1.35	0.36	0.050			0.9	5.75	6.25	0.50	0.99	0.050	0.045	0.50	0.022	8%
8	6.50	1.49	0.37	0.066			0.9	6.25	6.70	0.45	1.12	0.066	0.059	0.50	0.030	10%
9	6.90	1.50	0.42	0.074			0.9	6.70	7.15	0.45	1.08	0.074	0.067	0.49	0.032	11%
10	7.40	1.50	0.42	0.050			0.9	7.15	7.65	0.50	1.08	0.050	0.045	0.54	0.024	8%
11	7.90	1.58	0.45	0.064			0.9	7.65	8.15	0.50	1.13	0.064	0.058	0.57	0.033	11%
12	8.40	1.60	0.45	0.050			0.9	8.15	8.65	0.50	1.15	0.050	0.045	0.58	0.026	9%
13	8.90	1.58	0.45	0.044			0.9	8.65	9.15	0.50	1.13	0.044	0.040	0.57	0.022	8%
14	9.40	1.60	0.45	0.049			0.9	9.15	9.60	0.45	1.15	0.049	0.044	0.52	0.023	8%
15	9.80	1.58	0.47	0.030			0.9	9.60	10.05	0.45	1.11	0.030	0.027	0.50	0.013	5%
16	10.30	1.45	0.45	0.013			0.9	10.05	10.60	0.55	1.00	0.013	0.012	0.55	0.006	2%
17	10.90	1.32	0.40	0.012			0.9	10.60	11.15	0.50	0.92	0.012	0.011	0.51	0.005	2%
18	11.40	1.29	0.35	0.003			0.9	11.15	11.65	0.50	0.94	0.003	0.003	0.47	0.001	0%
19	11.90	1.00	0.34	0.014			0.9	11.65	12.15	0.50	0.66	0.014	0.013	0.33	0.004	1%
20	12.40	0.80	0.25	-0.017			0.9	12.15	12.65	0.50	0.55	-0.017	-0.015	0.28	-0.004	-1%
21	12.90	0.60	0.25	-0.011			0.9	12.65	13.10	0.45	0.35	-0.011	-0.010	0.16	-0.002	-1%
Right	13.30	0.00	0.00	0.000	0.000	0.000	1.0	13.10	13.30	0.20	0.09	-0.003	-0.003	0.02	0.000	0%

Total Flow 0.286

Measurement Details:

Start Time (MST):	10:00
End Time (MST):	11:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	-25°C windy

Flow characteristics:

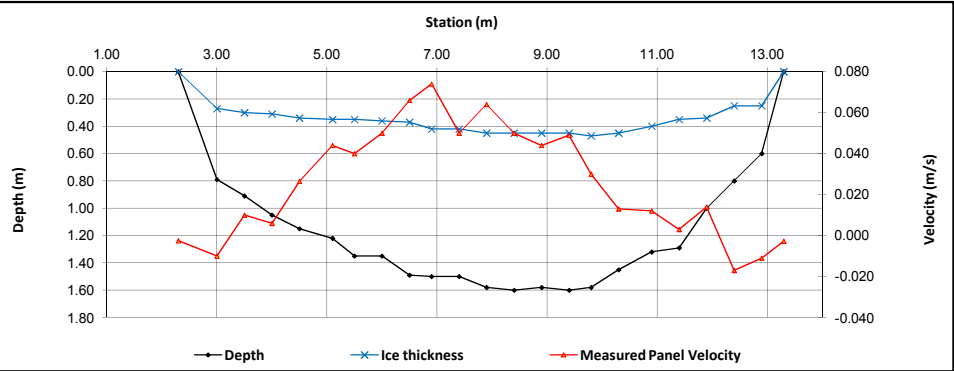
Total Flow:	0.286	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	9.42	(m ²)
Wetted Width:	11.00	(m)
Hydraulic Depth:	0.856	(m)
Mean Velocity:	0.030	(m/s)
Froude Number:	0.011	

Datalogger Details:

	Before	After
Transducer Reading:		1.619
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	14:00	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	97.30	
RH:	-	
Water °C:	0.40	
Memory Used:	-	
Dessiccant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Remote download.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-post near logger	1.306	282.662	1.167	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.816	282.159	1.678	282.159	-
Top of Ice:		2.963	281.005	2.825	281.004	281.005
Water Level:		2.986	280.989	2.850	280.987	280.988
Transducer Reading:		1.619	279.370	1.619	279.368	279.369
Other:						

General Notes: Low SNR Errors on flow meter values.

Field Personnel:	BL, SG	Trip Date:	15-Feb-11
Data Entry Personnel:	SG	Date:	22-Feb-11
Data Check Personnel:	DB	Date:	31-Mar-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: March 10, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	2.00	0.00	0.00	0.000	0.000	0.000	0.9	2.00	2.25	0.25	0.10	0.000	0.000	0.03	0.000	0%
1	2.50	0.75	0.35	0.001			0.9	2.25	2.70	0.45	0.40	0.001	0.001	0.18	0.000	0%
2	2.90	0.92	0.35	-0.002			0.9	2.70	3.05	0.35	0.57	-0.002	-0.002	0.20	0.000	0%
3	3.20	1.05	0.35	0.014			0.9	3.05	3.35	0.30	0.70	0.014	0.013	0.21	0.003	1%
4	3.50	1.20	0.40		0.011	0.010	1.0	3.35	3.70	0.35	0.80	0.011	0.011	0.28	0.003	1%
5	3.90	1.27	0.42		0.026	-0.013	1.0	3.70	4.05	0.35	0.85	0.007	0.007	0.30	0.002	1%
6	4.20	1.33	0.42		0.029	0.019	1.0	4.05	4.40	0.35	0.91	0.024	0.024	0.32	0.008	3%
7	4.60	1.40	0.45		0.008	0.003	1.0	4.40	4.80	0.40	0.95	0.006	0.006	0.38	0.002	1%
8	5.00	1.45	0.47		0.059	0.038	1.0	4.80	5.13	0.33	0.98	0.049	0.049	0.32	0.015	7%
9	5.25	1.48	0.50		0.053	0.095	1.0	5.13	5.43	0.30	0.98	0.074	0.074	0.29	0.022	9%
10	5.60	1.46	0.50		0.088	0.089	1.0	5.43	5.80	0.38	0.96	0.089	0.089	0.36	0.032	14%
11	6.00	1.50	0.46		0.088	0.078	1.0	5.80	6.18	0.38	1.04	0.083	0.083	0.39	0.032	14%
12	6.35	1.50	0.50		0.065	0.029	1.0	6.18	6.53	0.35	1.00	0.047	0.047	0.35	0.016	7%
13	6.70	1.55	0.50		0.047	0.050	1.0	6.53	6.83	0.30	1.05	0.049	0.049	0.32	0.015	7%
14	6.95	1.56	0.50		0.035	0.072	1.0	6.83	7.13	0.30	1.06	0.054	0.054	0.32	0.017	7%
15	7.30	1.60	0.52		0.042	0.050	1.0	7.13	7.48	0.35	1.08	0.046	0.046	0.38	0.017	7%
16	7.65	1.63	0.55		0.031	0.011	1.0	7.48	7.83	0.35	1.08	0.021	0.021	0.38	0.008	3%
17	8.00	1.55	0.57		0.033	0.050	1.0	7.83	8.18	0.35	0.98	0.042	0.042	0.34	0.014	6%
18	8.35	1.55	0.57		0.016	0.050	1.0	8.18	8.58	0.40	0.98	0.033	0.033	0.39	0.013	6%
19	8.80	1.45	0.60		0.021	0.035	1.0	8.58	8.95	0.38	0.85	0.028	0.028	0.32	0.009	4%
20	9.10	1.45	0.60		0.029	0.011	1.0	8.95	9.30	0.35	0.85	0.020	0.020	0.30	0.006	3%
21	9.50	1.50	0.56		0.050	0.008	1.0	9.30	9.70	0.40	0.94	0.029	0.029	0.38	0.011	5%
22	9.90	1.50	0.55		0.000	0.006	1.0	9.70	10.05	0.35	0.95	0.000	0.000	0.33	0.000	0%
23	10.20	1.45	0.50		-0.014	-0.011	1.0	10.05	10.45	0.40	0.95	-0.013	-0.013	0.38	-0.005	-2%
24	10.70	1.30	0.48		-0.009	-0.023	1.0	10.45	10.90	0.45	0.82	-0.016	-0.016	0.37	-0.006	-3%
25	11.10	1.30	0.40		-0.010	0.001	1.0	10.90	11.30	0.40	0.90	-0.005	-0.005	0.36	-0.002	-1%
Right	11.50	0.00	0.00	0.000	0.000	0.000	1.0	11.30	11.50	0.20	0.23	-0.001	-0.001	0.04	0.000	0%
Total Flow															0.233	

Measurement Details:

Start Time (MST):	10:45
End Time (MST):	12:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Light snow, wind gusts

Flow characteristics:

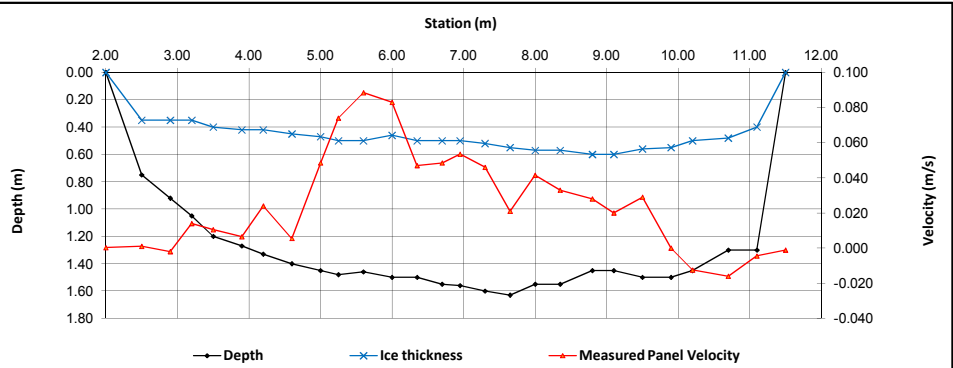
Total Flow:	0.233	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	8.21	(m ²)
Wetted Width:	9.50	(m)
Hydraulic Depth:	0.864	(m)
Mean Velocity:	0.028	(m/s)
Froude Number:	0.010	

Datalogger Details:

	Before	After
Transducer Reading:		1.391
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	11:00	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	98.70	
RH:	-	
Water °C:	0.40	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Download completed remotely



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.161	282.662	1.152	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.685	282.159	1.674	282.159	-
Top of Ice:		2.864	280.980	2.855	280.978	280.979
Water Level:		2.864	280.980	2.855	280.978	280.979
Transducer Reading:		1.391	279.589	1.391	279.587	279.588
Other:						

General Notes: Low SNR Errors on flow meter

Field Personnel:	GB, BL	Trip Date:	10-Mar-11
Data Entry Personnel:	DB	Date:	17-Mar-11
Data Check Personnel:	CM	Date:	7-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: April 5, 2011



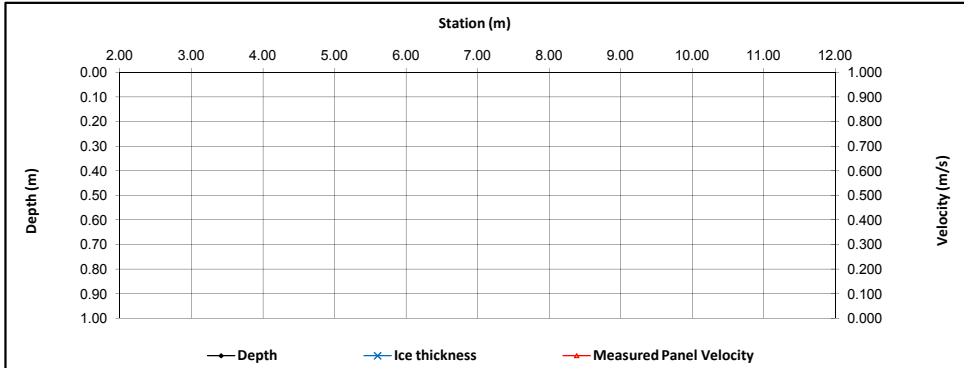
Measured Data							Calculated Data											
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow		
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000			
2							1.0				0.00	0.000	0.000	0.00	0.000			
3							1.0				0.00	0.000	0.000	0.00	0.000			
4							1.0				0.00	0.000	0.000	0.00	0.000			
5							1.0				0.00	0.000	0.000	0.00	0.000			
6							1.0				0.00	0.000	0.000	0.00	0.000			
7							1.0				0.00	0.000	0.000	0.00	0.000			
8							1.0				0.00	0.000	0.000	0.00	0.000			
9							1.0				0.00	0.000	0.000	0.00	0.000			
10							1.0				0.00	0.000	0.000	0.00	0.000			
11							1.0				0.00	0.000	0.000	0.00	0.000			
12							1.0				0.00	0.000	0.000	0.00	0.000			
13							1.0				0.00	0.000	0.000	0.00	0.000			
14							1.0				0.00	0.000	0.000	0.00	0.000			
15							1.0				0.00	0.000	0.000	0.00	0.000			
16							1.0				0.00	0.000	0.000	0.00	0.000			
17							1.0				0.00	0.000	0.000	0.00	0.000			
18							1.0				0.00	0.000	0.000	0.00	0.000			
19							1.0				0.00	0.000	0.000	0.00	0.000			
20							1.0				0.00	0.000	0.000	0.00	0.000			
21							1.0				0.00	0.000	0.000	0.00	0.000			
22							1.0				0.00	0.000	0.000	0.00	0.000			
23							1.0				0.00	0.000	0.000	0.00	0.000			
24							1.0				0.00	0.000	0.000	0.00	0.000			
25							1.0				0.00	0.000	0.000	0.00	0.000			
		0.00	0.00	0.000	0.000	0.000	1.0									Total Flow	0.000	

Measurement Details:	
Start Time (MST):	10:45
End Time (MST):	11:25
Equipment:	ADV
Method:	-
River Condition:	Partially open
Quality/Error (see reverse):	-
Weather:	Clear

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		1.53
Battery (Main):	14.50	
Battery (Aux):	-	
Datalogger Clock:	10:06	
Laptop Clock:	10:02	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.40	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 Barometric pressure (kpa): 96.27, air pressure sensor changed.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.145	282.662	1.135	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.662	282.159	1.652	282.159	-
Top of Ice:		2.742	281.065	2.729	281.068	281.067
Water Level:		2.702	281.119	2.690	281.121	281.120
Transducer Reading:		1.530	279.589	1.530	279.591	279.590
Other:						

General Notes:
 Ice very unsafe, full width open upstream and downstream (see photos). Ice surface < 6" in thickness. Warning received from Syncrude Area Authority regarding the ice conditions.

Field Personnel:	JO, BL	Trip Date:	5-Apr-11
Data Entry Personnel:	CM	Date:	6-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: April 20, 2011



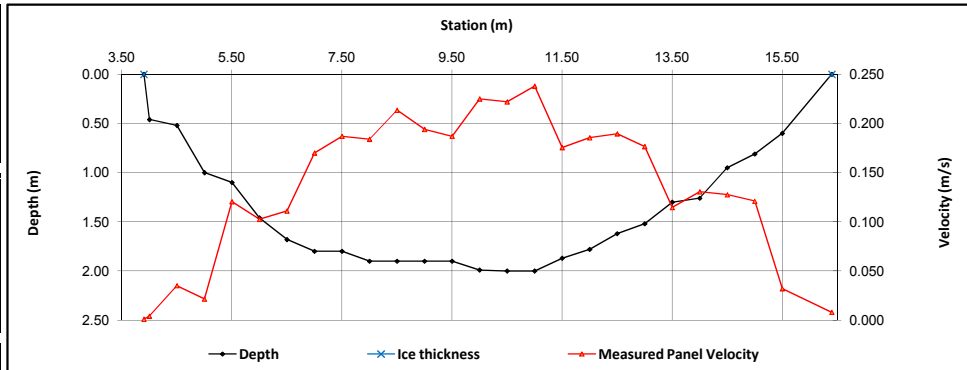
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	16.40	0.00	0.00	0.000	0.000	0.000	1.0	16.40	15.95	0.45	0.15	0.008	0.008	0.07	0.001	0%
1	15.50	0.60		0.032			1.0	15.95	15.25	0.70	0.60	0.032	0.032	0.42	0.013	0%
2	15.00	0.81			0.113	0.129	1.0	15.25	14.75	0.50	0.81	0.121	0.121	0.41	0.049	2%
3	14.50	0.95			0.117	0.138	1.0	14.75	14.25	0.50	0.95	0.128	0.128	0.48	0.061	2%
4	14.00	1.26			0.088	0.173	1.0	14.25	13.75	0.50	1.26	0.131	0.131	0.63	0.082	3%
5	13.50	1.30			0.042	0.187	1.0	13.75	13.25	0.50	1.30	0.115	0.115	0.65	0.074	3%
6	13.00	1.52			0.167	0.186	1.0	13.25	12.75	0.50	1.52	0.177	0.177	0.76	0.134	5%
7	12.50	1.62			0.220	0.159	1.0	12.75	12.25	0.50	1.62	0.190	0.190	0.81	0.153	5%
8	12.00	1.78			0.167	0.204	1.0	12.25	11.75	0.50	1.78	0.186	0.186	0.89	0.165	6%
9	11.50	1.87			0.152	0.199	1.0	11.75	11.25	0.50	1.87	0.176	0.176	0.94	0.164	6%
10	11.00	2.00			0.243	0.233	1.0	11.25	10.75	0.50	2.00	0.238	0.238	1.00	0.238	8%
11	10.50	2.00			0.185	0.259	1.0	10.75	10.25	0.50	2.00	0.222	0.222	1.00	0.222	8%
12	10.00	1.99			0.218	0.232	1.0	10.25	9.75	0.50	1.99	0.225	0.225	1.00	0.224	8%
13	9.50	1.90			0.191	0.183	1.0	9.75	9.25	0.50	1.90	0.187	0.187	0.95	0.178	6%
14	9.00	1.90			0.175	0.213	1.0	9.25	8.75	0.50	1.90	0.194	0.194	0.95	0.184	6%
15	8.50	1.90			0.194	0.233	1.0	8.75	8.25	0.50	1.90	0.214	0.214	0.95	0.203	7%
16	8.00	1.90			0.140	0.228	1.0	8.25	7.75	0.50	1.90	0.184	0.184	0.95	0.175	6%
17	7.50	1.80			0.134	0.240	1.0	7.75	7.25	0.50	1.80	0.187	0.187	0.90	0.168	6%
18	7.00	1.80			0.143	0.197	1.0	7.25	6.75	0.50	1.80	0.170	0.170	0.90	0.153	5%
19	6.50	1.68			0.086	0.136	1.0	6.75	6.25	0.50	1.68	0.111	0.111	0.84	0.093	3%
20	6.00	1.46			0.107	0.098	1.0	6.25	5.75	0.50	1.46	0.103	0.103	0.73	0.075	3%
21	5.50	1.10			0.172	0.069	1.0	5.75	5.25	0.50	1.10	0.121	0.121	0.55	0.066	2%
22	5.00	1.00			0.525	0.014	1.0	5.25	4.75	0.50	1.00	0.022	0.022	0.50	0.011	0%
23	4.50	0.52		0.035			1.0	4.75	4.25	0.50	0.52	0.035	0.035	0.26	0.009	0%
24	4.00	0.46		0.004			1.0	4.25	3.95	0.30	0.46	0.004	0.004	0.14	0.001	0%
Left	3.90	0.00	0.00	0.000	0.000	0.000	1.0	3.95	3.90	0.05	0.12	0.001	0.001	0.01	0.000	0%
Total Flow															2.897	

Measurement Details:	
Start Time (MST):	9:15
End Time (MST):	10:25
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Clear, -2°C

Flow characteristics:		
Total Flow:	2.897	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	17.66	(m ²)
Wetted Width:	12.00	(m)
Hydraulic Depth:	1.472	(m)
Mean Velocity:	0.164	(m/s)
Froude Number:	0.043	

Datalogger Details:		
	Before	After
Transducer Reading:		1.87
Battery (Main):	14.56	
Battery (Aux):	-	
Datalogger Clock:	8:26	
Laptop Clock:	8:22	
Air Temperature °C:	-	
Air Pressure:	97.23	
RH:	-	
Water °C:	1.20	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	1.102	282.662	1.100	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.619	282.159	1.613	282.159	-
Top of Ice:						
Water Level:		2.332	281.446	2.325	281.447	281.447
Transducer Reading:		1.870	279.576	1.870	279.577	279.577
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	20-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: June 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
TL	1.50	0.00	0.00	0.000	0.000	0.000	1.0	1.50	1.75	0.25	0.08	0.000	0.000	0.02	0.000	0%
1	2.00	0.30		0.000			1.0	1.75	2.25	0.50	0.30	0.000	0.000	0.15	0.000	0%
2	2.50	0.59		-0.003			1.0	2.25	2.75	0.50	0.59	-0.003	-0.003	0.30	-0.001	0%
3	3.00	0.72		0.032			1.0	2.75	3.25	0.50	0.72	0.032	0.032	0.36	0.012	2%
4	3.50	1.08			0.012	0.028	1.0	3.25	3.75	0.50	1.08	0.020	0.020	0.54	0.011	2%
5	4.00	1.36			0.016	0.050	1.0	3.75	4.25	0.50	1.36	0.033	0.033	0.68	0.022	4%
6	4.50	1.38			0.042	0.059	1.0	4.25	4.75	0.50	1.38	0.051	0.051	0.69	0.035	6%
7	5.00	1.38			0.046	0.039	1.0	4.75	5.25	0.50	1.38	0.043	0.043	0.69	0.029	5%
8	5.50	1.43			0.074	0.077	1.0	5.25	5.75	0.50	1.43	0.076	0.076	0.72	0.054	10%
9	6.00	1.48			0.064	0.070	1.0	5.75	6.25	0.50	1.48	0.067	0.067	0.74	0.050	9%
10	6.50	1.48			0.073	0.104	1.0	6.25	6.75	0.50	1.48	0.089	0.089	0.74	0.065	12%
11	7.00	1.42			0.062	0.099	1.0	6.75	7.25	0.50	1.42	0.081	0.081	0.71	0.057	10%
12	7.50	1.46			0.068	0.103	1.0	7.25	7.75	0.50	1.46	0.086	0.086	0.73	0.062	11%
13	8.00	1.52			0.055	0.080	1.0	7.75	8.25	0.50	1.52	0.068	0.068	0.76	0.051	9%
14	8.50	1.50			0.043	0.071	1.0	8.25	8.75	0.50	1.50	0.057	0.057	0.75	0.043	8%
15	9.00	1.54			0.058	0.044	1.0	8.75	9.25	0.50	1.54	0.051	0.051	0.77	0.039	7%
16	9.50	1.48			0.028	0.019	1.0	9.25	9.75	0.50	1.48	0.024	0.024	0.74	0.017	3%
17	10.00	1.28			0.009	0.023	1.0	9.75	10.25	0.50	1.28	0.016	0.016	0.64	0.010	2%
18	10.50	1.12			0.002	0.004	1.0	10.25	10.75	0.50	1.12	0.003	0.003	0.56	0.002	0%
19	11.00	0.99			-0.002	-0.013	1.0	10.75	11.25	0.50	0.99	-0.008	-0.008	0.50	-0.004	-1%
20	11.50	0.76			-0.008	0.010	1.0	11.25	11.75	0.50	0.76	0.001	0.001	0.38	0.000	0%
21	12.00	0.58		0.001			1.0	11.75	12.25	0.50	0.58	0.001	0.001	0.29	0.000	0%
22	12.50	0.48		0.000			1.0	12.25	13.00	0.75	0.48	0.000	0.000	0.36	0.000	0%
TR	13.50	0.00	0.00	0.000	0.000	0.000	1.0	13.00	13.50	0.50	0.12	0.000	0.000	0.06	0.000	0%
Total Flow															0.556	

Measurement Details:

Start Time (MST):	10:15
End Time (MST):	12:10
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Smoke, 18 deg C

Flow characteristics:

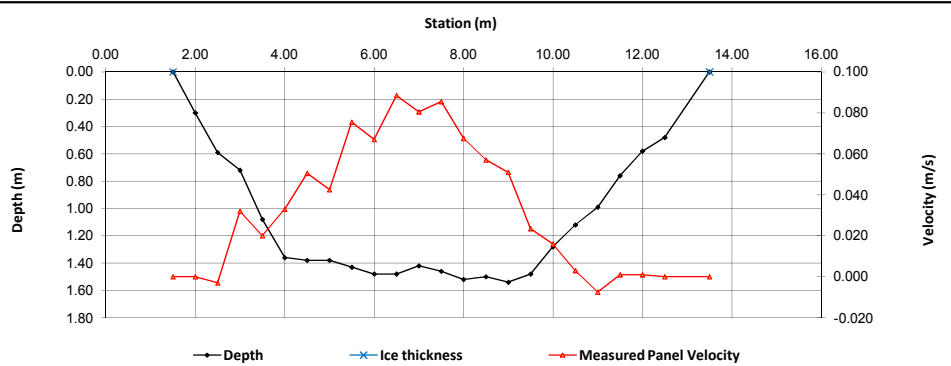
Total Flow:	0.556	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	12.86	(m ²)
Wetted Width:	12.00	(m)
Hydraulic Depth:	1.072	(m)
Mean Velocity:	0.043	(m/s)
Froude Number:	0.013	

Datalogger Details:

	Before	After
Transducer Reading:		1.401
Water °C:	14.60	
Air Pressure:	97.38	
Battery (Main):	14.14	
Datalogger Clock:	9:35	
Laptop Clock:	9:35	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

OS Updated to v 22 @ 10:45h: Checked: OK



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	0.868	282.662	0.859	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.386	282.159	1.378	282.159	-
Top of Ice:						
Water Level:		2.568	280.977	2.561	280.976	280.977
Transducer Reading:		1.401	279.576	1.401	279.575	279.576
Other:						

General Notes:

Field Personnel:	JO, Sm	Trip Date:	15-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek

UTM Location: 476100 E, 6351600 N

Site Visit Date: August 8, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	2.90	0.00	0.00	0.000	0.000	0.000	1.0	2.90	3.20	0.30	0.12	0.005	0.005	0.03	0.000	0%
1	3.50	0.46		0.019			1.0	3.20	3.75	0.55	0.46	0.019	0.019	0.25	0.005	3%
2	4.00	0.74		-0.001			1.0	3.75	4.25	0.50	0.74	-0.001	-0.001	0.37	0.000	0%
3	4.50	0.90			0.096	-0.004	1.0	4.25	4.75	0.50	0.90	0.046	0.046	0.45	0.021	11%
4	5.00	1.30			-0.001	0.009	1.0	4.75	5.25	0.50	1.30	0.004	0.004	0.65	0.003	1%
5	5.50	1.35			0.000	0.003	1.0	5.25	5.75	0.50	1.35	0.000	0.000	0.68	0.000	0%
6	6.00	1.38			0.008	0.022	1.0	5.75	6.25	0.50	1.38	0.015	0.015	0.69	0.010	6%
7	6.50	1.41			0.018	0.015	1.0	6.25	6.75	0.50	1.41	0.017	0.017	0.71	0.012	6%
8	7.00	1.38			0.020	0.039	1.0	6.75	7.25	0.50	1.38	0.030	0.030	0.69	0.020	11%
9	7.50	1.40			0.023	0.032	1.0	7.25	7.75	0.50	1.40	0.028	0.028	0.70	0.019	11%
10	8.00	1.39			0.025	0.035	1.0	7.75	8.25	0.50	1.39	0.030	0.030	0.70	0.021	12%
11	8.50	1.39			0.023	0.021	1.0	8.25	8.75	0.50	1.39	0.022	0.022	0.70	0.015	8%
12	9.00	1.34			0.018	0.030	1.0	8.75	9.25	0.50	1.34	0.024	0.024	0.67	0.016	9%
13	9.50	1.34			0.023	0.006	1.0	9.25	9.75	0.50	1.34	0.015	0.015	0.67	0.010	5%
14	10.00	1.30			0.017	0.010	1.0	9.75	10.25	0.50	1.30	0.014	0.014	0.65	0.009	5%
15	10.50	1.27			0.023	0.009	1.0	10.25	10.75	0.50	1.27	0.016	0.016	0.64	0.010	6%
16	11.00	1.40			0.013	0.012	1.0	10.75	11.25	0.50	1.40	0.013	0.013	0.70	0.009	5%
17	11.50	1.48			0.003	0.008	1.0	11.25	11.75	0.50	1.48	0.006	0.006	0.74	0.004	2%
18	12.00	1.54			0.008	0.005	1.0	11.75	12.25	0.50	1.54	0.007	0.007	0.77	0.005	3%
19	12.50	1.34			0.009	-0.002	1.0	12.25	12.75	0.50	1.34	0.004	0.004	0.67	0.002	1%
20	13.00	0.74		0.005			1.0	12.75	13.25	0.50	0.74	0.005	0.005	0.37	0.002	1%
21	13.50	0.40		-0.036			1.0	13.25	14.00	0.75	0.40	-0.036	-0.036	0.30	-0.011	-6%
RB	14.50	0.00	0.00	0.000	0.000	0.000	1.0	14.00	14.50	0.50	0.10	-0.009	-0.009	0.05	0.000	0%
Total Flow															0.181	

Measurement Details:

Start Time (MST):	9:40
End Time (MST):	10:45
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Sunny, 20°C

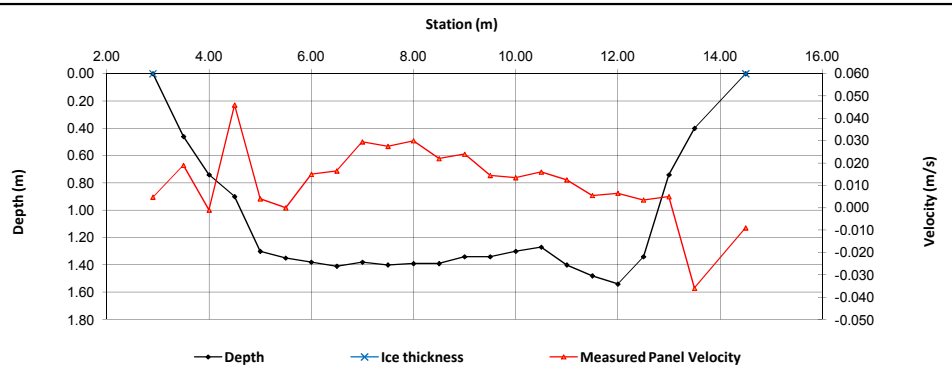
Flow characteristics:

Total Flow:	0.181	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	12.83	(m ²)
Wetted Width:	11.60	(m)
Hydraulic Depth:	1.106	(m)
Mean Velocity:	0.014	(m/s)
Froude Number:	0.004	

Datalogger Details:

	Before	After
Transducer Reading:		1.344
Battery (Main):	13.99	
Battery (Aux):		
Datalogger Clock:	9:42	
Laptop Clock:	9:44	
Air Temperature °C:	-	
Air Pressure:	97.76	
RH:	-	
Water °C:	17.90	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	0.947	282.662	0.938	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.462	282.159	1.452	282.159	-
Top of Ice:						
Water Level:		2.687	280.934	2.675	280.936	280.935
Transducer Reading:		1.344	279.590	1.344	279.592	279.591
Other:						

General Notes:

No visual flow present, water circulating on surface

Field Personnel:	SG, SM	Trip Date:	8-Aug-11
Data Entry Personnel:	DB	Date:	23-Aug-11
Data Check Personnel:	JP	Date:	26-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: September 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	4.20	0.00	0.00	0.000	0.000	0.000	1.0	4.20	4.60	0.40	0.11	0.000	0.000	0.04	0.000	0%
1	5.00	0.42		0.000			1.0	4.60	5.25	0.65	0.42	0.000	0.000	0.27	0.000	0%
2	5.50	0.64		0.011			1.0	5.25	5.75	0.50	0.64	0.011	0.011	0.32	0.004	2%
3	6.00	0.92			0.010	0.007	1.0	5.75	6.25	0.50	0.92	0.009	0.009	0.46	0.004	3%
4	6.50	1.12			0.023	0.013	1.0	6.25	6.65	0.40	1.12	0.018	0.018	0.45	0.008	6%
5	6.80	1.12			0.018	0.006	1.0	6.65	6.90	0.25	1.12	0.012	0.012	0.28	0.003	2%
6	7.00	1.25			0.019	0.028	1.0	6.90	7.25	0.35	1.25	0.024	0.024	0.44	0.010	7%
7	7.50	1.30			0.031	0.015	1.0	7.25	7.75	0.50	1.30	0.023	0.023	0.65	0.015	10%
8	8.00	1.34			0.019	0.016	1.0	7.75	8.25	0.50	1.34	0.018	0.018	0.67	0.012	8%
9	8.50	1.34			0.023	0.027	1.0	8.25	8.75	0.50	1.34	0.025	0.025	0.67	0.017	12%
10	9.00	1.46			0.020	0.013	1.0	8.75	9.25	0.50	1.46	0.017	0.017	0.73	0.012	8%
11	9.50	1.40			0.018	0.014	1.0	9.25	9.75	0.50	1.40	0.016	0.016	0.70	0.011	8%
12	10.00	1.40			0.022	0.010	1.0	9.75	10.25	0.50	1.40	0.016	0.016	0.70	0.011	8%
13	10.50	1.44			0.016	0.002	1.0	10.25	10.75	0.50	1.44	0.009	0.009	0.72	0.006	5%
14	11.00	1.45			0.017	0.008	1.0	10.75	11.25	0.50	1.45	0.013	0.013	0.73	0.009	6%
15	11.50	1.40			0.009	0.005	1.0	11.25	11.75	0.50	1.40	0.007	0.007	0.70	0.005	3%
16	12.00	1.38			0.012	0.003	1.0	11.75	12.25	0.50	1.38	0.008	0.008	0.69	0.005	4%
17	12.50	1.38			0.017	0.009	1.0	12.25	12.75	0.50	1.38	0.013	0.013	0.69	0.009	6%
18	13.00	1.14			-0.004	-0.007	1.0	12.75	13.25	0.50	1.14	-0.006	-0.006	0.57	-0.003	-2%
19	13.50	1.00				-0.002	1.0	13.25	13.75	0.50	1.00	-0.002	-0.002	0.50	-0.001	-1%
20	14.00	0.58		0.012			1.0	13.75	14.25	0.50	0.58	0.012	0.012	0.29	0.003	2%
21	14.50	0.53		0.005			1.0	14.25	14.85	0.60	0.53	0.005	0.005	0.32	0.002	1%
RB	15.20	0.00	0.00	0.000	0.000	0.000	1.0	14.85	15.20	0.35	0.13	0.001	0.001	0.05	0.000	0%
Total Flow															0.143	

Measurement Details:

Start Time (MST):	8:50
End Time (MST):	10:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	good
Weather:	light breeze-windy

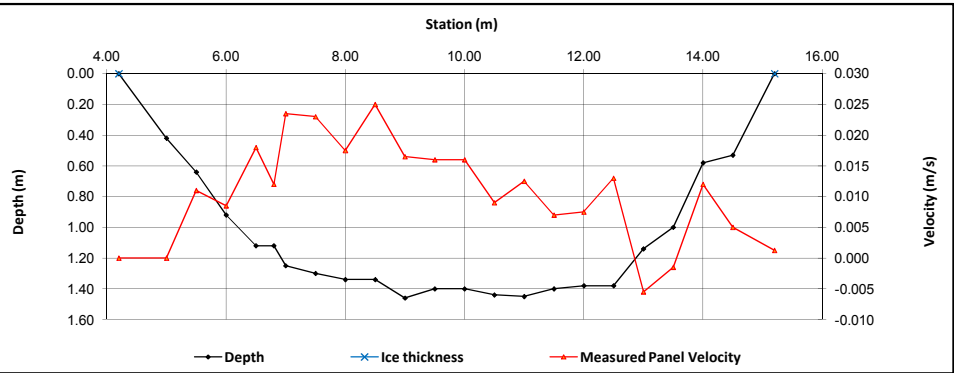
Flow characteristics:

Total Flow:	0.143	(m ³ /s)
Perceived Measurement Quality:	good	
Cross Section Area:	11.63	(m ²)
Wetted Width:	11.00	(m)
Hydraulic Depth:	1.057	(m)
Mean Velocity:	0.012	(m/s)
Froude Number:	0.004	

Datalogger Details:

	Before	After
Transducer Reading:		1.283
Battery (Main):	13.51	
Battery (Aux):	-	
Datalogger Clock:	8:57	
Laptop Clock:	8:59	
Air Temperature °C:	-	
Air Pressure:	96.53	
RH:	-	
Water °C:	11.90	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-post near logger	0.911	282.662	0.895	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.427	282.159	1.411	282.159	-
Top of Ice:						
Water Level:		2.722	280.864	2.703	280.867	280.866
Transducer Reading:		1.283	279.581	1.283	279.584	279.583
Other:						

General Notes:

Field Personnel:	SM, GB	Trip Date:	26-Sep-11
Data Entry Personnel:	tk	Date:	27-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek
 UTM Location: 476100 E, 6351600 N

Site Visit Date: November 4, 2011



Flow Measurement:

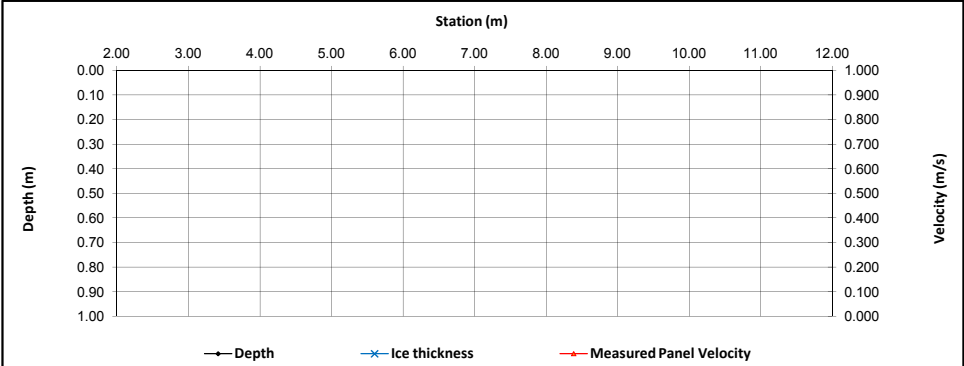
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:	
Start Time (MST):	10:15
End Time (MST):	11:30
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear, Breezy, -8C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		1.384
Battery (Main):	15.02	
Battery (Aux):	-	
Datalogger Clock:	9:38	
Laptop Clock:	9:40	
Air Temperature °C:	-	
Air Pressure:	97.59	
RH:	-	
Water °C:	1.70	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 replaced solar controller since voltage at battery was too high



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	0.858	282.662	0.840	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.377	282.159	1.356	282.159	-
Top of Ice:		2.555	280.965	2.536	280.966	280.966
Water Level:		2.564	280.972	2.548	280.967	280.970
Transducer Reading:		1.384	279.588	1.384	279.583	279.586
Other:						

General Notes:
 Full ice cover on river 2-2.5" thick not considered safe conditions.
 BMI 0.56m
 BM2 0.30m

Field Personnel:	GB, SM	Trip Date:	4-Nov-11
Data Entry Personnel:	DW	Date:	14-Nov-11
Data Check Personnel:	VS	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S5A - Muskeg River above Muskeg Creek

UTM Location: 476100 E, 6351600 N

Site Visit Date: December 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	3.00	0.00	0.00	0.000	0.000	0.000	0.9	3.00	3.43	0.43	0.10	-0.001	0.000	0.04	0.000	0%
1	3.85	0.55	0.16	-0.002			0.9	3.43	4.10	0.68	0.39	-0.002	-0.002	0.26	0.000	0%
2	4.35	0.67	0.17	0.008			0.9	4.10	4.63	0.53	0.50	0.008	0.007	0.26	0.002	1%
3	4.90	0.75	0.16	0.002			0.9	4.63	5.10	0.48	0.59	0.002	0.002	0.28	0.001	0%
4	5.30	0.85	0.19	0.017			0.9	5.10	5.58	0.48	0.66	0.017	0.015	0.31	0.005	2%
5	5.85	1.02	0.21		0.013	0.022	1.0	5.58	6.08	0.50	0.81	0.018	0.018	0.41	0.007	3%
6	6.30	1.12	0.21		0.033	0.024	1.0	6.08	6.55	0.48	0.91	0.029	0.029	0.43	0.012	5%
7	6.80	1.20	0.21		0.037	0.024	1.0	6.55	7.03	0.48	0.99	0.031	0.031	0.47	0.014	6%
8	7.25	1.25	0.21		0.036	0.034	1.0	7.03	7.48	0.45	1.04	0.035	0.035	0.47	0.016	7%
9	7.70	1.34	0.20		0.040	0.038	1.0	7.48	7.93	0.45	1.14	0.039	0.039	0.51	0.020	9%
10	8.15	1.40	0.21		0.042	0.036	1.0	7.93	8.35	0.43	1.19	0.039	0.039	0.51	0.020	9%
11	8.55	1.45	0.23		0.055	0.048	1.0	8.35	8.78	0.42	1.22	0.052	0.052	0.52	0.027	12%
12	9.00	1.55	0.23		0.034	0.049	1.0	8.78	9.20	0.42	1.32	0.042	0.042	0.56	0.023	10%
13	9.40	1.61	0.24		0.038	0.042	1.0	9.20	9.68	0.48	1.37	0.040	0.040	0.65	0.026	11%
14	9.95	1.60	0.25		0.031	0.039	1.0	9.68	10.15	0.47	1.35	0.035	0.035	0.64	0.022	10%
15	10.35	1.55	0.23		0.019	0.027	1.0	10.15	10.58	0.43	1.32	0.023	0.023	0.56	0.013	6%
16	10.80	1.50	0.24		0.013	0.018	1.0	10.58	10.98	0.40	1.26	0.016	0.016	0.50	0.008	3%
17	11.15	1.40	0.21		0.009	0.013	1.0	10.98	11.40	0.42	1.19	0.011	0.011	0.51	0.006	2%
18	11.65	1.28	0.20		0.008	0.006	1.0	11.40	11.93	0.53	1.08	0.007	0.007	0.57	0.004	2%
19	12.20	1.10	0.18		0.008	0.005	1.0	11.93	12.48	0.55	0.92	0.007	0.007	0.51	0.003	1%
20	12.75	0.80	0.17	-0.005			0.9	12.48	13.03	0.55	0.63	-0.005	-0.005	0.35	-0.002	-1%
21	13.30	0.55	0.16	0.000			1.0	13.03	13.65	0.63	0.39	0.000	0.000	0.24	0.000	0%
R	14.00	0.00	0.00	0.000	0.000	0.000	1.0	13.65	14.00	0.35	0.10	0.000	0.000	0.03	0.000	0%

Total Flow 0.227

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	12:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, light breeze, -2

Flow characteristics:

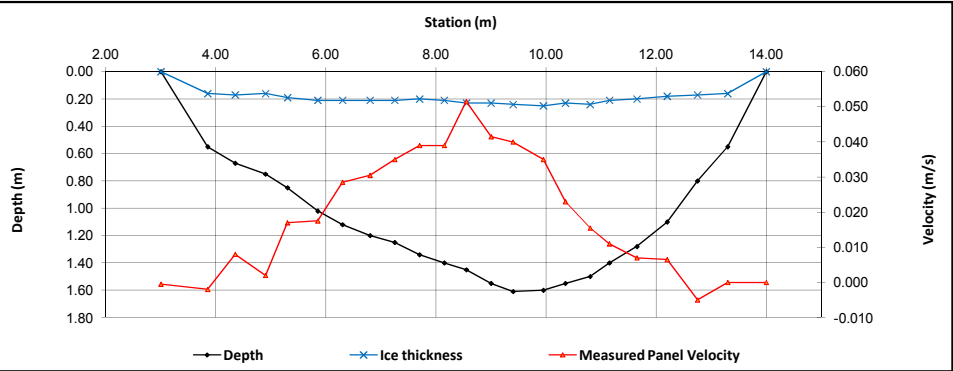
Total Flow:	0.227	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	9.59	(m ²)
Wetted Width:	11.00	(m)
Hydraulic Depth:	0.872	(m)
Mean Velocity:	0.024	(m/s)
Froude Number:	0.008	

Datalogger Details:

	Before	After
Transducer Reading:		1.353
Battery (Main):	8.82	
Battery (Aux):	-	
Datalogger Clock:	11:08	
Laptop Clock:	11:11	
Air Temperature °C:	-	
Air Pressure:	96.94	
RH:	-	
Water °C:	0.70	
Memory Used:	-	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

replaced battery, re-wired solar controller



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post near logger	0.999	282.662	0.987	282.662	-
Bench Mark 2:	Pipe by trail before clearing	1.517	282.159	1.506	282.159	-
Top of Ice:		2.745	280.916	2.733	280.916	280.916
Water Level:		2.743	280.933	2.731	280.934	280.934
Transducer Reading:		1.353	279.580	1.353	279.581	279.581
Other:						

General Notes:

- Installed isolation device for modem communication

Field Personnel:	SG, SM	Trip Date:	5-Dec-11
Data Entry Personnel:	DW	Date:	12-Dec-11
Data Check Personnel:	SG	Date:	12-Dec-11

Hydrometric Measurement / Site Visit Record

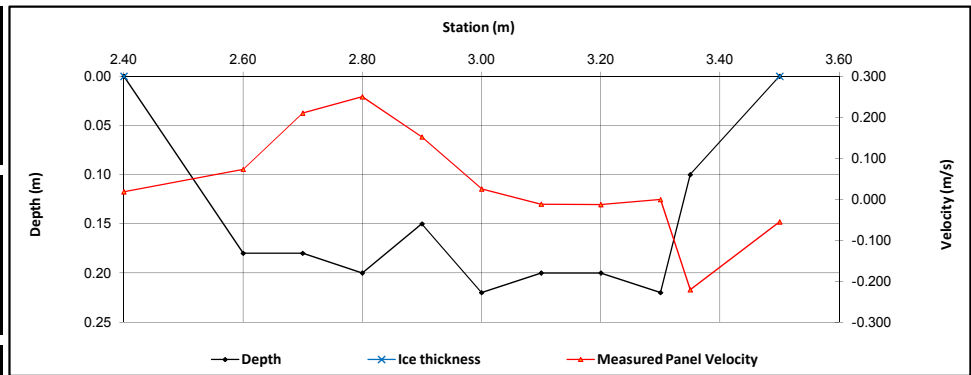
Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: January 15, 2011



Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.50	3.43	0.08	0.03	-0.055	-0.055	0.00	0.000	-1%
1	3.35	0.10		-0.221			1.0	3.43	3.33	0.10	0.10	-0.221	-0.221	0.01	-0.002	-20%
2	3.30	0.22		-0.001			1.0	3.33	3.25	0.08	0.22	-0.001	-0.001	0.02	0.000	0%
3	3.20	0.20		-0.013			1.0	3.25	3.15	0.10	0.20	-0.013	-0.013	0.02	0.000	-2%
4	3.10	0.20		-0.012			1.0	3.15	3.05	0.10	0.20	-0.012	-0.012	0.02	0.000	-2%
5	3.00	0.22		0.025			1.0	3.05	2.95	0.10	0.22	0.025	0.025	0.02	0.001	5%
6	2.90	0.15		0.152			1.0	2.95	2.85	0.10	0.15	0.152	0.152	0.02	0.002	21%
7	2.80	0.20		0.250			1.0	2.85	2.75	0.10	0.20	0.250	0.250	0.02	0.005	46%
8	2.70	0.18		0.210			1.0	2.75	2.65	0.10	0.18	0.210	0.210	0.02	0.004	35%
9	2.60	0.18		0.073			1.0	2.65	2.50	0.15	0.18	0.073	0.073	0.03	0.002	18%
Right	2.40	0.00	0.00	0.000	0.000	0.000	1.0	2.50	2.40	0.10	0.05	0.018	0.018	0.00	0.000	1%
Total Flow															0.011	

Measurement Details:	
Start Time (MST):	16:10
End Time (MST):	17:10
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Overcast, -30°C



Flow characteristics:		
Total Flow:	0.011	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.17	(m ²)
Wetted Width:	0.93	(m)
Hydraulic Depth:	0.189	(m)
Mean Velocity:	0.062	(m/s)
Froude Number:	0.046	

Datalogger Details:	Before	After
Transducer Reading:		0.58
Battery (Main):	13.94	
Battery (Aux):	-	
Datalogger Clock:	16:11	
Laptop Clock:	16:10	
Air Temperature °C:	1.4	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC		273.600		273.600	-
Bench Mark 2:	Equipment mast		274.119		274.119	-
Top of Ice:						
Water Level:			273.600		273.600	-
Transducer Reading:		0.580	273.020	0.580	273.020	273.020
Other:						

General Notes:

Datalogger / Station Notes:

Field Personnel:	DB, JO	Trip Date:	15-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: February 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	1.00	0.00	0.00	0.000	0.000	0.000	1.0	1.00	1.05	0.05	0.04	0.000	0.000	0.00	0.000	0%
1	1.10	0.16		0.000			1.0	1.05	1.13	0.08	0.16	0.000	0.000	0.01	0.000	0%
2	1.15	0.15		-0.038			1.0	1.13	1.18	0.05	0.15	-0.038	-0.038	0.01	0.000	-12%
3	1.20	0.16		0.104			1.0	1.18	1.23	0.05	0.16	0.104	0.104	0.01	0.001	34%
4	1.25	0.08		0.160			1.0	1.23	1.28	0.05	0.08	0.160	0.160	0.00	0.001	26%
5	1.30	0.08		0.090			1.0	1.28	1.33	0.05	0.08	0.090	0.090	0.00	0.000	15%
6	1.35	0.06		0.087			1.0	1.33	1.38	0.05	0.06	0.087	0.087	0.00	0.000	11%
7	1.40	0.05		0.013			1.0	1.38	1.43	0.05	0.05	0.013	0.013	0.00	0.000	1%
8	1.45	0.06		0.110			1.0	1.43	1.48	0.05	0.06	0.110	0.110	0.00	0.000	13%
9	1.50	0.06		-0.003			1.0	1.48	1.53	0.05	0.06	-0.003	-0.003	0.00	0.000	0%
10	1.55	0.10		0.054			1.0	1.53	1.58	0.05	0.10	0.054	0.054	0.01	0.000	11%
11	1.60	0.10		0.002			1.0	1.58	1.63	0.05	0.10	0.002	0.002	0.00	0.000	0%
12	1.65	0.08		0.006			1.0	1.63	1.68	0.05	0.08	0.006	0.006	0.00	0.000	1%
13	1.70	0.12		0.001			1.0	1.68	1.73	0.05	0.12	0.001	0.001	0.01	0.000	0%
14	1.75	0.10		-0.001			1.0	1.73	1.78	0.05	0.10	-0.001	-0.001	0.00	0.000	0%
15	1.80	0.08		0.000			1.0	1.78	1.85	0.08	0.08	0.000	0.000	0.01	0.000	0%
Left	1.90	0.00	0.00	0.000	0.000	0.000	1.0	1.85	1.90	0.05	0.02	0.000	0.000	0.00	0.000	0%
Total Flow														0.002		

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	15:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Overcast

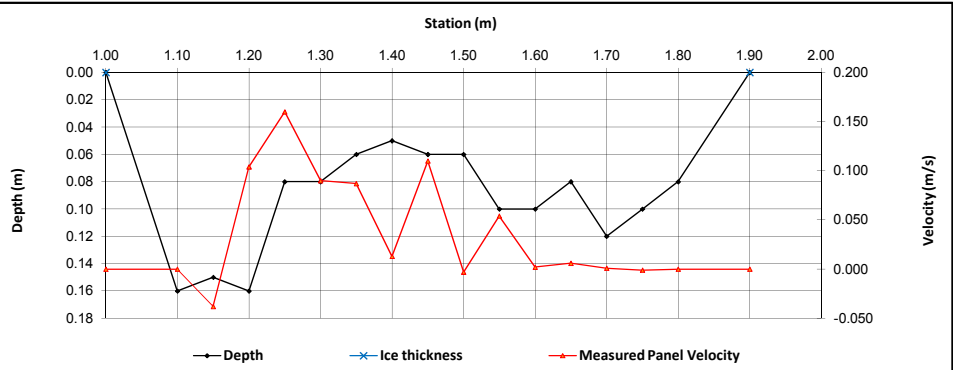
Flow characteristics:

Total Flow:	0.002	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.08	(m ²)
Wetted Width:	0.90	(m)
Hydraulic Depth:	0.090	(m)
Mean Velocity:	0.030	(m/s)
Froude Number:	0.032	

Datalogger Details:

	Before	After
Transducer Reading:		0.57
Battery (Main):	15.20	
Battery (Aux):	-	
Datalogger Clock:	13:13	
Laptop Clock:	13:12	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.20	
Memory Used:	-	
Dessicant:	Good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.105	273.600	1.123	273.600	-
Bench Mark 2:	Equipment mast	0.538	274.119	0.558	274.119	-
Top of Ice:						
Water Level:		2.696	272.009	2.718	272.005	272.007
Transducer Reading:		0.570	271.439	0.570	271.435	271.437
Other:						

General Notes:

Field Personnel:	BL, SG	Trip Date:	14-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: March 10, 2011



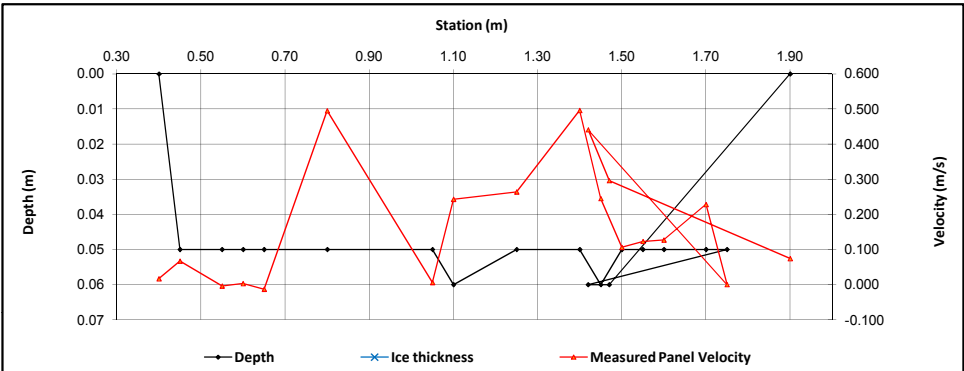
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.40	0.00		0.000	0.000	0.000	1.0	0.40	0.43	0.03	0.01	0.017	0.017	0.00	0.000	0%
1	0.45	0.05		0.067			1.0	0.43	0.50	0.08	0.05	0.067	0.067	0.00	0.000	1%
2	0.55	0.05		-0.004			1.0	0.50	0.58	0.08	0.05	-0.004	-0.004	0.00	0.000	0%
3	0.60	0.05		0.003			1.0	0.58	0.63	0.05	0.05	0.003	0.003	0.00	0.000	0%
4	0.65	0.05		-0.013			1.0	0.63	0.73	0.10	0.05	-0.013	-0.013	0.01	0.000	0%
5	0.80	0.05		0.495			1.0	0.73	0.93	0.20	0.05	0.495	0.495	0.01	0.005	23%
6	1.05	0.05		0.006			1.0	0.93	1.08	0.15	0.05	0.006	0.006	0.01	0.000	0%
7	1.10	0.06		0.243			1.0	1.08	1.18	0.10	0.06	0.243	0.243	0.01	0.001	7%
8	1.25	0.05		0.264			1.0	1.18	1.33	0.15	0.05	0.264	0.264	0.01	0.002	9%
9	1.40	0.05		0.496			1.0	1.33	1.43	0.10	0.05	0.496	0.496	0.00	0.002	11%
10	1.45	0.06		0.245			1.0	1.43	1.48	0.05	0.06	0.245	0.245	0.00	0.001	3%
11	1.50	0.05		0.106			1.0	1.48	1.53	0.05	0.05	0.106	0.106	0.00	0.000	1%
12	1.55	0.05		0.123			1.0	1.53	1.58	0.05	0.05	0.123	0.123	0.00	0.000	1%
13	1.60	0.05		0.127			1.0	1.58	1.65	0.07	0.05	0.127	0.127	0.00	0.000	2%
14	1.70	0.05		0.228			1.0	1.65	1.73	0.08	0.05	0.228	0.228	0.00	0.001	4%
15	1.75	0.05		0.000			1.0	1.73	1.59	0.14	0.05	0.000	0.000	0.01	0.000	0%
16	1.42	0.06		0.441			1.0	1.59	1.45	0.14	0.06	0.441	0.441	0.01	0.004	17%
17	1.47	0.06		0.296			1.0	1.45	1.69	0.24	0.06	0.296	0.296	0.01	0.004	19%
Left	1.90	0.00		0.000	0.000	0.000	1.0	1.69	1.90	0.22	0.02	0.074	0.074	0.00	0.000	1%
Total Flow															0.022	

Measurement Details:	
Start Time (MST):	14:45
End Time (MST):	15:15
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Overcast, light snow

Flow characteristics:		
Total Flow:	0.022	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.10	(m ²)
Wetted Width:	1.50	(m)
Hydraulic Depth:	0.067	(m)
Mean Velocity:	0.220	(m/s)
Froude Number:	0.272	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	15.45	
Battery (Aux):	-	
Datalogger Clock:	14:47	
Laptop Clock:	14:45	
Air Temperature °C:	-16.93	
Air Pressure:	-	
RH:	-	
Water °C:	1.00	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.099	273.600	1.080	273.600	-
Bench Mark 2:	Equipment mast	0.528	274.119	0.507	274.119	-
Top of Ice:						
Water Level:		2.700	271.999	2.681	271.999	271.999
Transducer Reading:		0.570	271.429	0.570	271.429	271.429
Other:						

General Notes:

Field Personnel:	GB, BL	Trip Date:	10-Mar-11
Data Entry Personnel:	CM	Date:	21-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: April 5, 2011



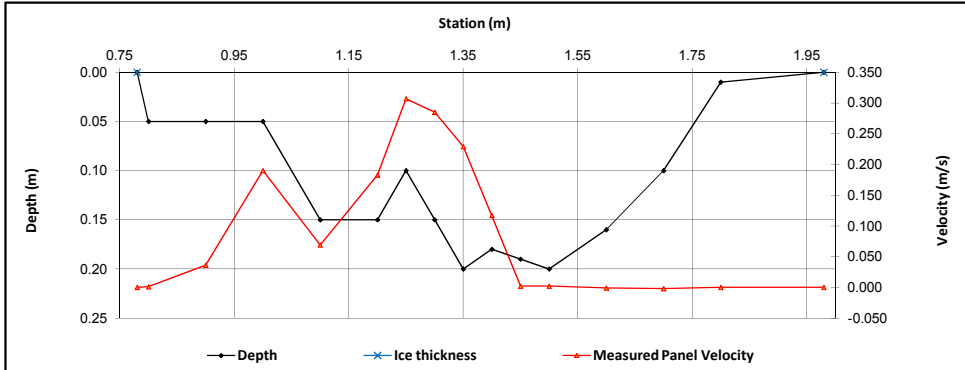
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.78	0.00	0.00	0.000	0.000	0.000	1.0	0.78	0.79	0.01	0.01	0.000	0.000	0.00	0.000	0%
1	0.80	0.05		0.001			1.0	0.79	0.85	0.06	0.05	0.001	0.001	0.00	0.000	0%
2	0.90	0.05		0.036			1.0	0.85	0.95	0.10	0.05	0.036	0.036	0.00	0.000	2%
3	1.00	0.05		0.190			1.0	0.95	1.05	0.10	0.05	0.190	0.190	0.01	0.001	8%
4	1.10	0.15		0.069			1.0	1.05	1.15	0.10	0.15	0.069	0.069	0.02	0.001	9%
5	1.20	0.15		0.183			1.0	1.15	1.23	0.08	0.15	0.183	0.183	0.01	0.002	18%
6	1.25	0.10		0.307			1.0	1.23	1.28	0.05	0.10	0.307	0.307	0.00	0.002	14%
7	1.30	0.15		0.285			1.0	1.28	1.33	0.05	0.15	0.285	0.285	0.01	0.002	19%
8	1.35	0.20		0.229			1.0	1.33	1.38	0.05	0.20	0.229	0.229	0.01	0.002	20%
9	1.40	0.18		0.117			1.0	1.38	1.43	0.05	0.18	0.117	0.117	0.01	0.001	9%
10	1.45	0.19		0.002			1.0	1.43	1.48	0.05	0.19	0.002	0.002	0.01	0.000	0%
11	1.50	0.20		0.002			1.0	1.48	1.55	0.08	0.20	0.002	0.002	0.02	0.000	0%
12	1.60	0.16		-0.001			1.0	1.55	1.65	0.10	0.16	-0.001	-0.001	0.02	0.000	0%
13	1.70	0.10		-0.002			1.0	1.65	1.75	0.10	0.10	-0.002	-0.002	0.01	0.000	0%
14	1.80	0.01		0.000			1.0	1.75	1.89	0.14	0.01	0.000	0.000	0.00	0.000	0%
Left	1.98	0.00	0.00	0.000	0.000	0.000	1.0	1.89	1.98	0.09	0.00	0.000	0.000	0.00	0.000	0%
Total Flow															0.011	

Measurement Details:	
Start Time (MST):	12:45
End Time (MST):	13:10
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Fair
Weather:	Clear, -10°C

Flow characteristics:		
Total Flow:	0.011	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	0.12	(m ²)
Wetted Width:	1.20	(m)
Hydraulic Depth:	0.103	(m)
Mean Velocity:	0.092	(m/s)
Froude Number:	0.091	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	14.61	
Battery (Aux):	-	
Datalogger Clock:	11:52	
Laptop Clock:	11:50	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.50	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.550	273.600	1.530	273.600	-
Bench Mark 2:	Equipment mast	0.985	274.119	0.965	274.119	-
Top of Ice:						
Water Level:		3.100	272.050	3.075	272.055	272.053
Transducer Reading:		0.620	271.430	0.620	271.435	271.433
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	5-Apr-11
Data Entry Personnel:	CM	Date:	6-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: April 20, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.23	0.03	0.02	0.002	0.002	0.00	0.000	0%
1	0.25	0.08		0.009			1.0	0.23	0.28	0.05	0.08	0.009	0.009	0.00	0.000	0%
2	0.30	0.07		0.007			1.0	0.28	0.33	0.05	0.07	0.007	0.007	0.00	0.000	0%
3	0.35	0.08		0.029			1.0	0.33	0.38	0.05	0.08	0.029	0.029	0.00	0.000	0%
4	0.40	0.10		-0.012			1.0	0.38	0.43	0.05	0.10	-0.012	-0.012	0.01	0.000	0%
5	0.45	0.09		-0.003			1.0	0.43	0.48	0.05	0.09	-0.003	-0.003	0.00	0.000	0%
6	0.50	0.09		0.007			1.0	0.48	0.53	0.05	0.09	0.007	0.007	0.00	0.000	0%
7	0.55	0.08		0.065			1.0	0.53	0.58	0.05	0.08	0.065	0.065	0.00	0.000	1%
8	0.60	0.08		0.127			1.0	0.58	0.63	0.05	0.08	0.127	0.127	0.00	0.001	1%
9	0.65	0.08		0.182			1.0	0.63	0.68	0.05	0.08	0.182	0.182	0.00	0.001	1%
10	0.70	0.12		0.217			1.0	0.68	0.73	0.05	0.12	0.217	0.217	0.01	0.001	3%
11	0.75	0.10		0.283			1.0	0.73	0.78	0.05	0.10	0.283	0.283	0.01	0.001	3%
12	0.80	0.10		0.239			1.0	0.78	0.83	0.05	0.10	0.239	0.239	0.00	0.001	2%
13	0.85	0.18		0.209			1.0	0.83	0.88	0.05	0.18	0.209	0.209	0.01	0.002	4%
14	0.90	0.18		0.317			1.0	0.88	0.93	0.05	0.18	0.317	0.317	0.01	0.003	6%
15	0.95	0.20		0.375			1.0	0.93	0.98	0.05	0.20	0.375	0.375	0.01	0.004	8%
16	1.00	0.20		0.285			1.0	0.98	1.03	0.05	0.20	0.285	0.285	0.01	0.003	6%
17	1.05	0.20		0.419			1.0	1.03	1.08	0.05	0.20	0.419	0.419	0.01	0.004	8%
18	1.10	0.20		0.366			1.0	1.08	1.13	0.05	0.20	0.366	0.366	0.01	0.004	7%
19	1.15	0.22		0.366			1.0	1.13	1.18	0.05	0.22	0.366	0.366	0.01	0.004	8%
20	1.20	0.24		0.360			1.0	1.18	1.23	0.05	0.24	0.360	0.360	0.01	0.004	9%
21	1.25	0.24		0.477			1.0	1.23	1.28	0.05	0.24	0.477	0.477	0.01	0.006	11%
22	1.30	0.27		0.429			1.0	1.28	1.33	0.05	0.27	0.429	0.429	0.01	0.006	12%
23	1.35	0.28		0.220			1.0	1.33	1.38	0.05	0.28	0.220	0.220	0.01	0.003	6%
24	1.40	0.24		0.162			1.0	1.38	1.43	0.05	0.24	0.162	0.162	0.01	0.002	4%
25	1.45	0.20		0.009			1.0	1.43	1.50	0.08	0.20	0.009	0.009	0.02	0.000	0%
26	1.55	0.14		0.001			1.0	1.50	1.88	0.38	0.14	0.001	0.001	0.05	0.000	0%
Left	2.20	0.00	0.00	0.000	0.000	0.000	1.0	1.88	2.20	0.33	0.04	0.000	0.000	0.01	0.000	0%
Total Flow															0.050	

Measurement Details:

Start Time (MST):	15:15
End Time (MST):	15:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Partly cloudy

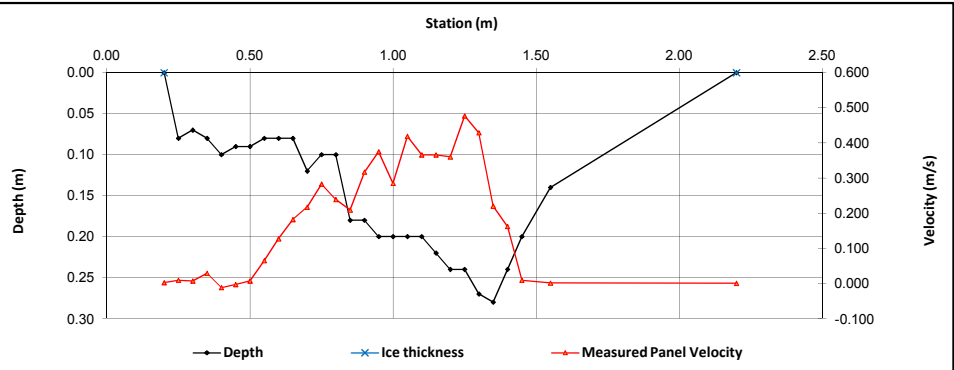
Flow characteristics:

Total Flow:	0.050	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.27	(m ²)
Wetted Width:	2.00	(m)
Hydraulic Depth:	0.133	(m)
Mean Velocity:	0.188	(m/s)
Froude Number:	0.165	

Datalogger Details:

	Before	After
Transducer Reading:		0.78
Battery (Main):	14.64	
Battery (Aux):	-	
Datalogger Clock:	14:19	
Laptop Clock:	14:18	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.80	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.041	273.600	1.038	273.600	-
Bench Mark 2:	Equipment mast	0.517	274.119	0.513	274.119	-
Top of Ice:						
Water Level:		2.438	272.203	2.435	272.203	272.203
Transducer Reading:		0.780	271.423	0.780	271.423	271.423
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	20-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: June 15, 2011



Flow Measurement:

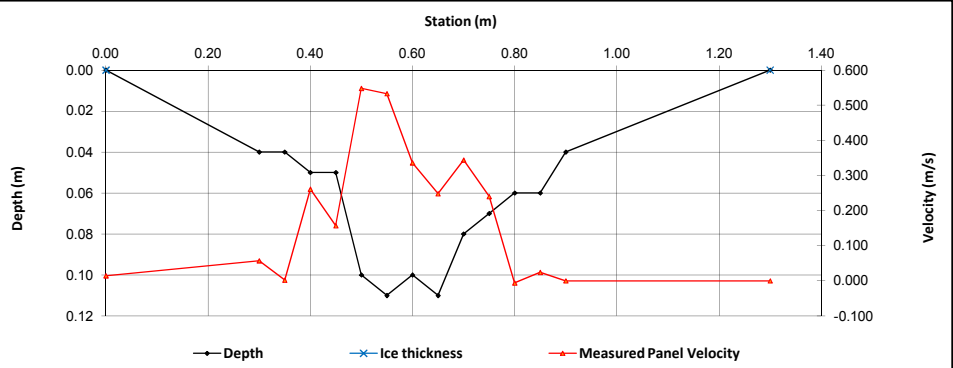
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TR	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	0.15	0.15	0.01	0.014	0.014	0.00	0.000	0%
1	0.30	0.04		0.057			1.0	0.15	0.33	0.17	0.04	0.057	0.057	0.01	0.000	3%
2	0.35	0.04		0.002			1.0	0.33	0.38	0.05	0.04	0.002	0.002	0.00	0.000	0%
3	0.40	0.05		0.261			1.0	0.38	0.43	0.05	0.05	0.261	0.261	0.00	0.001	5%
4	0.45	0.05		0.157			1.0	0.43	0.48	0.05	0.05	0.157	0.157	0.00	0.000	3%
5	0.50	0.10		0.548			1.0	0.48	0.53	0.05	0.10	0.548	0.548	0.01	0.003	22%
6	0.55	0.11		0.533			1.0	0.53	0.58	0.05	0.11	0.533	0.533	0.01	0.003	24%
7	0.60	0.10		0.336			1.0	0.58	0.63	0.05	0.10	0.336	0.336	0.01	0.002	13%
8	0.65	0.11		0.248			1.0	0.63	0.68	0.05	0.11	0.248	0.248	0.01	0.001	11%
9	0.70	0.08		0.344			1.0	0.68	0.73	0.05	0.08	0.344	0.344	0.00	0.001	11%
10	0.75	0.07		0.240			1.0	0.73	0.78	0.05	0.07	0.240	0.240	0.00	0.001	7%
11	0.80	0.06		-0.006			1.0	0.78	0.83	0.05	0.06	-0.006	-0.006	0.00	0.000	0%
12	0.85	0.06		0.024			1.0	0.83	0.88	0.05	0.06	0.024	0.024	0.00	0.000	1%
13	0.90	0.04		0.000			1.0	0.88	1.10	0.23	0.04	0.000	0.000	0.01	0.000	0%
TL	1.30	0.00	0.00	0.000	0.000	0.000	1.0	1.10	1.30	0.20	0.01	0.000	0.000	0.00	0.000	0%
Total Flow															0.012	

Measurement Details:

Start Time (MST):	8:15
End Time (MST):	9:20
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Smoke, 16 deg C

Flow characteristics:

Total Flow:	0.012	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.06	(m ²)
Wetted Width:	1.30	(m)
Hydraulic Depth:	0.047	(m)
Mean Velocity:	0.204	(m/s)
Froude Number:	0.301	



Datalogger Details:

	Before	After
Transducer Reading:		0.624
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	7:26	
Laptop Clock:	7:25	
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	9.60	
Memory Used:	-	-
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.805	273.600	1.807	273.600	-
Bench Mark 2:	Equipment mast	1.295	274.119	1.298	274.119	-
Top of Ice:						
Water Level:		3.355	272.050	3.353	272.054	272.052
Transducer Reading:		0.624	271.426	0.624	271.430	271.428
Other:						

General Notes:

Datalogger / Station Notes:

OS updated to v 22 @ 08:40 h. Checked OK: clock reset

Field Personnel:	JO, SM	Trip Date:	15-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: August 8, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	1.00	0.00	0.00	0.000	0.000	0.000	1.0	1.00	1.03	0.02	0.02	0.008	0.008	0.00	0.000	0%
1	1.05	0.08		0.031			1.0	1.03	1.08	0.05	0.08	0.031	0.031	0.00	0.000	1%
2	1.10	0.09		0.132			1.0	1.08	1.13	0.05	0.09	0.132	0.132	0.00	0.001	5%
3	1.15	0.10		0.184			1.0	1.13	1.18	0.05	0.10	0.184	0.184	0.00	0.001	8%
4	1.20	0.09		0.379			1.0	1.18	1.23	0.05	0.09	0.379	0.379	0.00	0.002	14%
5	1.25	0.09		0.634			1.0	1.23	1.28	0.05	0.09	0.634	0.634	0.00	0.003	24%
6	1.30	0.09		0.487			1.0	1.28	1.33	0.05	0.09	0.487	0.487	0.00	0.002	18%
7	1.35	0.14		0.334			1.0	1.33	1.38	0.05	0.14	0.334	0.334	0.01	0.002	19%
8	1.40	0.12		0.159			1.0	1.38	1.43	0.05	0.12	0.159	0.159	0.01	0.001	8%
9	1.45	0.11		0.063			1.0	1.43	1.48	0.05	0.11	0.063	0.063	0.01	0.000	3%
10	1.50	0.12		0.004			1.0	1.48	1.53	0.05	0.12	0.004	0.004	0.01	0.000	0%
11	1.55	0.06		0.001			1.0	1.53	1.63	0.10	0.06	0.001	0.001	0.01	0.000	0%
LB	1.70	0.00	0.00	0.000	0.000	0.000	1.0	1.63	1.70	0.08	0.02	0.000	0.000	0.00	0.000	0%

Total Flow 0.012

Measurement Details:

Start Time (MST):	9:10
End Time (MST):	9:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Sunny

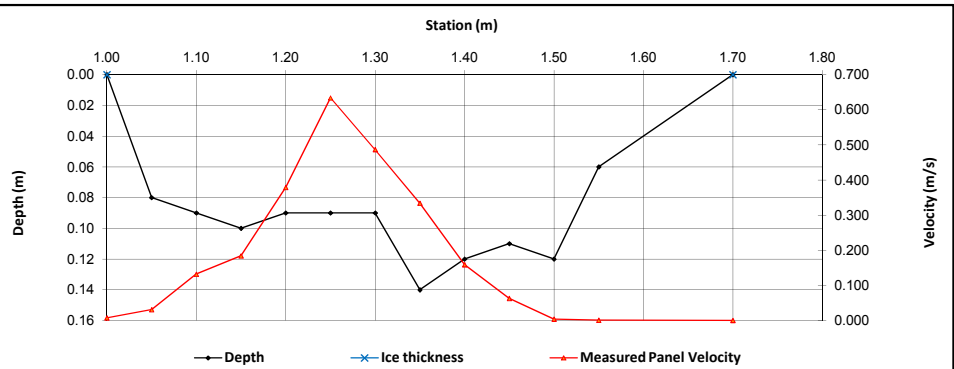
Flow characteristics:

Total Flow:	0.012	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.06	(m ²)
Wetted Width:	0.70	(m)
Hydraulic Depth:	0.084	(m)
Mean Velocity:	0.204	(m/s)
Froude Number:	0.224	

Datalogger Details:

	Before	After
Transducer Reading:		0.633
Battery (Main):	14.57	
Battery (Aux):	-	
Datalogger Clock:	8:11	
Laptop Clock:	8:13	
Air Temperature °C:	13	
Air Pressure:	-	
RH:	-	
Water °C:	12.30	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.091	273.600	1.088	273.600	-
Bench Mark 2:	Equipment mast	0.381	274.119	0.578	274.119	-
Top of Ice:						
Water Level:		2.627	272.064	2.625	272.063	272.064
Transducer Reading:		0.633	271.431	0.633	271.430	271.431
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	8-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	31-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: September 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.28	0.08	0.01	-0.004	-0.004	0.00	0.000	0%
1	0.35	0.04		-0.014			1.0	0.28	0.38	0.10	0.04	-0.014	-0.014	0.00	0.000	-1%
2	0.40	0.09		-0.002			1.0	0.38	0.43	0.05	0.09	-0.002	-0.002	0.00	0.000	0%
3	0.45	0.10		-0.014			1.0	0.43	0.48	0.05	0.10	-0.014	-0.014	0.00	0.000	-1%
4	0.50	0.12		-0.029			1.0	0.48	0.53	0.05	0.12	-0.029	-0.029	0.01	0.000	-3%
5	0.55	0.12		0.025			1.0	0.53	0.58	0.05	0.12	0.025	0.025	0.01	0.000	2%
6	0.60	0.12		0.050			1.0	0.58	0.63	0.05	0.12	0.050	0.050	0.01	0.000	4%
7	0.65	0.10		0.103			1.0	0.63	0.68	0.05	0.10	0.103	0.103	0.01	0.001	8%
8	0.70	0.10		0.111			1.0	0.68	0.73	0.05	0.10	0.111	0.111	0.00	0.001	8%
9	0.75	0.10		0.180			1.0	0.73	0.78	0.05	0.10	0.180	0.180	0.01	0.001	13%
10	0.80	0.10		0.222			1.0	0.78	0.83	0.05	0.10	0.222	0.222	0.00	0.001	16%
11	0.85	0.10		0.206			1.0	0.83	0.88	0.05	0.10	0.206	0.206	0.01	0.001	15%
12	0.90	0.13		0.239			1.0	0.88	0.93	0.05	0.13	0.239	0.239	0.01	0.002	23%
13	0.95	0.08		0.137			1.0	0.93	0.98	0.05	0.08	0.137	0.137	0.00	0.001	8%
14	1.00	0.07		0.088			1.0	0.98	1.03	0.05	0.07	0.088	0.088	0.00	0.000	5%
15	1.05	0.07		0.050			1.0	1.03	1.08	0.05	0.07	0.050	0.050	0.00	0.000	3%
RB	1.10	0.00	0.00	0.000	0.000	0.000	1.0	1.08	1.10	0.02	0.02	0.013	0.013	0.00	0.000	0%
Total Flow														0.007		

Measurement Details:

Start Time (MST):	11:15
End Time (MST):	12:21
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Partly cloudy

Flow characteristics:

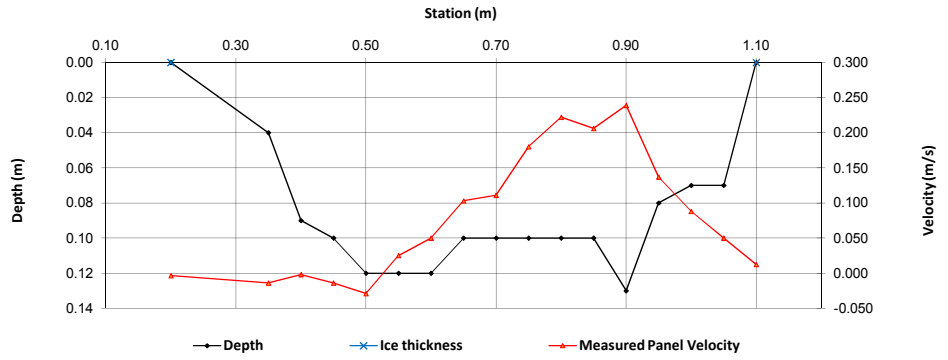
Total Flow:	0.007	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.08	(m ²)
Wetted Width:	0.90	(m)
Hydraulic Depth:	0.084	(m)
Mean Velocity:	0.091	(m/s)
Froude Number:	0.101	

Datalogger Details:

	Before	After
Transducer Reading:		0.629
Battery (Main):	14.36	
Battery (Aux):	-	
Datalogger Clock:	10:25	
Laptop Clock:	10:27	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	9.70	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Fixed POS Battery wire



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.090	273.600	1.076	273.600	-
Bench Mark 2:	Equipment mast	0.580	274.119	0.568	274.119	-
Top of Ice:						
Water Level:		2.654	272.036	2.641	272.035	272.036
Transducer Reading:		0.629	271.407	0.629	271.406	271.407
Other:						

General Notes:

Field Personnel:	SM, GB	Trip Date:	22-Sep-11
Data Entry Personnel:	tk	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: November 4, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.55	0.05	0.02	0.047	0.047	0.00	0.000	0%
1	0.60	0.08		0.186			1.0	0.55	0.62	0.07	0.08	0.186	0.186	0.01	0.001	8%
2	0.64	0.08		0.101			1.0	0.62	0.66	0.04	0.08	0.101	0.101	0.00	0.000	3%
3	0.68	0.10		0.090			1.0	0.66	0.69	0.03	0.10	0.090	0.090	0.00	0.000	2%
4	0.70	0.10		0.180			1.0	0.69	0.71	0.02	0.10	0.180	0.180	0.00	0.000	3%
5	0.72	0.12		0.229			1.0	0.71	0.73	0.02	0.12	0.229	0.229	0.00	0.001	4%
6	0.74	0.12		0.324			1.0	0.73	0.75	0.02	0.12	0.324	0.324	0.00	0.001	6%
7	0.76	0.13		0.290			1.0	0.75	0.77	0.02	0.13	0.290	0.290	0.00	0.001	6%
8	0.78	0.12		0.331			1.0	0.77	0.79	0.02	0.12	0.331	0.331	0.00	0.001	6%
9	0.80	0.12		0.524			1.0	0.79	0.81	0.02	0.12	0.524	0.524	0.00	0.001	10%
10	0.82	0.11		0.510			1.0	0.81	0.83	0.02	0.11	0.510	0.510	0.00	0.001	9%
11	0.84	0.12		0.327			1.0	0.83	0.85	0.02	0.12	0.327	0.327	0.00	0.001	6%
12	0.86	0.12		0.358			1.0	0.85	0.87	0.02	0.12	0.358	0.358	0.00	0.001	7%
13	0.88	0.15		0.216			1.0	0.87	0.89	0.02	0.15	0.216	0.216	0.00	0.001	5%
14	0.90	0.12		0.225			1.0	0.89	0.91	0.02	0.12	0.225	0.225	0.00	0.001	4%
15	0.92	0.16		0.109			1.0	0.91	0.93	0.02	0.16	0.109	0.109	0.00	0.000	3%
16	0.94	0.14		0.102			1.0	0.93	0.95	0.02	0.14	0.102	0.102	0.00	0.000	2%
17	0.96	0.17		0.215			1.0	0.95	0.98	0.03	0.17	0.215	0.215	0.01	0.001	9%
18	1.00	0.17		0.023			1.0	0.98	1.02	0.04	0.17	0.023	0.023	0.01	0.000	1%
19	1.04	0.12		0.007			1.0	1.02	1.06	0.04	0.12	0.007	0.007	0.00	0.000	0%
20	1.08	0.12		0.020			1.0	1.06	1.19	0.13	0.12	0.020	0.020	0.02	0.000	3%
LB	1.30	0.00	0.00	0.000	0.000	0.000	1.0	1.19	1.30	0.11	0.03	0.005	0.005	0.00	0.000	0%
Total Flow														0.012		

Measurement Details:

Start Time (MST):	14:40
End Time (MST):	15:30
Equipment:	ADV
Method:	Wading
River Condition:	Low, Open
Quality/Error (see reverse):	Good
Weather:	Clear, Breezy, -4

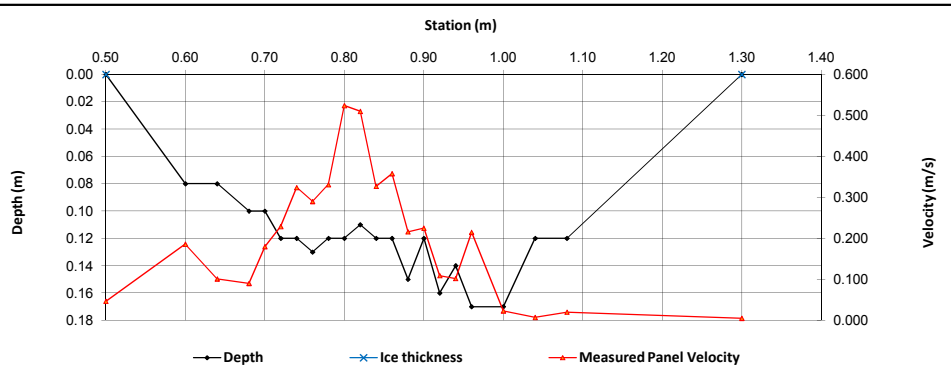
Flow characteristics:

Total Flow:	0.012	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.08	(m ²)
Wetted Width:	0.80	(m)
Hydraulic Depth:	0.101	(m)
Mean Velocity:	0.153	(m/s)
Froude Number:	0.153	

Datalogger Details:

	Before	After
Transducer Reading:		0.621
Battery (Main):	15.05	
Battery (Aux):	-	
Datalogger Clock:	1:47	
Laptop Clock:	1:49	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	4.80	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.124	273.600	1.107	273.600	-
Bench Mark 2:	Equipment mast	0.622	274.119	0.607	274.119	-
Top of Ice:						
Water Level:		2.665	272.059	2.645	272.062	272.061
Transducer Reading:		0.621	271.438	0.621	271.441	271.440
Other:						

General Notes:

BM1: 0.35 m

Field Personnel:	SM, GB	Trip Date:	4-Nov-11
Data Entry Personnel:	DW	Date:	14-Nov-11
Data Check Personnel:	VS	Date:	23-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S6 - Mills Creek at Hwy 63
 UTM Location: 463829 E, 6344743 N

Site Visit Date: November 28, 2011



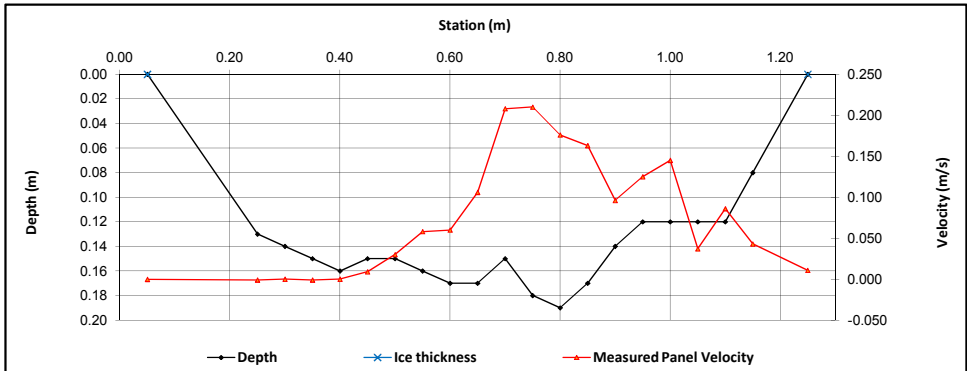
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	0.05	0.00	0.00	0.000	0.000	0.000	1.0	0.05	0.15	0.10	0.03	0.000	0.000	0.00	0.000	0%
1	0.25	0.13		-0.001			1.0	0.15	0.28	0.13	0.13	-0.001	-0.001	0.02	0.000	0%
2	0.30	0.14		0.000			1.0	0.28	0.33	0.05	0.14	0.000	0.000	0.01	0.000	0%
3	0.35	0.15		-0.001			1.0	0.33	0.38	0.05	0.15	-0.001	-0.001	0.01	0.000	0%
4	0.40	0.16		0.000			1.0	0.38	0.43	0.05	0.16	0.000	0.000	0.01	0.000	0%
5	0.45	0.15		0.009			1.0	0.43	0.48	0.05	0.15	0.009	0.009	0.01	0.000	1%
6	0.50	0.15		0.030			1.0	0.48	0.53	0.05	0.15	0.030	0.030	0.01	0.000	2%
7	0.55	0.16		0.058			1.0	0.53	0.58	0.05	0.16	0.058	0.058	0.01	0.000	4%
8	0.60	0.17		0.060			1.0	0.58	0.63	0.05	0.17	0.060	0.060	0.01	0.001	4%
9	0.65	0.17		0.106			1.0	0.63	0.68	0.05	0.17	0.106	0.106	0.01	0.001	8%
10	0.70	0.15		0.208			1.0	0.68	0.73	0.05	0.15	0.208	0.208	0.01	0.002	13%
11	0.75	0.18		0.210			1.0	0.73	0.78	0.05	0.18	0.210	0.210	0.01	0.002	16%
12	0.80	0.19		0.176			1.0	0.78	0.83	0.05	0.19	0.176	0.176	0.01	0.002	14%
13	0.85	0.17		0.163			1.0	0.83	0.88	0.05	0.17	0.163	0.163	0.01	0.001	12%
14	0.90	0.14		0.096			1.0	0.88	0.93	0.05	0.14	0.096	0.096	0.01	0.001	6%
15	0.95	0.12		0.125			1.0	0.93	0.98	0.05	0.12	0.125	0.125	0.01	0.001	6%
16	1.00	0.12		0.145			1.0	0.98	1.03	0.05	0.12	0.145	0.145	0.01	0.001	7%
17	1.05	0.12		0.037			1.0	1.03	1.08	0.05	0.12	0.037	0.037	0.01	0.000	2%
18	1.10	0.12		0.086			1.0	1.08	1.13	0.05	0.12	0.086	0.086	0.01	0.001	4%
19	1.15	0.08		0.043			1.0	1.13	1.20	0.08	0.08	0.043	0.043	0.01	0.000	2%
R	1.25	0.00	0.00	0.000	0.000	0.000	1.0	1.20	1.25	0.05	0.02	0.011	0.011	0.00	0.000	0%
Total Flow															0.012	

Measurement Details:	
Start Time (MST):	10:40
End Time (MST):	11:25
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Fair
Weather:	Clear, Calm, -15C

Flow characteristics:		
Total Flow:	0.012	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	0.15	(m ²)
Wetted Width:	1.20	(m)
Hydraulic Depth:	0.129	(m)
Mean Velocity:	0.077	(m/s)
Froude Number:	0.069	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	15.27	
Battery (Aux):	-	
Datalogger Clock:	11:00	
Laptop Clock:	11:02	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	2.70	
Memory Used:		
Dessicant:	Good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC	1.130	273.600	1.116	273.600	-
Bench Mark 2:	Equipment mast	0.607	274.119	0.593	274.119	-
Top of Ice:						
Water Level:		2.687	272.043	2.670	272.046	272.045
Transducer Reading:		0.607	271.436	0.607	271.439	271.438
Other:						

General Notes:

Field Personnel:	SM, DB	Trip Date:	28-Nov-11
Data Entry Personnel:	DW	Date:	6-Dec-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: January 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.00	0.00	0.00	0.000	0.000	0.000	0.9	0.00	1.60	1.60	0.08	0.005	0.004	0.13	0.001	0%
1	3.20	0.58	0.25	0.019			0.9	1.60	3.50	1.90	0.33	0.019	0.017	0.63	0.011	5%
2	3.80	0.58	0.25	0.091			0.9	3.50	4.00	0.50	0.33	0.091	0.082	0.17	0.014	6%
3	4.20	0.52	0.25	0.079			0.9	4.00	4.50	0.50	0.27	0.079	0.071	0.14	0.010	4%
4	4.80	0.55	0.30	0.088			0.9	4.50	5.00	0.50	0.25	0.088	0.079	0.13	0.010	4%
5	5.20	0.52	0.32	0.211			0.9	5.00	5.50	0.50	0.20	0.211	0.190	0.10	0.019	8%
6	5.80	0.55	0.34	0.066			0.9	5.50	6.00	0.50	0.21	0.066	0.059	0.11	0.006	3%
7	6.20	0.57	0.32	0.234			0.9	6.00	6.35	0.35	0.25	0.234	0.211	0.09	0.018	8%
8	6.50	0.55	0.35	0.044			0.9	6.35	6.80	0.45	0.20	0.044	0.040	0.09	0.004	2%
9	7.10	0.60	0.35	0.065			0.9	6.80	7.35	0.55	0.25	0.065	0.059	0.14	0.008	3%
10	7.60	0.64	0.35	0.090			0.9	7.35	7.90	0.55	0.29	0.090	0.081	0.16	0.013	6%
11	8.20	0.61	0.35	0.056			0.9	7.90	8.60	0.70	0.26	0.056	0.050	0.18	0.009	4%
12	9.00	0.60	0.35	0.127			0.9	8.60	9.45	0.85	0.25	0.127	0.114	0.21	0.024	11%
13	9.90	0.51	0.35	0.236			0.9	9.45	10.20	0.75	0.16	0.236	0.212	0.12	0.025	11%
14	10.50	0.58	0.35	-0.087			0.9	10.20	10.90	0.70	0.23	-0.087	-0.078	0.16	-0.013	-5%
15	11.30	0.57	0.35	0.041			0.9	10.90	11.75	0.85	0.22	0.041	0.037	0.19	0.007	3%
16	12.20	0.53	0.34	-0.066			0.9	11.75	12.70	0.95	0.19	-0.066	-0.059	0.18	-0.011	-5%
17	13.20	0.58	0.31	0.082			0.9	12.70	13.50	0.80	0.27	0.082	0.074	0.22	0.016	7%
18	13.80	0.58	0.31	0.040			0.9	13.50	14.15	0.65	0.27	0.040	0.036	0.18	0.006	3%
19	14.50	0.58	0.35	0.079			0.9	14.15	14.80	0.65	0.23	0.079	0.071	0.15	0.011	5%
20	15.10	0.52	0.25	0.090			0.9	14.80	15.45	0.65	0.27	0.090	0.081	0.18	0.014	6%
21	15.80	0.51	0.21	0.085			0.9	15.45	16.65	1.20	0.30	0.085	0.077	0.36	0.028	12%
Left	17.50	0.00	0.00	0.000	0.000	0.000	1.0	16.65	17.50	0.85	0.08	0.021	0.021	0.06	0.001	1%
Total Flow															0.231	

Measurement Details:

Start Time (MST):	10:45
End Time (MST):	12:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	-32° Clear

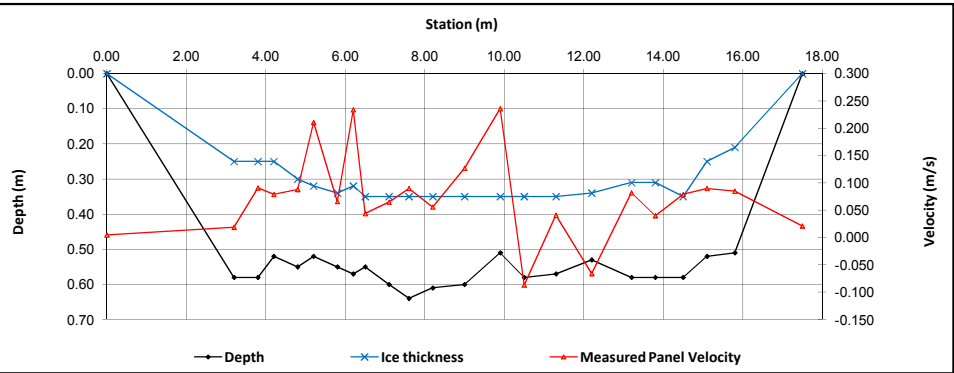
Flow characteristics:

Total Flow:	0.231	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	4.05	(m ²)
Wetted Width:	17.50	(m)
Hydraulic Depth:	0.231	(m)
Mean Velocity:	0.057	(m/s)
Froude Number:	0.038	

Datalogger Details:

	Before	After
Transducer Reading:		0.765
Battery (Main):	12.54	
Battery (Aux):	-	
Datalogger Clock:	10:54	
Laptop Clock:	10:55	
Air Temperature °C:	-32	
Air Pressure:	-	
RH:	-	
Water °C:	0.60	
Memory Used:	-	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.445	275.565	0.441	275.565	-
Bench Mark 2:	Rebar in black PVC	0.590	275.406	0.585	275.406	-
Top of Ice:		4.138	271.872	4.133	271.873	271.873
Water Level:		4.202	271.808	4.190	271.816	271.812
Transducer Reading:		0.765	271.043	0.765	271.051	271.047
Other:						

General Notes:

Field Personnel:	JO, DB	Trip Date:	16-Jan-11
Data Entry Personnel:	SG	Date:	24-Jan-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: February 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	2.00	0.00	0.00	0.000	0.000	0.000	0.9	2.00	2.55	0.55	0.06	0.028	0.025	0.03	0.001	0%
1	3.10	0.58	0.34	0.111			0.9	2.55	3.30	0.75	0.24	0.111	0.100	0.18	0.018	6%
2	3.50	0.60	0.33	0.092			0.9	3.30	3.80	0.50	0.27	0.092	0.082	0.14	0.011	4%
3	4.10	0.65	0.35	0.180			0.9	3.80	4.40	0.60	0.30	0.180	0.162	0.18	0.029	9%
4	4.70	0.69	0.37	0.154			0.9	4.40	5.00	0.60	0.32	0.154	0.138	0.19	0.027	9%
5	5.30	0.70	0.40	0.124			0.9	5.00	5.55	0.55	0.30	0.124	0.112	0.17	0.018	6%
6	5.80	0.71	0.40	-0.047			0.9	5.55	6.00	0.45	0.31	-0.047	-0.042	0.14	-0.006	-2%
7	6.20	0.73	0.42	0.131			0.9	6.00	6.50	0.50	0.31	0.131	0.118	0.16	0.018	6%
8	6.80	0.70	0.42	0.097			0.9	6.50	7.05	0.55	0.28	0.097	0.087	0.15	0.013	4%
9	7.30	0.70	0.42	0.131			0.9	7.05	7.55	0.50	0.28	0.131	0.118	0.14	0.017	5%
10	7.80	0.70	0.45	-0.135			0.9	7.55	8.05	0.50	0.25	-0.135	-0.122	0.13	-0.015	-5%
11	8.30	0.70	0.45	0.105			0.9	8.05	8.60	0.55	0.25	0.105	0.095	0.14	0.013	4%
12	8.90	0.70	0.45	0.020			0.9	8.60	9.15	0.55	0.25	0.020	0.018	0.14	0.002	1%
13	9.40	0.55	0.42	0.093			0.9	9.15	9.60	0.45	0.13	0.093	0.084	0.06	0.005	2%
14	9.80	0.66	0.42	0.115			0.9	9.60	10.00	0.40	0.24	0.115	0.104	0.10	0.010	3%
15	10.20	0.65	0.40	0.066			0.9	10.00	10.45	0.45	0.25	0.066	0.059	0.11	0.007	2%
16	10.70	0.65	0.40	0.126			0.9	10.45	10.95	0.50	0.25	0.126	0.113	0.13	0.014	5%
17	11.20	0.67	0.40	0.079			0.9	10.95	11.50	0.55	0.27	0.079	0.071	0.15	0.011	3%
18	11.80	0.68	0.35	0.080			0.9	11.50	12.05	0.55	0.33	0.080	0.072	0.18	0.013	4%
19	12.30	0.67	0.34	0.121			0.9	12.05	12.60	0.55	0.33	0.121	0.109	0.18	0.020	6%
20	12.90	0.62	0.33	0.119			0.9	12.60	13.15	0.55	0.29	0.119	0.107	0.16	0.017	5%
21	13.40	0.61	0.30	0.168			0.9	13.15	13.70	0.55	0.31	0.168	0.151	0.17	0.026	8%
22	14.00	0.52	0.25	-0.060			0.9	13.70	14.25	0.55	0.27	-0.060	-0.054	0.15	-0.008	-3%
23	14.50	0.60	0.25	0.170			0.9	14.25	14.75	0.50	0.35	0.170	0.153	0.18	0.027	9%
24	15.00	0.60	0.24	0.150			0.9	14.75	15.25	0.50	0.36	0.150	0.135	0.18	0.024	8%
25	15.50	0.50	0.23	0.001			0.9	15.25	15.75	0.50	0.27	0.001	0.001	0.14	0.000	0%
Left	16.00	0.00	0.00	0.000	0.000	0.000	1.0	15.75	16.00	0.25	0.07	0.000	0.000	0.02	0.000	0%
Total Flow														0.312		

Measurement Details:

Start Time (MST):	13:58
End Time (MST):	15:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear

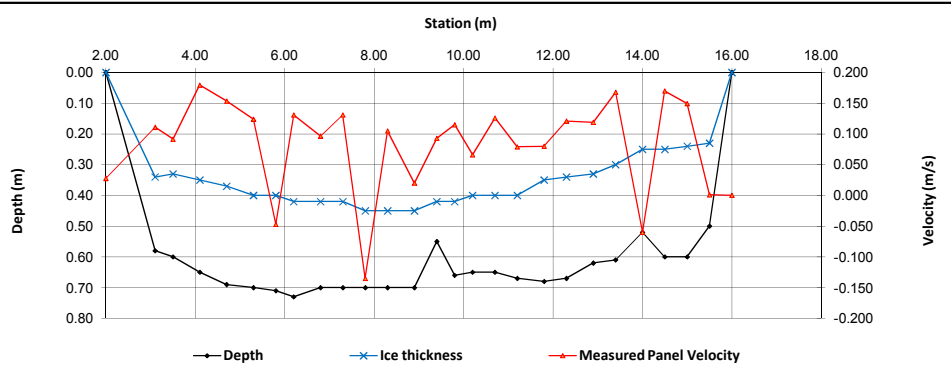
Flow characteristics:

Total Flow:	0.312	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.76	(m ²)
Wetted Width:	14.00	(m)
Hydraulic Depth:	0.269	(m)
Mean Velocity:	0.083	(m/s)
Froude Number:	0.051	

Datalogger Details:

	Before	After
Transducer Reading:		0.855
Battery (Main):	14.91	
Battery (Aux):	-	
Datalogger Clock:	14:03	
Laptop Clock:	14:02	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.50	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.027	275.565	1.015	275.565	-
Bench Mark 2:	Rebar in black PVC	1.181	275.406	1.170	275.406	-
Top of Ice:		4.643	271.949	4.631	271.949	271.949
Water Level:		4.607	271.985	4.600	271.980	271.983
Transducer Reading:		0.855	271.130	0.855	271.125	271.128
Other:						

General Notes:

Field Personnel:	BL, SG	Trip Date:	14-Feb-11
Data Entry Personnel:	DB	Date:	22-Feb-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: March 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	1.20	0.00	0.00	0.000	0.000	0.000	0.9	1.20	1.55	0.35	0.09	0.003	0.003	0.03	0.000	0%
1	1.90	0.62	0.25	0.013			0.9	1.55	2.40	0.85	0.37	0.013	0.012	0.31	0.004	2%
2	2.90	0.70	0.30	0.145			0.9	2.40	3.25	0.85	0.40	0.145	0.130	0.34	0.044	19%
3	3.60	0.68	0.40	0.140			0.9	3.25	3.98	0.73	0.28	0.140	0.126	0.20	0.026	11%
4	4.35	0.70	0.40	0.210			0.9	3.98	4.73	0.75	0.30	0.210	0.189	0.23	0.042	18%
5	5.10	0.68	0.42	-0.203			0.9	4.73	5.43	0.70	0.26	-0.203	-0.183	0.18	-0.033	-14%
6	5.75	0.66	0.50	-0.139			0.9	5.43	6.23	0.80	0.16	-0.139	-0.125	0.13	-0.016	-7%
7	6.70	0.66	0.50	-0.052			0.9	6.23	7.05	0.83	0.16	-0.052	-0.047	0.13	-0.006	-3%
8	7.40	0.66	0.50	0.109			0.9	7.05	7.75	0.70	0.16	0.109	0.098	0.11	0.011	5%
9	8.10	0.70	0.52	0.141			0.9	7.75	8.45	0.75	0.18	0.141	0.127	0.13	0.016	7%
10	8.80	0.80	0.57	0.192			0.9	8.45	9.18	0.73	0.23	0.192	0.173	0.17	0.029	12%
11	9.55	0.78	0.55	0.120			0.9	9.18	9.88	0.70	0.23	0.120	0.108	0.16	0.017	7%
12	10.20	0.74	0.54	0.137			0.9	9.88	10.45	0.57	0.20	0.137	0.123	0.12	0.014	6%
13	10.70	0.76	0.52	0.114			0.9	10.45	11.05	0.60	0.24	0.114	0.103	0.14	0.015	6%
14	11.40	0.75	0.50	0.176			0.9	11.05	11.75	0.70	0.25	0.176	0.158	0.18	0.028	12%
15	12.10	0.68	0.48	0.092			0.9	11.75	12.50	0.75	0.20	0.092	0.083	0.15	0.012	5%
16	12.90	0.68	0.48	-0.075			0.9	12.50	13.25	0.75	0.20	-0.075	-0.068	0.15	-0.010	-4%
17	13.60	0.60	0.45	-0.098			0.9	13.25	13.95	0.70	0.15	-0.098	-0.088	0.11	-0.009	-4%
18	14.30	0.55	0.40	0.120			0.9	13.95	15.20	1.25	0.15	0.120	0.108	0.19	0.020	9%
19	16.10	0.50	0.39	0.187			0.9	15.20	16.75	1.55	0.11	0.187	0.168	0.17	0.029	12%
Right	17.40	0.00	0.00	0.000	0.000	0.000	1.0	16.75	17.40	0.65	0.03	0.047	0.047	0.02	0.001	0%
Total Flow															0.233	

Measurement Details:

Start Time (MST):	13:45
End Time (MST):	14:45
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	-5° C, overcast

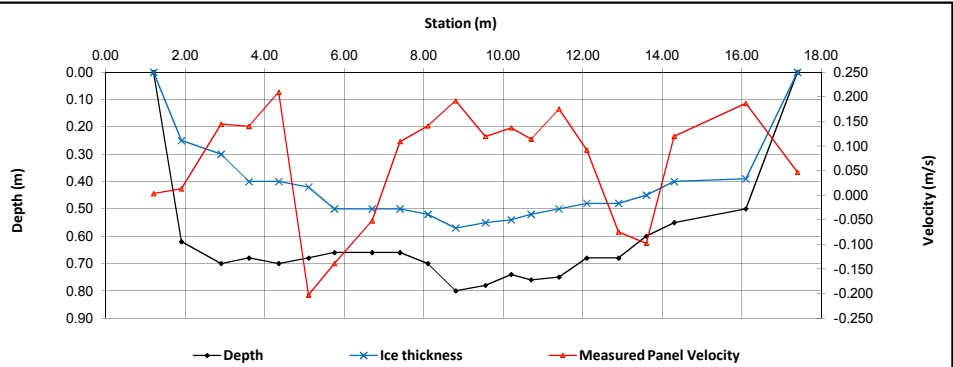
Flow characteristics:

Total Flow:	0.233	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	3.34	(m ²)
Wetted Width:	16.20	(m)
Hydraulic Depth:	0.206	(m)
Mean Velocity:	0.070	(m/s)
Froude Number:	0.049	

Datalogger Details:

	Before	After
Transducer Reading:		0.835
Battery (Main):	14.77	
Battery (Aux):	-	
Datalogger Clock:	13:54	
Laptop Clock:	14:01	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.40	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.648	275.565	0.642	275.565	-
Bench Mark 2:	Rebar in black PVC	0.799	275.406	0.795	275.406	-
Top of Ice:		4.209	272.004	4.206	272.001	272.003
Water Level:		4.245	271.968	4.241	271.966	271.967
Transducer Reading:		0.835	271.133	0.835	271.131	271.132
Other:						

General Notes:

Field Personnel:	DB, GB	Trip Date:	13-Mar-11
Data Entry Personnel:	DB	Date:	17-Mar-11
Data Check Personnel:	CM	Date:	7-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: April 2, 2011



Flow Measurement:

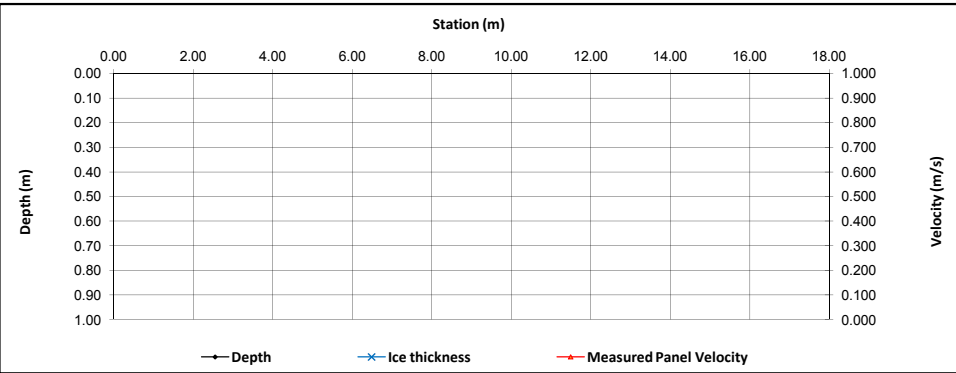
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	16:00
End Time (MST):	16:30
Equipment:	ADV
Method:	Ice
River Condition:	Partially open
Quality/Error (see reverse):	-
Weather:	Clear, 0°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		0.93
Battery (Main):	14.54	
Battery (Aux):	-	
Datalogger Clock:	15:07	
Laptop Clock:	15:05	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.50	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Nail in tree	0.845	275.565	0.835	275.565	-
Bench Mark 2:	Rebar in black PVC	0.999	275.406	0.989	275.406	-
Top of Ice:		4.338	272.072	4.325	272.075	272.074
Water Level:		4.367	272.043	4.352	272.048	272.046
Transducer Reading:		0.930	271.113	0.930	271.118	271.116
Other:						

General Notes:
 No flow measurements taken due to open and flowing water downstream (full width) and against left bank (see photos).
 Conditions deemed unsafe.

Field Personnel:	JO, BL	Trip Date:	2-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: April 20, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	18.90	0.00	0.00	0.000	0.000	0.000	1.0	18.90	18.80	0.10	0.02	0.000	0.000	0.00	0.000	0%
1	18.70	0.08		0.000			1.0	18.80	18.35	0.45	0.08	0.000	0.000	0.04	0.000	0%
2	18.00	0.54		0.198			1.0	18.35	17.65	0.70	0.54	0.198	0.198	0.38	0.075	2%
3	17.30	0.68		0.294			1.0	17.65	16.95	0.70	0.68	0.294	0.294	0.48	0.140	3%
4	16.60	0.80			0.209	0.385	1.0	16.95	16.25	0.70	0.80	0.297	0.297	0.56	0.166	4%
5	15.90	0.78			0.320	0.420	1.0	16.25	15.55	0.70	0.78	0.370	0.370	0.55	0.202	5%
6	15.20	0.78			0.292	0.447	1.0	15.55	14.85	0.70	0.78	0.370	0.370	0.55	0.202	5%
7	14.50	0.78			0.370	0.461	1.0	14.85	14.15	0.70	0.78	0.416	0.416	0.55	0.227	6%
8	13.80	0.80			0.313	0.439	1.0	14.15	13.45	0.70	0.80	0.376	0.376	0.56	0.211	5%
9	13.10	0.81			0.334	0.470	1.0	13.45	12.75	0.70	0.81	0.402	0.402	0.57	0.228	6%
10	12.40	0.82			0.352	0.435	1.0	12.75	12.05	0.70	0.82	0.394	0.394	0.57	0.226	6%
11	11.70	0.80			0.334	0.458	1.0	12.05	11.35	0.70	0.80	0.396	0.396	0.56	0.222	5%
12	11.00	0.82			0.233	0.480	1.0	11.35	10.65	0.70	0.82	0.357	0.357	0.57	0.205	5%
13	10.30	0.86			0.393	0.445	1.0	10.65	9.95	0.70	0.86	0.419	0.419	0.60	0.252	6%
14	9.60	0.78			0.338	0.366	1.0	9.95	9.25	0.70	0.78	0.352	0.352	0.55	0.192	5%
15	8.90	0.76			0.294	0.403	1.0	9.25	8.55	0.70	0.76	0.349	0.349	0.53	0.185	5%
16	8.20	0.80			0.317	0.434	1.0	8.55	7.85	0.70	0.80	0.376	0.376	0.56	0.210	5%
17	7.50	0.82			0.401	0.400	1.0	7.85	7.15	0.70	0.82	0.401	0.401	0.57	0.230	6%
18	6.80	0.78			0.324	0.392	1.0	7.15	6.45	0.70	0.78	0.358	0.358	0.55	0.195	5%
19	6.10	0.82			0.329	0.368	1.0	6.45	5.75	0.70	0.82	0.349	0.349	0.57	0.200	5%
20	5.40	0.80			0.222	0.358	1.0	5.75	5.05	0.70	0.80	0.290	0.290	0.56	0.162	4%
21	4.70	0.75		0.279			1.0	5.05	4.35	0.70	0.75	0.279	0.279	0.53	0.146	4%
22	4.00	0.74		0.217			1.0	4.35	3.65	0.70	0.74	0.217	0.217	0.52	0.112	3%
23	3.30	0.70		0.164			1.0	3.65	2.95	0.70	0.70	0.164	0.164	0.49	0.080	2%
24	2.60	0.30		0.112			1.0	2.95	2.45	0.50	0.30	0.112	0.112	0.15	0.017	0%
Left	2.30	0.00	0.00	0.000	0.000	0.000	1.0	2.45	2.30	0.15	0.08	0.028	0.028	0.01	0.000	0%
Total Flow															4.087	

Measurement Details:

Start Time (MST):	16:00
End Time (MST):	17:00
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Partly cloudy, 7°C

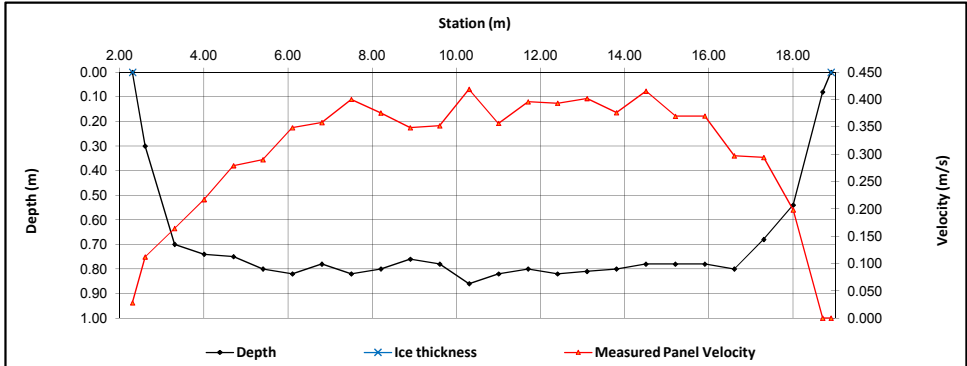
Flow characteristics:

Total Flow:	4.087	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	12.11	(m ²)
Wetted Width:	16.35	(m)
Hydraulic Depth:	0.741	(m)
Mean Velocity:	0.337	(m/s)
Froude Number:	0.125	

Datalogger Details:

	Before	After
Transducer Reading:		1.000
Battery (Main):	14.35	
Battery (Aux):	-	
Datalogger Clock:	15:16	
Laptop Clock:	15:13	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.70	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.631	275.565	0.625	275.565	-
Bench Mark 2:	Rebar in black PVC	0.785	275.406	0.780	275.406	-
Top of Ice:						
Water Level:		4.060	272.136	4.055	272.135	272.136
Transducer Reading:		1.000	271.136	1.000	271.135	271.136
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	20-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: June 16, 2011



Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TL	0.30	0.00	0.00	0.000	0.000	0.000	1.0	0.30	0.40	0.10	0.10	-0.001	-0.001	0.01	0.000	0%
1	0.50	0.39		-0.002			1.0	0.40	0.75	0.35	0.39	-0.002	-0.002	0.14	0.000	0%
2	1.00	0.48		-0.005			1.0	0.75	1.50	0.75	0.48	-0.005	-0.005	0.36	-0.002	0%
3	2.00	0.49		0.091			1.0	1.50	2.50	1.00	0.49	0.091	0.091	0.49	0.045	4%
4	3.00	0.53		0.140			1.0	2.50	3.50	1.00	0.53	0.140	0.140	0.53	0.074	7%
5	4.00	0.55		0.133			1.0	3.50	4.50	1.00	0.55	0.133	0.133	0.55	0.073	7%
6	5.00	0.56		0.173			1.0	4.50	5.50	1.00	0.56	0.173	0.173	0.56	0.097	9%
7	6.00	0.52		0.172			1.0	5.50	6.50	1.00	0.52	0.172	0.172	0.52	0.089	8%
8	7.00	0.54		0.180			1.0	6.50	7.50	1.00	0.54	0.180	0.180	0.54	0.097	9%
9	8.00	0.57		0.215			1.0	7.50	8.50	1.00	0.57	0.215	0.215	0.57	0.123	11%
10	9.00	0.58		0.192			1.0	8.50	9.50	1.00	0.58	0.192	0.192	0.58	0.111	10%
11	10.00	0.60		0.148			1.0	9.50	10.50	1.00	0.60	0.148	0.148	0.60	0.089	8%
12	11.00	0.54		0.198			1.0	10.50	11.50	1.00	0.54	0.198	0.198	0.54	0.107	10%
13	12.00	0.51		0.203			1.0	11.50	12.50	1.00	0.51	0.203	0.203	0.51	0.104	9%
14	13.00	0.53		0.095			1.0	12.50	13.50	1.00	0.53	0.095	0.095	0.53	0.050	5%
15	14.00	0.54		0.128			1.0	13.50	14.50	1.00	0.54	0.128	0.128	0.54	0.069	6%
16	15.00	0.53		0.002			1.0	14.50	15.50	1.00	0.53	0.002	0.002	0.53	0.001	0%
17	16.00	0.45		-0.048			1.0	15.50	16.25	0.75	0.45	-0.048	-0.048	0.34	-0.016	-1%
18	16.50	0.30		0.000			1.0	16.25	16.50	0.25	0.30	0.000	0.000	0.08	0.000	0%
TR	16.50	0.00	0.00	0.000	0.000	0.000	1.0	16.50	16.50	0.00	0.08	0.000	0.000	0.00	0.000	0%
Total Flow															1.111	

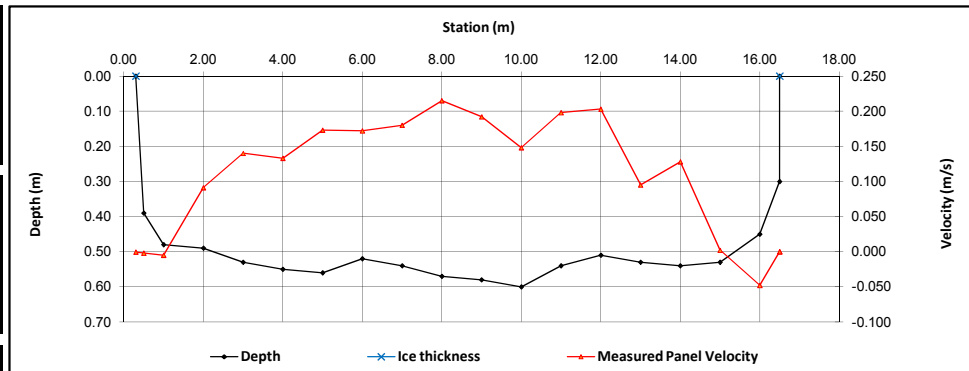
Measurement Details:	
Start Time (MST):	15:00
End Time (MST):	15:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Rain, 17 deg C

Flow characteristics:	
Total Flow:	1.111 (m ³ /s)
Perceived Measurement Quality:	Good
Cross Section Area:	8.51 (m ²)
Wetted Width:	16.20 (m)
Hydraulic Depth:	0.525 (m)
Mean Velocity:	0.131 (m/s)
Froude Number:	0.058

Datalogger Details:		Before	After
Transducer Reading:		0.762	
Battery (Main):		14.30	
Battery (Aux):		-	
Datalogger Clock:		13:52	
Laptop Clock:		13:49	
Air Temperature °C:		-	
Air Pressure:		-	
RH:		-	
Water °C:		16.20	
Memory Used:		-	
Dessicant:		Changed	
Logger# (if Δ):			
PT# (if Δ):			

Datalogger / Station Notes:

OS updated to v 22. Checked: OK



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.466	275.565	0.462	275.565	-
Bench Mark 2:	Rebar in black PVC	0.621	275.406	0.618	275.406	-
Top of Ice:						
Water Level:		4.142	271.889	4.140	271.887	271.888
Transducer Reading:		0.762	271.127	0.762	271.125	271.126
Other:						

General Notes:

Field Personnel:	JO, SM	Trip Date:	16-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: August 8, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
				(m/s)	(m/s)	(m/s)	(m)				(m)	(m/s)	(m/s)			
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	Total Flow
																0.000

Measurement Details:

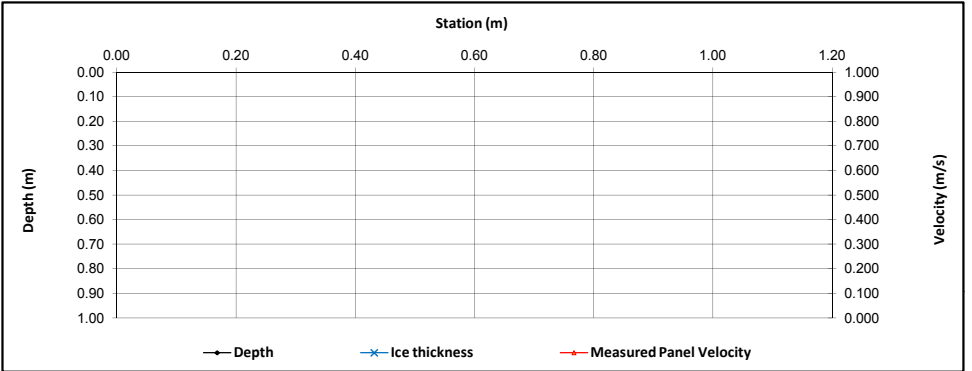
Start Time (MST):	15:30
End Time (MST):	15:50
Equipment:	-
Method:	-
River Condition:	Open, low
Quality/Error (see reverse):	-
Weather:	Sunny, 20°C

Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		0.657
Battery (Main):	14.00	
Battery (Aux):	-	
Datalogger Clock:	15:17	
Laptop Clock:	15:19	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	18.70	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.340	275.565	0.315	275.565	-
Bench Mark 2:	Rebar in black PVC	0.491	275.406	0.488	275.406	-
Top of Ice:						
Water Level:		4.113	271.792	4.091	271.789	271.791
Transducer Reading:		0.657	271.135	0.657	271.132	271.134
Other:	3/4 inch pipe	0.407	275.490	0.385	275.489	

General Notes:

Field Personnel:	SM, SG	Trip Date:	8-Aug-11
Data Entry Personnel:	DB	Date:	23-Aug-11
Data Check Personnel:	JP	Date:	29-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: September 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

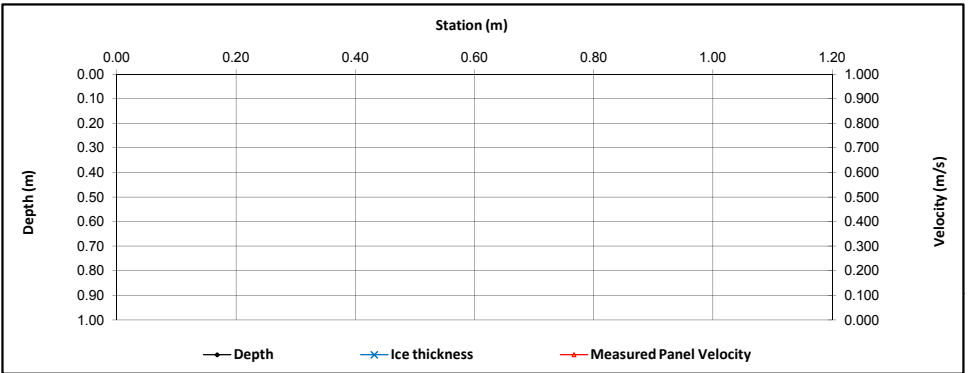
Start Time (MST):	15:41
End Time (MST):	16:40
Equipment:	-
Method:	-
River Condition:	Open, low
Quality/Error (see reverse):	-
Weather:	-

Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		0.618
Battery (Main):	14.02	
Battery (Aux):	-	
Datalogger Clock:	15:40	
Laptop Clock:	15:42	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	12.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.508	275.565	0.496	275.565	-
Bench Mark 2:	Rebar in black PVC	0.664	275.406	0.651	275.406	-
Top of Ice:						
Water Level:		4.323	271.750	4.310	271.751	271.751
Transducer Reading:		0.618	271.132	0.618	271.133	271.133
Other:	3/4 inch pipe					

General Notes:

Installed antenna for trying telemetry at this location. RSSI -86

Field Personnel:	DB, SM	Trip Date:	9-Sep-11
Data Entry Personnel:	DB	Date:	21-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: November 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	5.50	0.00	0.00	0.000	0.000	0.000	1.0	5.50	5.75	0.25	0.02	0.078	0.078	0.00	0.000	0%
1	6.00	0.06		0.311			1.0	5.75	6.25	0.50	0.06	0.311	0.311	0.03	0.009	2%
2	6.50	0.06		0.307			1.0	6.25	6.75	0.50	0.06	0.307	0.307	0.03	0.009	2%
3	7.00	0.08		0.320			1.0	6.75	7.25	0.50	0.08	0.320	0.320	0.04	0.013	2%
4	7.50	0.09		0.322			1.0	7.25	7.75	0.50	0.09	0.322	0.322	0.05	0.014	3%
5	8.00	0.13		0.426			1.0	7.75	8.25	0.50	0.13	0.426	0.426	0.07	0.028	5%
6	8.50	0.16		0.427			1.0	8.25	8.75	0.50	0.16	0.427	0.427	0.08	0.034	6%
7	9.00	0.15		0.273			1.0	8.75	9.25	0.50	0.15	0.273	0.273	0.08	0.020	4%
8	9.50	0.14		0.451			1.0	9.25	9.75	0.50	0.14	0.451	0.451	0.07	0.032	6%
9	10.00	0.19		0.412			1.0	9.75	10.25	0.50	0.19	0.412	0.412	0.10	0.039	7%
10	10.50	0.19		0.344			1.0	10.25	10.75	0.50	0.19	0.344	0.344	0.10	0.033	6%
11	11.00	0.23		0.473			1.0	10.75	11.25	0.50	0.23	0.473	0.473	0.12	0.054	10%
12	11.50	0.24		0.445			1.0	11.25	11.75	0.50	0.24	0.445	0.445	0.12	0.053	9%
13	12.00	0.24		0.506			1.0	11.75	12.25	0.50	0.24	0.506	0.506	0.12	0.061	11%
14	12.50	0.22		0.461			1.0	12.25	12.75	0.50	0.22	0.461	0.461	0.11	0.051	9%
15	13.00	0.20		0.397			1.0	12.75	13.25	0.50	0.20	0.397	0.397	0.10	0.040	7%
16	13.50	0.19		0.381			1.0	13.25	13.75	0.50	0.19	0.381	0.381	0.10	0.036	6%
17	14.00	0.13		0.305			1.0	13.75	14.25	0.50	0.13	0.305	0.305	0.07	0.020	3%
18	14.50	0.12		0.286			1.0	14.25	14.75	0.50	0.12	0.286	0.286	0.06	0.017	3%
19	15.00	0.10		0.112			1.0	14.75	15.30	0.55	0.10	0.112	0.112	0.06	0.006	1%
LB	15.60	0.00	0.00	0.000	0.000	0.000	1.0	15.30	15.60	0.30	0.03	0.028	0.028	0.01	0.000	0%
Total Flow															0.570	

Measurement Details:

Start Time (MST):	15:10
End Time (MST):	15:45
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	Good
Weather:	-

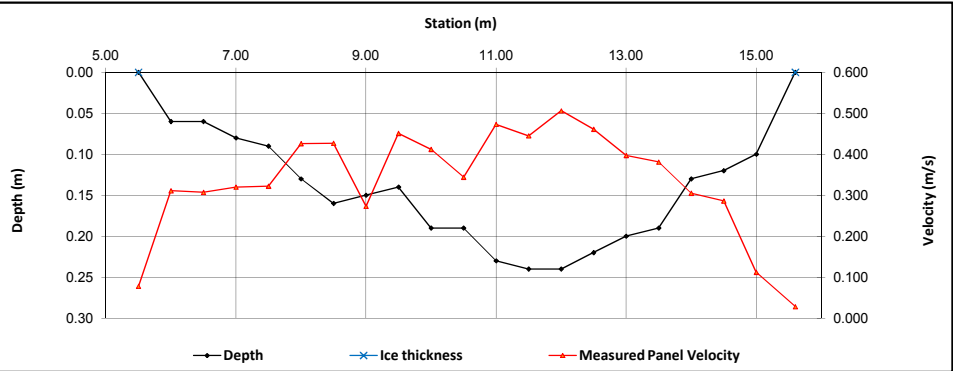
Flow characteristics:

Total Flow:	0.570	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.48	(m ²)
Wetted Width:	10.10	(m)
Hydraulic Depth:	0.146	(m)
Mean Velocity:	0.386	(m/s)
Froude Number:	0.323	

Datalogger Details:

	Before	After
Transducer Reading:	-	0.662
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	16:00	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	1.70	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.562	275.565	0.549	275.565	-
Bench Mark 2:	Rebar in black PVC	0.627	275.406	0.616	275.406	-
Top of Ice:		4.329	271.798	4.317	271.797	271.798
Water Level:		4.335	271.792	4.321	271.793	271.793
Transducer Reading:		0.662	271.130	0.662	271.131	271.131
Other:						

General Notes:

pipe: 0.72 m

Field Personnel:	SM, GB	Trip Date:	5-Nov-11
Data Entry Personnel:	DW	Date:	14-Nov-11
Data Check Personnel:	VS	Date:	23-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S7 - Muskeg River near Fort McKay

UTM Location: 465408 E, 6338944 N

Site Visit Date: November 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	3.20	0.00		0.000	0.000	0.000	0.9	3.20	3.80	0.60	0.06	0.021	0.019	0.04	0.001	0%
1	4.40	0.40	0.15	0.083			0.9	3.80	4.68	0.88	0.25	0.083	0.074	0.22	0.016	4%
2	4.95	0.45	0.14	0.155			0.9	4.68	5.23	0.55	0.31	0.155	0.140	0.17	0.024	6%
3	5.50	0.45	0.15	0.076			0.9	5.23	5.75	0.53	0.30	0.076	0.068	0.16	0.011	3%
4	6.00	0.43	0.17	0.101			0.9	5.75	6.23	0.48	0.26	0.101	0.091	0.12	0.011	3%
5	6.45	0.42	0.17	0.135			0.9	6.23	6.68	0.45	0.25	0.135	0.121	0.11	0.014	3%
6	6.90	0.45	0.20	0.041			0.9	6.68	7.10	0.42	0.25	0.041	0.037	0.11	0.004	1%
7	7.30	0.47	0.17	0.238			0.9	7.10	7.50	0.40	0.30	0.238	0.214	0.12	0.026	6%
8	7.70	0.50	0.18	0.062			0.9	7.50	7.90	0.40	0.32	0.062	0.055	0.13	0.007	2%
9	8.10	0.48	0.17	0.137			0.9	7.90	8.30	0.40	0.31	0.137	0.123	0.12	0.015	4%
10	8.50	0.48	0.22	0.123			0.9	8.30	8.73	0.42	0.26	0.123	0.111	0.11	0.012	3%
11	8.95	0.48	0.23	0.089			0.9	8.73	9.18	0.45	0.25	0.089	0.080	0.11	0.009	2%
12	9.40	0.51	0.22	0.142			0.9	9.18	9.63	0.45	0.29	0.142	0.127	0.13	0.017	4%
13	9.85	0.56	0.19	0.072			0.9	9.63	10.08	0.45	0.37	0.072	0.065	0.17	0.011	3%
14	10.30	0.52	0.21	0.115			0.9	10.08	10.55	0.48	0.31	0.115	0.104	0.15	0.015	4%
15	10.80	0.58	0.22	0.187			0.9	10.55	11.05	0.50	0.36	0.187	0.168	0.18	0.030	7%
16	11.30	0.57	0.21	0.215			0.9	11.05	11.55	0.50	0.36	0.215	0.193	0.18	0.035	9%
17	11.80	0.53	0.21	0.094			0.9	11.55	12.05	0.50	0.32	0.094	0.085	0.16	0.014	3%
18	12.30	0.50	0.22	0.077			0.9	12.05	12.50	0.45	0.28	0.077	0.069	0.13	0.009	2%
19	12.70	0.49	0.16	0.024			0.9	12.50	12.95	0.45	0.33	0.024	0.022	0.15	0.003	1%
20	13.20	0.49	0.16	0.116			0.9	12.95	13.43	0.48	0.33	0.116	0.104	0.16	0.016	4%
21	13.65	0.46	0.16	0.075			0.9	13.43	13.93	0.50	0.30	0.075	0.068	0.15	0.010	2%
22	14.20	0.44	0.16	0.095			0.9	13.93	14.50	0.57	0.28	0.095	0.085	0.16	0.014	3%
23	14.80	0.48	0.15	0.156			0.9	14.50	15.08	0.57	0.33	0.156	0.140	0.19	0.027	7%
24	15.35	0.47	0.15	0.146			0.9	15.08	15.68	0.60	0.32	0.146	0.131	0.19	0.025	6%
25	16.00	0.42	0.15	0.102			0.9	15.68	16.40	0.72	0.27	0.102	0.092	0.20	0.018	4%
26	16.80	0.41	0.16	0.053			0.9	16.40	17.65	1.25	0.25	0.053	0.048	0.31	0.015	4%
R	18.50	0.00		0.000	0.000	0.000	1.0	17.65	18.50	0.85	0.06	0.013	0.013	0.05	0.001	7%
Total Flow															0.408	

Measurement Details:

Start Time (MST):	15:10
End Time (MST):	16:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, windy, 4C

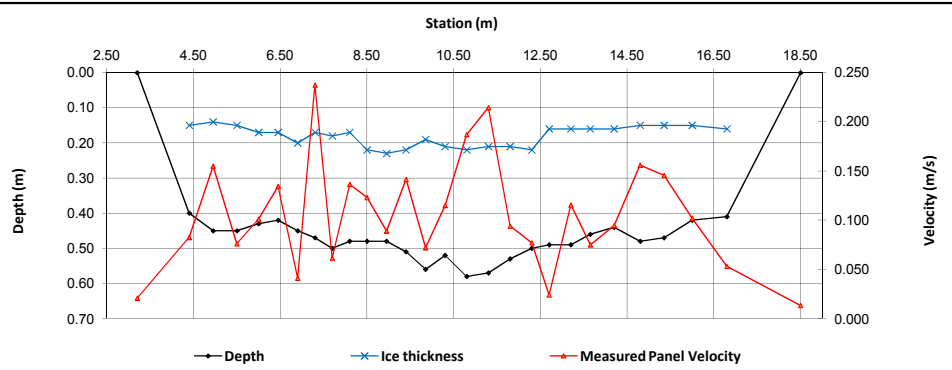
Flow characteristics:

Total Flow:	0.408	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	4.17	(m ²)
Wetted Width:	15.30	(m)
Hydraulic Depth:	0.273	(m)
Mean Velocity:	0.098	(m/s)
Froude Number:	0.060	

Datalogger Details:

	Before	After
Transducer Reading:		0.678
Battery (Main):	12.65	
Battery (Aux):	-	
Datalogger Clock:	15:13	
Laptop Clock:	15:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	0.741	275.565	0.735	275.565	-
Bench Mark 2:	Rebar in black PVC	0.892	275.406	0.884	275.406	-
Top of Ice:		4.494	271.812	4.486	271.814	271.813
Water Level:		4.500	271.806	4.494	271.806	271.806
Transducer Reading:		0.678	271.128	0.678	271.128	271.128
Other:	Pipe	0.807		0.807		

General Notes:

Note: all flow measurements low SNR each measurement run multiple times

Field Personnel:	SM, DB	Trip Date:	27-Nov-11
Data Entry Personnel:	DW	Date:	6-Dec-11
Data Check Personnel:	SG	Date:	19-Dec-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearsal Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: January 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	5.00	0.00	0.00	0.000	0.000	0.000	0.9	5.00	5.60	0.60	0.05	-0.001	0.000	0.03	0.000	0%
1	6.20	0.30	0.10	-0.002			0.9	5.60	6.30	0.70	0.20	-0.002	-0.002	0.14	0.000	0%
2	6.40	0.35	0.10	0.001			0.9	6.30	6.55	0.25	0.25	0.001	0.001	0.06	0.000	0%
3	6.70	0.40	0.10	0.058			0.9	6.55	6.83	0.27	0.30	0.058	0.052	0.08	0.004	6%
4	6.95	0.40	0.10	0.015			0.9	6.83	7.03	0.20	0.30	0.015	0.014	0.06	0.001	1%
5	7.10	0.45	0.12	0.043			0.9	7.03	7.20	0.17	0.33	0.043	0.039	0.06	0.002	3%
6	7.30	0.45	0.12	0.254			0.9	7.20	7.35	0.15	0.33	0.254	0.229	0.05	0.011	17%
7	7.40	0.45	0.12	0.118			0.9	7.35	7.50	0.15	0.33	0.118	0.106	0.05	0.005	8%
8	7.60	0.47	0.12	0.137			0.9	7.50	7.73	0.23	0.35	0.137	0.123	0.08	0.010	14%
9	7.85	0.45	0.12	0.051			0.9	7.73	7.93	0.20	0.33	0.051	0.046	0.07	0.003	4%
10	8.00	0.46	0.15	0.207			0.9	7.93	8.45	0.52	0.31	0.207	0.186	0.16	0.030	44%
Left	8.90	0.00	0.00	0.000	0.000	0.000	1.0	8.45	8.90	0.45	0.08	0.052	0.052	0.03	0.002	3%
Total Flow														0.069		

Measurement Details:

Start Time (MST):	9:05
End Time (MST):	10:05
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	-31 °C

Flow Characteristics:

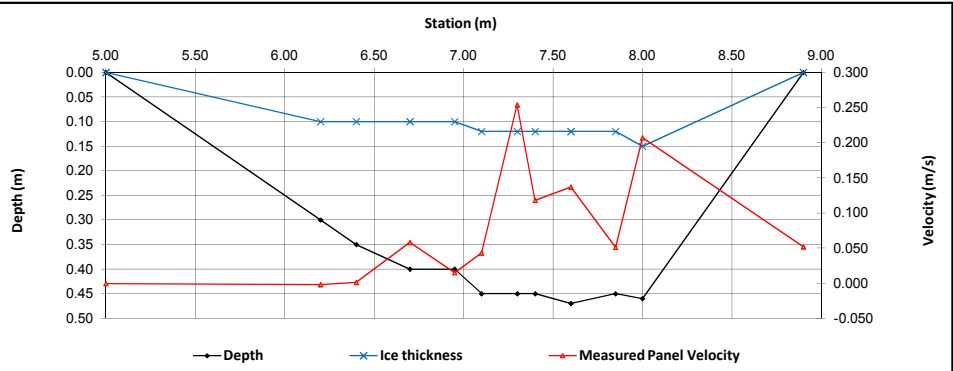
Total Flow:	0.069	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.87	(m ²)
Wetted Width:	3.90	(m)
Hydraulic Depth:	0.224	(m)
Mean Velocity:	0.078	(m/s)
Froude Number:	0.053	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

No datalogger installed in winter time.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.519	329.796	1.510	329.796	-
Bench Mark 2:	T-post	0.288	330.979	0.283	330.979	-
Top of Ice:		2.140	329.175	2.135	329.171	329.173
Water Level:		2.306	329.009	2.302	329.004	329.007
Transducer Reading:						
Other:						

General Notes:

10cm gap between ice and water. Poor measurement.

Field Personnel:	DB, JO	Trip Date:	15-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kears Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: February 9, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Panel	Panel	Panel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	14:59
End Time (MST):	16:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	
Weather:	Clear, -29 °C

Flow characteristics:

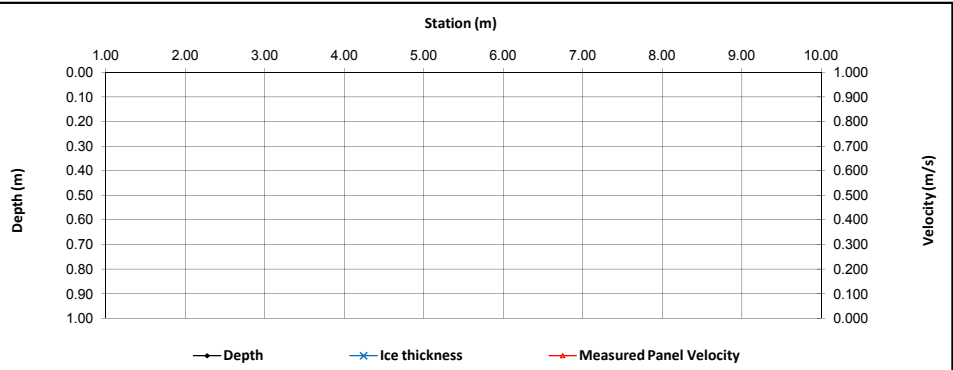
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

No datalogger installed in winter time.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.577	329.796	1.561	329.796	-
Bench Mark 2:	T-post	0.358	330.979	0.341	330.979	-
Top of Ice:		2.339	329.034	2.317	329.040	329.037
Water Level:		2.362	329.011	2.348	329.009	329.010
Transducer Reading:						
Other:						

General Notes:

Thin ice, no flow measurement taken.

Field Personnel:	BL, GB	Trip Date:	9-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kears Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: March 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	9:00
End Time (MST):	9:20
Equipment:	-
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Sunny, -15 °C

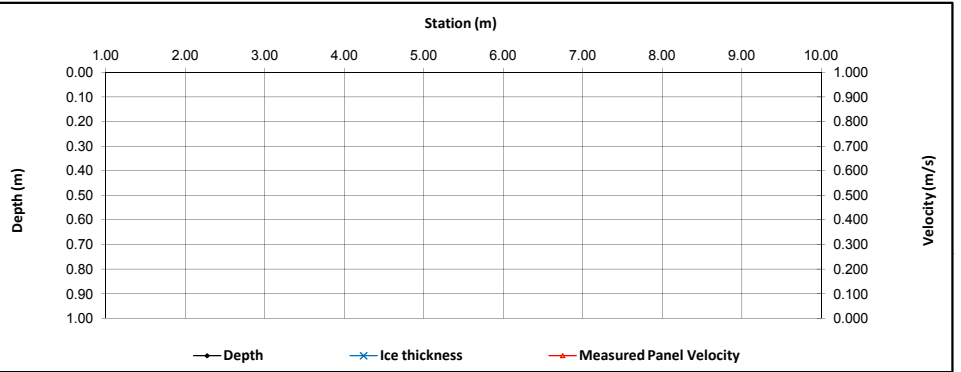
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.228	329.796	1.220	329.796	-
Bench Mark 2:	T-post	0.024	330.979	0.015	330.979	-
Top of Ice:		1.930	329.094	1.923	329.093	329.094
Water Level:		2.014	329.010	2.000	329.016	329.013
Transducer Reading:						
Other:						

General Notes:

Thin ice, easily broken. Water depth 25 - 30cm on way to centre. Too deep for winter boots.

Field Personnel:	DB, GB	Trip Date:	12-Mar-11
Data Entry Personnel:	CM	Date:	21-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearsal Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: April 2, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	9:05
End Time (MST):	9:20
Equipment:	ADV
Method:	-
River Condition:	Open
Quality/Error (see reverse):	-
Weather:	Cloudy

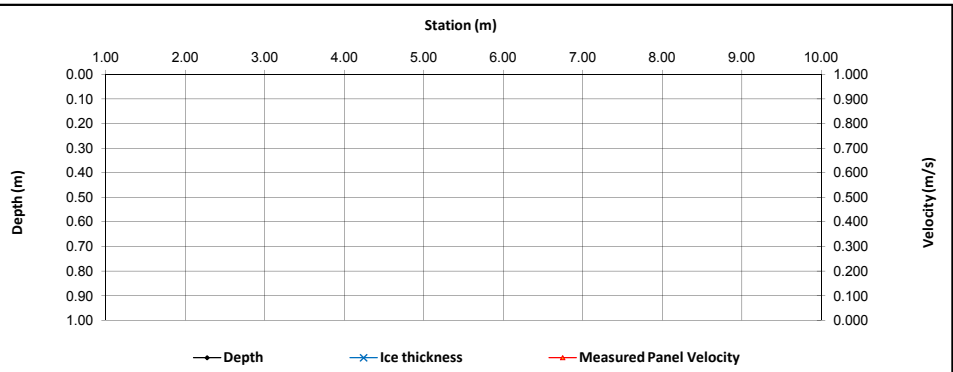
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	2.865	329.796	2.845	329.796	-
Bench Mark 2:	T-post	1.640	330.979	1.625	330.979	-
Top of Ice:						
Water Level:		3.790	328.871	3.772	328.869	328.870
Transducer Reading:						
Other:						

General Notes:

No measurements taken. Gated through Shell property - requiring escort from North American.

Field Personnel:	JO, BL	Trip Date:	2-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearsal Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: April 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.70	0.00	0.00	0.000	0.000	0.000	1.0	0.70	0.75	0.05	0.09	0.000	0.000	0.00	0.000	0%
1	0.80	0.34		0.001			1.0	0.75	0.95	0.20	0.34	0.001	0.001	0.07	0.000	0%
2	1.10	0.34		-0.005			1.0	0.95	1.25	0.30	0.34	-0.005	-0.005	0.10	-0.001	-1%
3	1.40	0.37		0.003			1.0	1.25	1.55	0.30	0.37	0.003	0.003	0.11	0.000	1%
4	1.70	0.36		-0.002			1.0	1.55	1.85	0.30	0.36	-0.002	-0.002	0.11	0.000	0%
5	2.00	0.38		0.000			1.0	1.85	2.15	0.30	0.38	0.000	0.000	0.11	0.000	0%
6	2.30	0.38		0.003			1.0	2.15	2.45	0.30	0.38	0.003	0.003	0.11	0.000	1%
7	2.60	0.39		0.029			1.0	2.45	2.75	0.30	0.39	0.029	0.029	0.12	0.003	6%
8	2.90	0.40		0.027			1.0	2.75	3.00	0.25	0.40	0.027	0.027	0.10	0.003	5%
9	3.10	0.39		0.021			1.0	3.00	3.20	0.20	0.39	0.021	0.021	0.08	0.002	3%
10	3.30	0.39		0.042			1.0	3.20	3.40	0.20	0.39	0.042	0.042	0.08	0.003	6%
11	3.50	0.40		0.046			1.0	3.40	3.60	0.20	0.40	0.046	0.046	0.08	0.004	6%
12	3.70	0.41		0.050			1.0	3.60	3.80	0.20	0.41	0.050	0.050	0.08	0.004	7%
13	3.90	0.42		0.078			1.0	3.80	4.00	0.20	0.42	0.078	0.078	0.08	0.007	11%
14	4.10	0.44		0.093			1.0	4.00	4.20	0.20	0.44	0.093	0.093	0.09	0.008	14%
15	4.30	0.46		0.063			1.0	4.20	4.40	0.20	0.46	0.063	0.063	0.09	0.006	10%
16	4.50	0.46		0.094			1.0	4.40	4.60	0.20	0.46	0.094	0.094	0.09	0.009	15%
17	4.70	0.44		0.042			1.0	4.60	4.80	0.20	0.44	0.042	0.042	0.09	0.004	6%
18	4.90	0.43		0.032			1.0	4.80	5.00	0.20	0.43	0.032	0.032	0.09	0.003	5%
19	5.10	0.41		0.013			1.0	5.00	5.20	0.20	0.41	0.013	0.013	0.08	0.001	2%
20	5.30	0.40		0.025			1.0	5.20	5.40	0.20	0.40	0.025	0.025	0.08	0.002	3%
21	5.50	0.37		-0.003			1.0	5.40	5.60	0.20	0.37	-0.003	-0.003	0.07	0.000	0%
Left	5.70	0.00	0.00	0.000	0.000	0.000	1.0	5.60	5.70	0.10	0.09	-0.001	-0.001	0.01	0.000	0%
Total Flow															0.057	

Measurement Details:

Start Time (MST):	9:00
End Time (MST):	10:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Sunny, 15°C

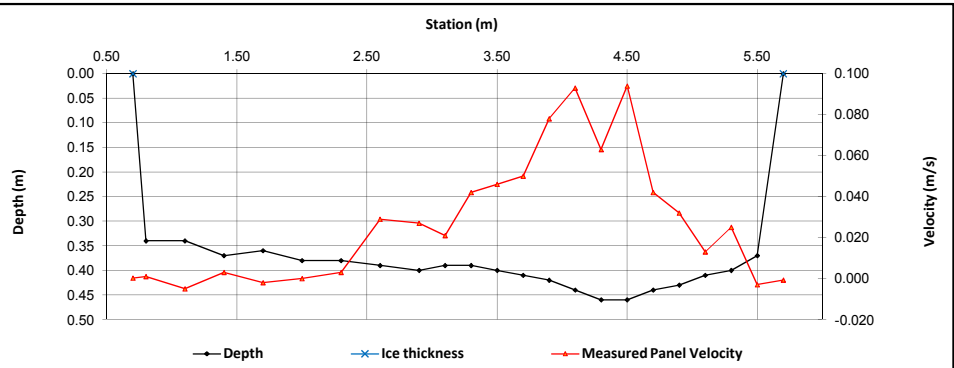
Flow characteristics:

Total Flow:	0.057	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.93	(m ²)
Wetted Width:	5.00	(m)
Hydraulic Depth:	0.386	(m)
Mean Velocity:	0.030	(m/s)
Froude Number:	0.015	

Datalogger Details:

	Before	After
Transducer Reading:		0.465
Battery (Main):	14.60	
Battery (Aux):		
Datalogger Clock:	9:30	
Laptop Clock:		
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	4.70	
Memory Used:	-	
Dessicant:	New	
Logger# (if Δ):	16117	
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.467	329.796	1.451	329.796	-
Bench Mark 2:	T-post	0.266	330.979	0.248	330.979	-
Top of Ice:						
Water Level:		2.157	329.106	2.140	329.107	329.107
Transducer Reading:		0.465	328.641	0.465	328.642	328.642
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	26-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearn Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: June 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TL	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.55	0.05	0.05	-0.002	-0.002	0.00	0.000	1%
1	0.60	0.21		-0.007			1.0	0.55	0.65	0.10	0.21	-0.007	-0.007	0.02	0.000	18%
2	0.70	0.14		-0.001			1.0	0.65	0.75	0.10	0.14	-0.001	-0.001	0.01	0.000	2%
3	0.80	0.16		-0.001			1.0	0.75	0.85	0.10	0.16	-0.001	-0.001	0.02	0.000	2%
4	0.90	0.18		-0.025			1.0	0.85	0.95	0.10	0.18	-0.025	-0.025	0.02	0.000	56%
5	1.00	0.22		0.016			1.0	0.95	1.05	0.10	0.22	0.016	0.016	0.02	0.000	-44%
6	1.10	0.27		-0.007			1.0	1.05	1.15	0.10	0.27	-0.007	-0.007	0.03	0.000	24%
7	1.20	0.30		-0.011			1.0	1.15	1.25	0.10	0.30	-0.011	-0.011	0.03	0.000	41%
8	1.30						1.0	1.25	1.35	0.10	0.08	0.000	0.000	0.01	0.000	0%
9	1.40						1.0	1.35	1.45	0.10	0.00	0.000	0.000	0.00	0.000	0%
10	1.50						1.0	1.45	1.55	0.10	0.00	0.000	0.000	0.00	0.000	0%
11	1.60						1.0	1.55	1.65	0.10	0.00	0.000	0.000	0.00	0.000	0%
12	1.70						1.0	1.65	1.75	0.10	0.00	0.000	0.000	0.00	0.000	0%
13	1.80						1.0	1.75	1.85	0.10	0.00	0.000	0.000	0.00	0.000	0%
14	1.90						1.0	1.85	1.95	0.10	0.00	0.000	0.000	0.00	0.000	0%
15	2.00						1.0	1.95	2.05	0.10	0.00	0.000	0.000	0.00	0.000	0%
16	2.10						1.0	2.05	2.15	0.10	0.00	0.000	0.000	0.00	0.000	0%
17	2.20						1.0	2.15	2.25	0.10	0.00	0.000	0.000	0.00	0.000	0%
18	2.30						1.0	2.25	2.35	0.10	0.00	0.000	0.000	0.00	0.000	0%
19	2.40						1.0	2.35	2.45	0.10	0.00	0.000	0.000	0.00	0.000	0%
20	2.50						1.0	2.45	2.55	0.10	0.00	0.000	0.000	0.00	0.000	0%
TR	2.60	0.00	0.00	0.000	0.000	0.000	1.0	2.55	2.60	0.05	0.00	0.000	0.000	0.00	0.000	0%
Total Flow															-0.001	

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	15:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	N/A
Weather:	Rain, 14 deg C

Flow characteristics:

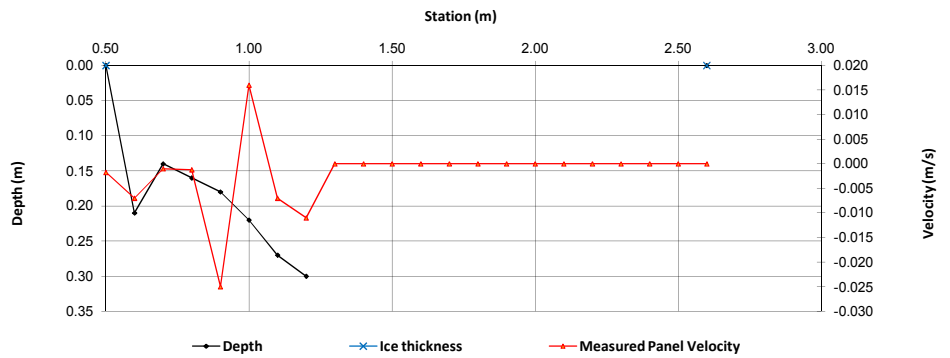
Total Flow:	-0.001	(m ³ /s)
Perceived Measurement Quality:	N/A	
Cross Section Area:	0.16	(m ²)
Wetted Width:	2.10	(m)
Hydraulic Depth:	0.075	(m)
Mean Velocity:	-0.005	(m/s)
Froude Number:	-0.006	

Datalogger Details:

	Before	After
Transducer Reading:		0.287
Battery (Main):	14.00	
Battery (Aux):	-	
Datalogger Clock:	13:59	
Laptop Clock:	14:00	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	13.20	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

OS updated to v 22: Checked: OK



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.383	329.796	1.359	329.796	-
Bench Mark 2:	T-post	0.143	330.979	0.119	330.979	-
Top of Ice:						
Water Level:		2.220	328.959	2.193	328.962	328.961
Transducer Reading:		0.287	328.672	0.287	328.675	328.674
Other:						

General Notes:

Flow gauge abandoned - beaver dam impact and low water giving substantial recirculation issues and negative numbers. Poor discharge site.

Field Personnel:	JO, SM	Trip Date:	17-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearl Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: August 10, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	1.30	0.00	0.00	0.000	0.000	0.000	1.0	1.30	1.35	0.05	0.01	-0.001	-0.001	0.00	0.000	0%
1	1.40	0.05		-0.005			1.0	1.35	1.45	0.10	0.05	-0.005	-0.005	0.00	0.000	-2%
2	1.50	0.06		-0.004			1.0	1.45	1.55	0.10	0.06	-0.004	-0.004	0.01	0.000	-2%
3	1.60	0.28		-0.001			1.0	1.55	1.65	0.10	0.28	-0.001	-0.001	0.03	0.000	-3%
4	1.70	0.20		-0.002			1.0	1.65	1.75	0.10	0.20	-0.002	-0.002	0.02	0.000	-4%
5	1.80	0.21		0.006			1.0	1.75	1.85	0.10	0.21	0.006	0.006	0.02	0.000	12%
6	1.90	0.26		0.006			1.0	1.85	1.95	0.10	0.26	0.006	0.006	0.03	0.000	14%
7	2.00	0.30		0.012			1.0	1.95	2.05	0.10	0.30	0.012	0.012	0.03	0.000	33%
8	2.10	0.18		0.036			1.0	2.05	2.15	0.10	0.18	0.036	0.036	0.02	0.001	60%
9	2.20	0.18		0.018			1.0	2.15	2.25	0.10	0.18	0.018	0.018	0.02	0.000	30%
10	2.30	0.26		0.003			1.0	2.25	2.35	0.10	0.26	0.003	0.003	0.03	0.000	7%
11	2.40	0.21		0.008			1.0	2.35	2.45	0.10	0.21	0.008	0.008	0.02	0.000	16%
12	2.50	0.20		0.002			1.0	2.45	2.55	0.10	0.20	0.002	0.002	0.02	0.000	4%
13	2.60	0.20		-0.003			1.0	2.55	2.65	0.10	0.20	-0.003	-0.003	0.02	0.000	-6%
14	2.70	0.20		-0.022			1.0	2.65	2.75	0.10	0.20	-0.022	-0.022	0.02	0.000	-41%
15	2.80	0.17		-0.008			1.0	2.75	2.85	0.10	0.17	-0.008	-0.008	0.02	0.000	-13%
16	2.90	0.18		-0.003			1.0	2.85	2.95	0.10	0.18	-0.003	-0.003	0.02	0.000	-5%
17	3.00	0.10		-0.001			1.0	2.95	3.10	0.15	0.10	-0.001	-0.001	0.02	0.000	-1%
RB	3.20	0.00	0.00	0.000	0.000	0.000	1.0	3.10	3.20	0.10	0.03	0.000	0.000	0.00	0.000	0%
Total Flow															0.001	

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	11:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Sunny

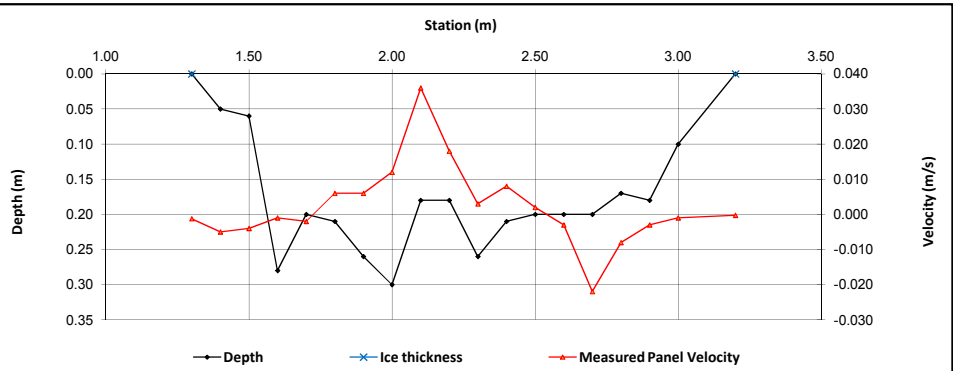
Flow characteristics:

Total Flow:	0.001	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.33	(m ²)
Wetted Width:	1.90	(m)
Hydraulic Depth:	0.175	(m)
Mean Velocity:	0.003	(m/s)
Froude Number:	0.002	

Datalogger Details:

	Before	After
Transducer Reading:		0.191
Battery (Main):	13.24	
Battery (Aux):	-	
Datalogger Clock:	11:06	
Laptop Clock:	11:07	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	14.70	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.742	329.796	1.719	329.796	-
Bench Mark 2:	T-post	0.500	330.979	0.478	330.979	-
Top of Ice:						
Water Level:		2.676	328.862	2.653	328.862	328.862
Transducer Reading:		0.191	328.671	0.191	328.671	328.671
Other:						

General Notes:

Very low flow.

Field Personnel:	SG, SM	Trip Date:	10-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearn Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: September 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.65	0.15	0.06	-0.001	-0.001	0.01	0.000	0%
1	0.80	0.25		-0.004			1.0	0.65	0.95	0.30	0.25	-0.004	-0.004	0.08	0.000	4%
2	1.10	0.37		-0.057			1.0	0.95	1.25	0.30	0.37	-0.057	-0.057	0.11	-0.006	92%
3	1.40	0.37		0.000			1.0	1.25	1.55	0.30	0.37	0.000	0.000	0.11	0.000	0%
4	1.70	0.37		0.000			1.0	1.55	1.85	0.30	0.37	0.000	0.000	0.11	0.000	0%
5	2.00	0.35		-0.002			1.0	1.85	2.15	0.30	0.35	-0.002	-0.002	0.11	0.000	3%
6	2.30	0.33		0.000			1.0	2.15	2.55	0.40	0.33	0.000	0.000	0.13	0.000	0%
LB	2.80	0.00	0.00	0.000	0.000	0.000	1.0	2.55	2.80	0.25	0.00	0.000	0.000	0.00	0.000	0%
Total Flow															-0.007	

Measurement Details:

Start Time (MST):	12:27
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	No visible moving flow
Quality/Error (see reverse):	Poor
Weather:	Sunny 10°C

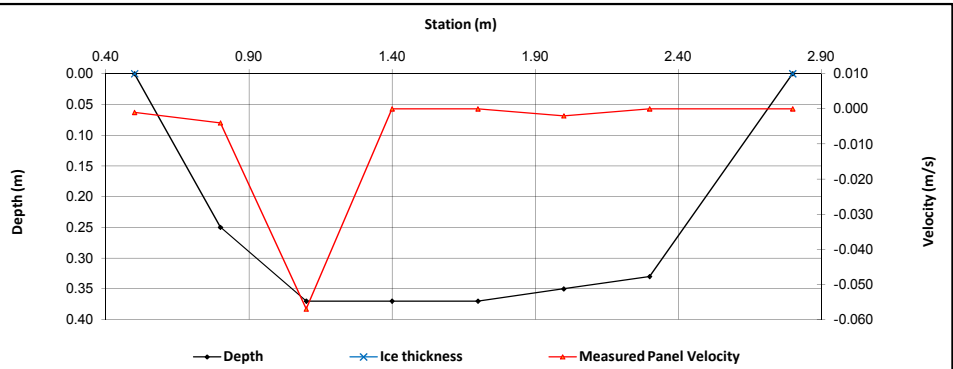
Flow characteristics:

Total Flow:	-0.007	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.65	(m ²)
Wetted Width:	2.30	(m)
Hydraulic Depth:	0.285	(m)
Mean Velocity:	-0.010	(m/s)
Froude Number:	-0.006	

Datalogger Details:

	Before	After
Transducer Reading:		0.155
Battery (Main):	14.05	
Battery (Aux):	-	
Datalogger Clock:	12:29	
Laptop Clock:	12:31	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	5.60	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.379	329.796	1.367	329.796	-
Bench Mark 2:	T-post	0.140	330.979	0.128	330.979	-
Top of Ice:						
Water Level:		2.349	328.826	2.337	328.826	328.826
Transducer Reading:		0.155	328.671	0.155	328.671	328.671
Other:						

General Notes:

No visible flow. Did velocity readings every 30cm to prove no flow or ??? velocity. Both culverts were dry.

Field Personnel:	DB, SM	Trip Date:	14-Sep-11
Data Entry Personnel:	TK	Date:	22-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kearl Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: November 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.55	0.05	0.11	-0.001	-0.001	0.01	0.000	0%
1	0.60	0.54	0.10	-0.005			1.0	0.55	0.70	0.15	0.44	-0.005	-0.005	0.07	0.000	10%
2	0.80	0.54		-0.001			1.0	0.70	0.90	0.20	0.54	-0.001	-0.001	0.11	0.000	3%
3	1.00	0.54		-0.002			1.0	0.90	1.10	0.20	0.54	-0.002	-0.002	0.11	0.000	7%
4	1.20	0.57		-0.009			1.0	1.10	1.30	0.20	0.57	-0.009	-0.009	0.11	-0.001	32%
5	1.40	0.56		-0.004			1.0	1.30	1.50	0.20	0.56	-0.004	-0.004	0.11	0.000	14%
6	1.60	0.57		-0.006			1.0	1.50	1.70	0.20	0.57	-0.006	-0.006	0.11	-0.001	21%
7	1.80	0.52		0.000			1.0	1.70	1.90	0.20	0.52	0.000	0.000	0.10	0.000	0%
8	2.00	0.54		0.000			1.0	1.90	2.10	0.20	0.54	0.000	0.000	0.11	0.000	0%
9	2.20	0.55		0.000			1.0	2.10	2.30	0.20	0.55	0.000	0.000	0.11	0.000	0%
10	2.40	0.50		-0.007			1.0	2.30	2.50	0.20	0.50	-0.007	-0.007	0.10	-0.001	22%
11	2.60	0.40		0.001			1.0	2.50	2.70	0.20	0.40	0.001	0.001	0.08	0.000	-2%
12	2.80	0.50		0.002			1.0	2.70	2.90	0.20	0.50	0.002	0.002	0.10	0.000	-6%
R	3.00	0.00	0.00	0.000	0.000	0.000	1.0	2.90	3.00	0.10	0.00	0.001	0.001	0.00	0.000	0%
Total Flow															-0.003	

Measurement Details:

Start Time (MST):	9:40
End Time (MST):	10:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Clear, Crisp, -10C

Flow characteristics:

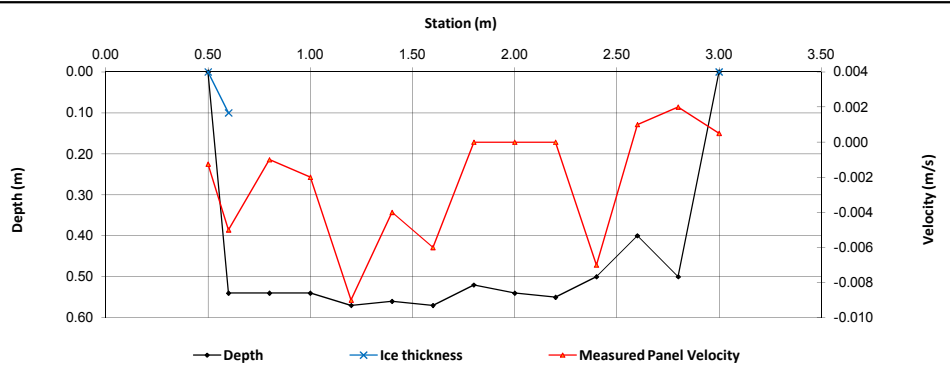
Total Flow:	-0.003	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	1.23	(m ²)
Wetted Width:	2.50	(m)
Hydraulic Depth:	0.492	(m)
Mean Velocity:	-0.003	(m/s)
Froude Number:	-0.001	

Datalogger Details:

	Before	After
Transducer Reading:		0.335
Battery (Main):	14.75	
Battery (Aux):	-	
Datalogger Clock:	9:49	
Laptop Clock:	9:51	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	2.50	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

removed CR800, PLS, Batt



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.308	329.796	1.297	329.796	-
Bench Mark 2:	T-post	0.069	330.979	0.057	330.979	-
Top of Ice:		2.081	329.023	2.088	329.025	329.024
Water Level:		2.098	329.006	2.087	329.006	329.006
Transducer Reading:		0.335	328.671	0.335	328.671	328.671
Other:						

General Notes:

- no flow detected at culverts upstream of flow station
- possible influence from beaver dam
- BM2 Height 1.28 m

Field Personnel:	SM, GB	Trip Date:	5-Nov-11
Data Entry Personnel:	DW	Date:	14-Nov-11
Data Check Personnel:	VS	Date:	24-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S9 - Kears Lake Outlet

UTM Location: 483962 E, 6346990 N

Site Visit Date: November 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	11:45
End Time (MST):	12:15
Equipment:	-
Method:	-
River Condition:	Ice Cover
Quality/Error (see reverse):	-
Weather:	Over cast, 6C

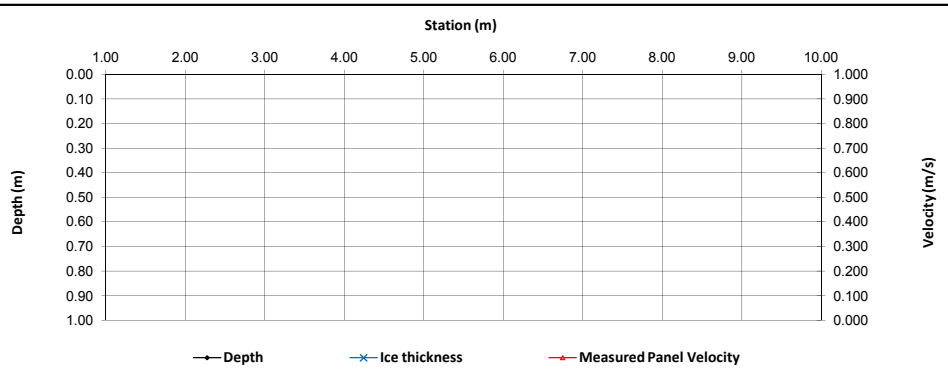
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in birch tree	1.517	329.796	1.507	329.796	-
Bench Mark 2:	T-post	0.277	330.979	0.267	330.979	-
Top of Ice:		2.226	329.087	2.216	329.087	329.087
Water Level:		2.244	329.069	2.233	329.070	329.070
Transducer Reading:						
Other:						

General Notes:

- lower ice layer overlain by stagnant water and an upper ice layer. Flow not measured.
- Surface ice thickness is 2"
- Total water + ice was 45cm
- Velocity tried at 0.6m depth below the ice layer with a velocity reading of 0 m/s

Field Personnel:	SM, DB	Trip Date:	27-Nov-11
Data Entry Personnel:	DW	Date:	18-Jan-12
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: January 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	12:15
End Time (MST):	13:15
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Overcast

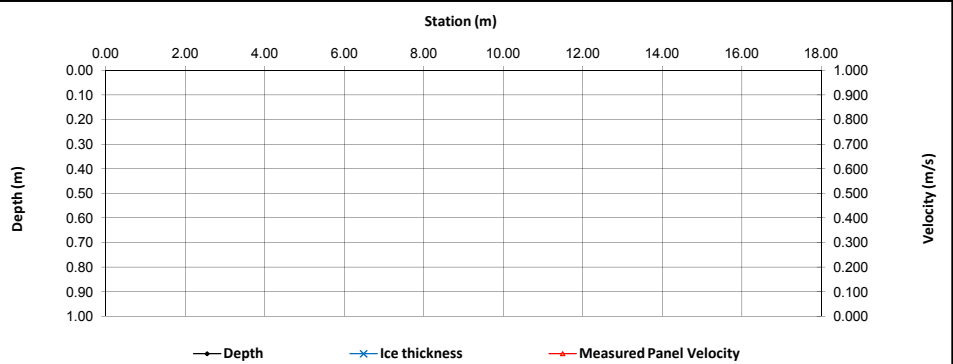
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:	-0.107	1.275
Battery (Main):	3.39	12.73
Battery (Aux):	1.68	4.5
Datalogger Clock:	12:18	13:24
Laptop Clock:	12:24	13:24
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	0.26	0.26
Memory Used:	31%	31%
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree		100.721		100.721	-
Bench Mark 2:	Rebar in black PVC		100.657		100.657	-
Top of Ice:						
Water Level:						0.000
Transducer Reading:		-0.107	0.107	-0.107	0.107	0.107
Other:						

General Notes:

Good data finished 13-Dec
 Battery power 3V due to faulty solar controller. Replaced.
 Ice unsafe to measure on.

Field Personnel:	DB, JO	Trip Date:	15-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: February 9, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	1.50	0.00	0.00	0.000	0.000	0.000	0.9	1.50	2.08	0.58	-0.06	-0.030	-0.027	-0.04	0.001	50%
1	2.65	0.35	0.60	-0.121			0.9	2.08	2.73	0.65	-0.25	-0.121	-0.109	-0.16	0.018	908%
2	2.80	0.40	0.55	0.000			1.0	2.73	2.95	0.23	-0.15	0.000	0.000	-0.03	0.000	0%
3	3.10	0.50	0.55	0.048			0.9	2.95	3.18	0.23	-0.05	0.048	0.043	-0.01	0.000	-25%
4	3.25	0.50	0.55	0.014			0.9	3.18	3.35	0.18	-0.05	0.014	0.013	-0.01	0.000	-6%
5	3.45	0.60	0.60	0.068			0.9	3.35	3.53	0.18	0.00	0.068	0.061	0.00	0.000	0%
6	3.60	0.60	0.60	0.086			0.9	3.53	3.73	0.20	0.00	0.086	0.077	0.00	0.000	0%
7	3.85	0.80	0.60	-0.003			0.9	3.73	3.93	0.20	0.20	-0.003	-0.003	0.04	0.000	-6%
8	4.00	0.90	0.60	-0.006			0.9	3.93	4.10	0.18	0.30	-0.006	-0.005	0.05	0.000	-15%
9	4.20	0.85	0.60	-0.009			0.9	4.10	4.23	0.13	0.25	-0.009	-0.008	0.03	0.000	-13%
10	4.25	0.80	0.60	-0.004			0.9	4.23	4.28	0.05	0.20	-0.004	-0.004	0.01	0.000	-2%
11	4.30	0.95	0.60	-0.056			0.9	4.28	4.45	0.17	0.35	-0.056	-0.050	0.06	-0.003	-158%
12	4.60	1.00	0.60	0.005			0.9	4.45	4.63	0.18	0.40	0.005	0.005	0.07	0.000	16%
13	4.65	1.00	0.60	-0.036			0.9	4.63	4.70	0.08	0.40	-0.036	-0.032	0.03	-0.001	-50%
14	4.75	1.00	0.60	-0.022			0.9	4.70	4.83	0.13	0.40	-0.022	-0.020	0.05	-0.001	-51%
15	4.90	1.00	0.60	-0.016			0.9	4.83	4.98	0.15	0.40	-0.016	-0.014	0.06	-0.001	-44%
16	5.05	1.00	0.60	-0.013			0.9	4.98	5.15	0.18	0.40	-0.013	-0.012	0.07	-0.001	-42%
17	5.25	1.00	0.60	-0.010			0.9	5.15	5.35	0.20	0.40	-0.010	-0.009	0.08	-0.001	-37%
18	5.45	1.10	0.60	-0.012			0.9	5.35	5.53	0.18	0.50	-0.012	-0.011	0.09	-0.001	-48%
19	5.60	1.00	0.60	-0.070			0.9	5.53	5.68	0.15	0.40	-0.070	-0.063	0.06	-0.004	-194%
20	5.75	1.10	0.60	-0.050			0.9	5.68	5.85	0.18	0.50	-0.050	-0.045	0.09	-0.004	-202%
21	5.95	0.80	0.60	0.010			0.9	5.85	6.03	0.18	0.20	0.010	0.009	0.04	0.000	16%
22	6.10	0.50	0.60	-0.005			0.9	6.03	6.23	0.20	-0.10	-0.005	-0.005	-0.02	0.000	5%
23	6.35	0.45	0.55	0.002			0.9	6.23	6.43	0.20	-0.10	0.002	0.002	-0.02	0.000	-2%
24	6.50	0.60	0.55	-0.001			0.9	6.43	6.80	0.38	0.05	-0.001	-0.001	0.02	0.000	-1%
Left	7.10	0.00	0.00	0.000	0.000	0.000	1.0	6.80	7.10	0.30	0.01	0.000	0.000	0.00	0.000	0%
Total Flow															0.002	

Measurement Details:

Start Time (MST):	9:30
End Time (MST):	11:46
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Clear

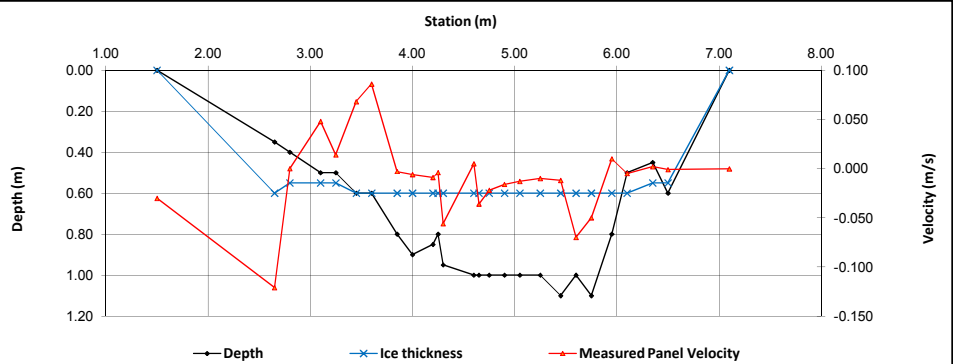
Flow characteristics:

Total Flow:	0.002	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.56	(m ²)
Wetted Width:	5.60	(m)
Hydraulic Depth:	0.099	(m)
Mean Velocity:	0.004	(m/s)
Froude Number:	0.004	

Datalogger Details:

	Before	After
Transducer Reading:		1.285
Battery (Main):	15.36	
Battery (Aux):	4.52	
Datalogger Clock:	11:06	
Laptop Clock:	11:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.45	
Memory Used:	35%	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.259	100.721	1.213	100.721	-
Bench Mark 2:	Rebar in PVC pipe	1.511	100.657	1.465	100.657	-
Top of Ice:		2.019	100.149	1.978	100.144	100.147
Water Level:		2.019	100.149	1.978	100.144	100.147
Transducer Reading:		1.285	98.864	1.285	98.859	98.862
Other:						

General Notes:

Flows under bridge.

Field Personnel:	BL, GB	Trip Date:	9-Feb-11
Data Entry Personnel:	DB	Date:	18-Feb-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: March 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1	6.40	0.00	0.00	0.000	0.000	0.000	1.0	6.40	6.28	0.13	0.03	0.000	0.000	0.00	0.000	0%
2	6.15	0.67	0.57				1.0	6.28	6.05	0.23	0.10	0.000	0.000	0.02	0.000	0%
3	5.95	0.67	0.57	0.002			0.9	6.05	5.88	0.18	0.10	0.002	0.002	0.02	0.000	0%
4	5.80	0.80	0.57				1.0	5.88	5.73	0.15	0.23	0.000	0.000	0.03	0.000	0%
5	5.65	0.80	0.57	0.001			0.9	5.73	5.43	0.30	0.23	0.001	0.001	0.07	0.000	0%
6	5.20	0.76	0.57	0.017			0.9	5.43	5.13	0.30	0.19	0.017	0.015	0.06	0.001	3%
7	5.05	0.85	0.58				1.0	5.13	4.95	0.18	0.27	0.000	0.000	0.05	0.000	0%
8	4.85	1.10	0.58	0.169			0.9	4.95	4.78	0.17	0.52	0.169	0.152	0.09	0.014	47%
9	4.70	1.10	0.59				1.0	4.78	4.63	0.15	0.51	0.000	0.000	0.08	0.000	0%
10	4.55	1.05	0.58	0.060			0.9	4.63	4.45	0.18	0.47	0.060	0.054	0.08	0.004	15%
11	4.35	1.05	0.59				1.0	4.45	4.28	0.17	0.46	0.000	0.000	0.08	0.000	0%
12	4.20	1.05	0.58	0.103			0.9	4.28	4.13	0.15	0.47	0.103	0.093	0.07	0.007	22%
13	4.05	1.05	0.58	0.047			0.9	4.13	3.98	0.15	0.47	0.047	0.042	0.07	0.003	10%
14	3.90	1.05	0.58				1.0	3.98	3.80	0.18	0.47	0.000	0.000	0.08	0.000	0%
15	3.70	0.85	0.55				1.0	3.80	3.60	0.20	0.30	0.000	0.000	0.06	0.000	0%
16	3.50	0.90	0.55				1.0	3.60	3.40	0.20	0.35	0.000	0.000	0.07	0.000	0%
17	3.30	0.95	0.57	0.011			0.9	3.40	3.20	0.20	0.38	0.011	0.010	0.08	0.001	3%
18	3.10	0.70	0.50	-0.001			0.9	3.20	3.05	0.15	0.20	-0.001	-0.001	0.03	0.000	0%
19	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.05	3.00	0.05	0.05	0.000	0.000	0.00	0.000	0%
Total Flow															0.029	

Measurement Details:

Start Time (MST):	12:15
End Time (MST):	13:10
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Sunny, -10 °C

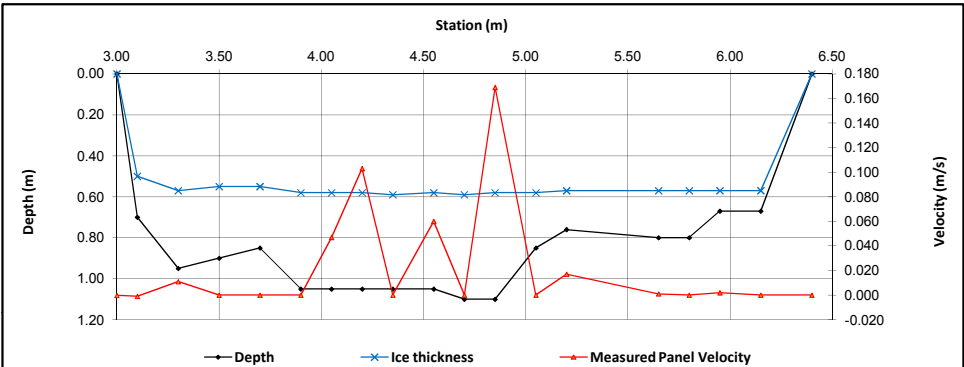
Flow characteristics:

Total Flow:	0.029	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	1.04	(m ²)
Wetted Width:	3.23	(m)
Hydraulic Depth:	0.323	(m)
Mean Velocity:	0.028	(m/s)
Froude Number:	0.016	

Datalogger Details:

	Before	After
Transducer Reading:		1.237
Battery (Main):	4.60	
Battery (Aux):	15	
Datalogger Clock:	12:04	
Laptop Clock:	12:14	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.36	
Memory Used:	41%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.220	100.721	1.212	100.721	-
Bench Mark 2:	Rebar in black PVC	1.474	100.657	1.466	100.657	-
Top of Ice:		1.991	100.140	1.985	100.138	100.139
Water Level:		2.050	100.081	2.041	100.082	100.082
Transducer Reading:		1.237	98.844	1.237	98.845	98.844
Other:						

General Notes:

Mostly slush, poor readings throughout (high noise: signal ratio).

Field Personnel:	DB, GB	Trip Date:	12-Mar-11
Data Entry Personnel:	CM	Date:	21-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road
 UTM Location: 490350 E, 6355500 N

Site Visit Date: April 2, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	2.20	0.00	0.00	0.000	0.000	0.000	0.9	2.20	3.25	1.05	0.04	-0.001	-0.001	0.04	0.000	0%
1	4.30	0.50	0.35	-0.003			0.9	3.25	4.35	1.10	0.15	-0.003	-0.003	0.17	0.000	-2%
2	4.40	0.50	0.35	0.002			0.9	4.35	4.53	0.18	0.15	0.002	0.002	0.03	0.000	0%
3	4.65	0.60	0.35	0.019			0.9	4.53	4.73	0.20	0.25	0.019	0.017	0.05	0.001	3%
4	4.80	0.65	0.35	0.018			0.9	4.73	4.90	0.18	0.30	0.018	0.016	0.05	0.001	3%
5	5.00	0.80	0.43	0.019			0.9	4.90	5.10	0.20	0.37	0.019	0.017	0.07	0.001	4%
6	5.20	0.95	0.44	0.026			0.9	5.10	5.30	0.20	0.51	0.026	0.023	0.10	0.002	8%
7	5.40	1.05	0.40	0.011			0.9	5.30	5.50	0.20	0.65	0.011	0.010	0.13	0.001	4%
8	5.60	1.10	0.44	0.023			0.9	5.50	5.70	0.20	0.66	0.023	0.021	0.13	0.003	10%
9	5.80	1.10	0.43	0.025			0.9	5.70	5.90	0.20	0.67	0.025	0.023	0.13	0.003	11%
10	6.00	1.11	0.45	0.024			0.9	5.90	6.10	0.20	0.66	0.024	0.022	0.13	0.003	10%
11	6.20	1.10	0.40	0.027			0.9	6.10	6.30	0.20	0.70	0.027	0.024	0.14	0.003	12%
12	6.40	1.11	0.35	0.030			0.9	6.30	6.45	0.15	0.76	0.030	0.027	0.11	0.003	11%
13	6.50	1.15	0.35	0.026			0.9	6.45	6.60	0.15	0.80	0.026	0.023	0.12	0.003	10%
14	6.70	1.14	0.35	0.015			0.9	6.60	6.75	0.15	0.79	0.015	0.014	0.12	0.002	6%
15	6.80	1.18	0.35	0.019			0.9	6.75	6.90	0.15	0.83	0.019	0.017	0.12	0.002	7%
16	7.00	0.80	0.35	0.011			0.9	6.90	7.10	0.20	0.45	0.011	0.010	0.09	0.001	3%
17	7.20	0.80	0.35	0.006			0.9	7.10	7.30	0.20	0.45	0.006	0.005	0.09	0.000	2%
18	7.40	0.88	0.36	-0.004			0.9	7.30	7.50	0.20	0.52	-0.004	-0.004	0.10	0.000	-1%
19	7.60	0.90	0.35	-0.002			0.9	7.50	7.70	0.20	0.55	-0.002	-0.002	0.11	0.000	-1%
20	7.80	0.75	0.35	0.000			1.0	7.70	7.85	0.15	0.40	0.000	0.000	0.06	0.000	0%
21	7.90	0.42	0.36	0.000			1.0	7.85	9.05	1.20	0.06	0.000	0.000	0.07	0.000	0%
Left	10.20	0.00	0.00	0.000	0.000	0.000	1.0	9.05	10.20	1.15	0.02	0.000	0.000	0.02	0.000	0%
Total Flow															0.029	

Measurement Details:

Start Time (MST):	13:10
End Time (MST):	14:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Light snow

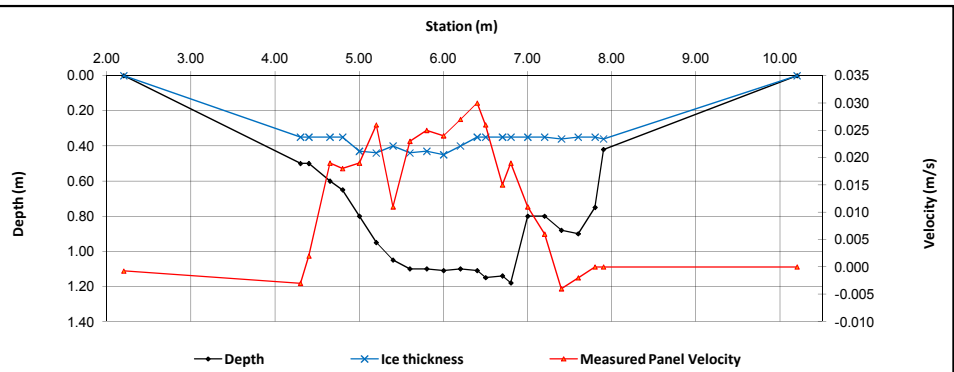
Flow characteristics:

Total Flow:	0.029	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	2.20	(m ²)
Wetted Width:	8.00	(m)
Hydraulic Depth:	0.275	(m)
Mean Velocity:	0.013	(m/s)
Froude Number:	0.008	

Datalogger Details:

	Before	After
Transducer Reading:		1.311
Battery (Main):	4.68	
Battery (Aux):	14.65	
Datalogger Clock:	12:11	
Laptop Clock:	12:22	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.71	
Memory Used:	45%	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.168	100.721	1.158	100.721	-
Bench Mark 2:	Rebar in black PVC	1.418	100.657	1.408	100.657	-
Top of Ice:		1.950	100.125	1.941	100.124	100.125
Water Level:		1.930	100.145	1.921	100.144	100.145
Transducer Reading:		1.311	98.834	1.311	98.833	98.833
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	2-Apr-11
Data Entry Personnel:	CM	Date:	6-Apr-11
Data Check Personnel:	DB	Date:	9-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: April 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	5.70	0.00		0.000	0.000	0.000	1.0	5.70	6.10	0.40	0.08	0.001	0.001	0.03	0.000	0%
1	6.50	0.30		0.003			1.0	6.10	6.65	0.55	0.30	0.003	0.003	0.17	0.000	0%
2	6.80	0.32		0.001			1.0	6.65	6.95	0.30	0.32	0.001	0.001	0.10	0.000	0%
3	7.10	0.32		0.029			1.0	6.95	7.25	0.30	0.32	0.029	0.029	0.10	0.003	1%
4	7.40	0.56		0.052			1.0	7.25	7.55	0.30	0.56	0.052	0.052	0.17	0.009	2%
5	7.70	0.66		0.054			1.0	7.55	7.85	0.30	0.66	0.054	0.054	0.20	0.011	2%
6	8.00	0.74		0.100			1.0	7.85	8.15	0.30	0.74	0.100	0.100	0.22	0.022	5%
7	8.30	0.98			0.075	0.101	1.0	8.15	8.45	0.30	0.98	0.088	0.088	0.29	0.026	6%
8	8.60	1.00			0.089	0.095	1.0	8.45	8.75	0.30	1.00	0.092	0.092	0.30	0.028	6%
9	8.90	1.40			0.065	0.020	1.0	8.75	9.05	0.30	1.40	0.043	0.043	0.42	0.018	4%
10	9.20	1.44			0.084	0.071	1.0	9.05	9.35	0.30	1.44	0.078	0.078	0.43	0.033	8%
11	9.50	1.43			0.052	0.056	1.0	9.35	9.65	0.30	1.43	0.054	0.054	0.43	0.023	5%
12	9.80	1.44			0.075	0.076	1.0	9.65	9.95	0.30	1.44	0.076	0.076	0.43	0.033	7%
13	10.10	1.42			0.080	0.069	1.0	9.95	10.25	0.30	1.42	0.075	0.075	0.43	0.032	7%
14	10.40	1.46			0.074	0.096	1.0	10.25	10.55	0.30	1.46	0.085	0.085	0.44	0.037	8%
15	10.70	1.44			0.100	0.088	1.0	10.55	10.85	0.30	1.44	0.094	0.094	0.43	0.041	9%
16	11.00	1.46			0.086	0.095	1.0	10.85	11.15	0.30	1.46	0.091	0.091	0.44	0.040	9%
17	11.30	1.13			0.090	0.079	1.0	11.15	11.45	0.30	1.13	0.085	0.085	0.34	0.029	6%
18	11.60	0.82			0.069	0.077	1.0	11.45	11.75	0.30	0.82	0.073	0.073	0.25	0.018	4%
19	11.90	0.59		0.068			1.0	11.75	12.05	0.30	0.59	0.068	0.068	0.18	0.012	3%
20	12.20	0.72		0.047			1.0	12.05	12.35	0.30	0.72	0.047	0.047	0.22	0.010	2%
21	12.50	0.72		0.076			1.0	12.35	12.75	0.40	0.72	0.076	0.076	0.29	0.022	5%
Right	13.00	0.00		0.000	0.000	0.000	1.0	12.75	13.00	0.25	0.18	0.000	0.000	0.05	0.000	0%
Total Flow															0.446	

Measurement Details:

Start Time (MST):	10:50
End Time (MST):	11:40
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 10°C

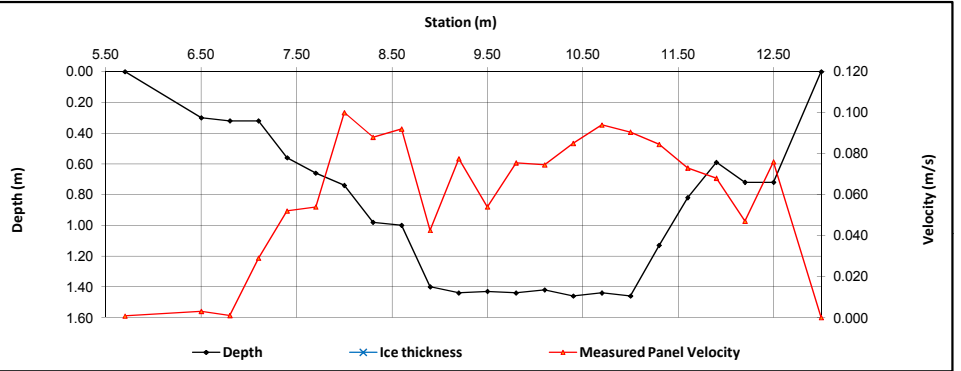
Flow characteristics:

Total Flow:	0.446	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	6.33	(m ²)
Wetted Width:	7.30	(m)
Hydraulic Depth:	0.867	(m)
Mean Velocity:	0.070	(m/s)
Froude Number:	0.024	

Datalogger Details:

	Before	After
Transducer Reading:		1.549
Battery (Main):	4.75	
Battery (Aux):	14.32	
Datalogger Clock:	10:38	
Laptop Clock:	10:48	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	5.38	
Memory Used:	49%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.158	100.721	1.141	100.721	-
Bench Mark 2:	Rebar in black PVC	1.408	100.657	1.394	100.657	-
Top of Ice:						
Water Level:		1.685	100.380	1.668	100.383	100.382
Transducer Reading:		1.549	98.831	1.549	98.834	98.833
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	26-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: June 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	16:10
End Time (MST):	16:30
Equipment:	-
Method:	-
River Condition:	Open, backwater
Quality/Error (see reverse):	-
Weather:	Cloudy 15°C

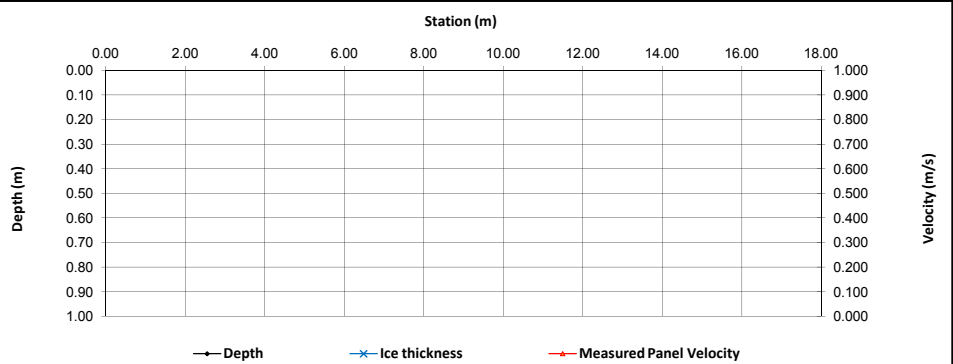
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:	1.58	
Battery (Main):	14.30	
Battery (Aux):	-	
Datalogger Clock:	14:58	
Laptop Clock:	15:08	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	14.90	
Memory Used:	58%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree		100.721		100.721	-
Bench Mark 2:	Rebar in black PVC		100.657		100.657	-
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:

No flow measurement conducted; velocities measured at 0.001 m/s. Cross section too large for such low flow measurement.

Field Personnel:	JO, SM	Trip Date:	17-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: August 10, 2011



Flow Measurement:

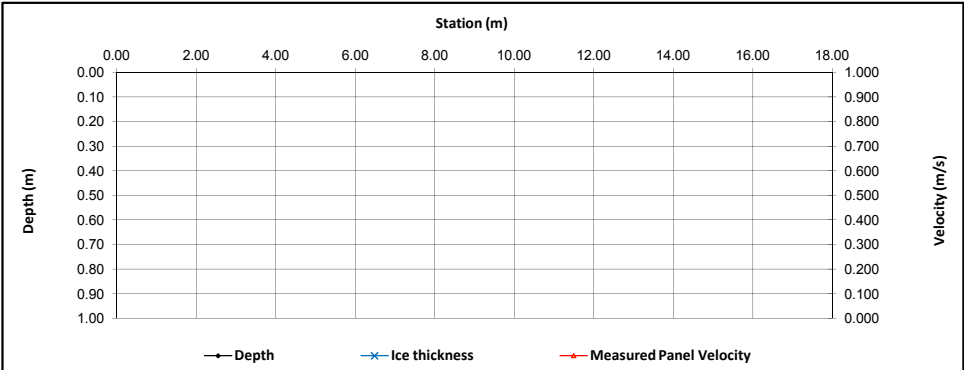
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	13:00
End Time (MST):	14:45
Equipment:	-
Method:	-
River Condition:	Open, backwater
Quality/Error (see reverse):	-
Weather:	Sunny, 25°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:	1.604	1.585
Battery (Main):	14.12	13.83
Battery (Aux):	4.85	
Datalogger Clock:	12:54	14:13
Laptop Clock:	13:07	14:13
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	13.50	14:24
Memory Used:	68%	
Dessicant:	Changed	
Logger# (if Δ):		SN 17935
PT# (if Δ):		

Datalogger / Station Notes:
Installed new CR800 PLS



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.223	100.721	1.209	100.721	-
Bench Mark 2:	Rebar in black PVC	1.342	100.657	1.328	100.657	-
Top of Ice:						
Water Level:		1.596	100.403	1.578	100.407	100.405
Transducer Reading:		1.604	98.799	1.604	98.803	98.801
Other:	New 3/4" pipe	1.066		1.052		

General Notes:
No flow measurement conducted; velocities measured at 0.001 m/s. Cross section too large for such low flow measurement.

Field Personnel:	SG, SM	Trip Date:	10-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: September 14, 2011



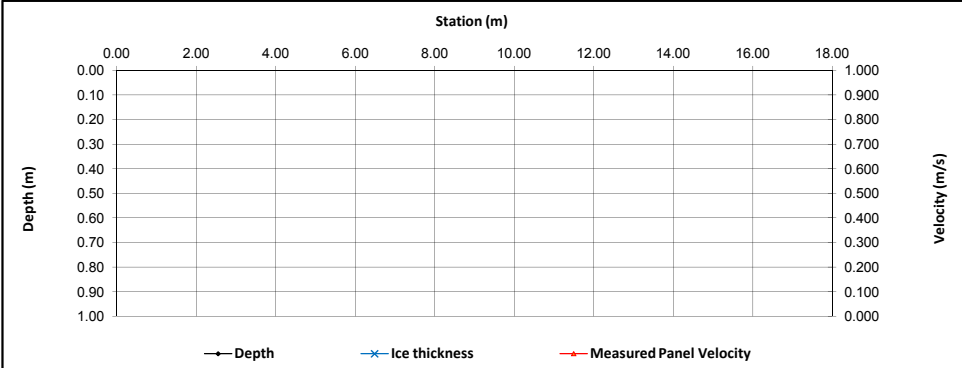
Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:	
Start Time (MST):	10:34
End Time (MST):	10:50
Equipment:	-
Method:	-
River Condition:	Open, backwater (beaver)
Quality/Error (see reverse):	-
Weather:	Sunny, 10°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:	1.61	
Battery (Main):	14.29	
Battery (Aux):	-	
Datalogger Clock:	10:35	
Laptop Clock:	10:35	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	9.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.254	100.721	1.240	100.721	-
Bench Mark 2:	Rebar in PVC pipe	1.374	100.657	1.359	100.657	-
Top of Ice:						
Water Level:		1.598	100.433	1.583	100.433	100.433
Transducer Reading:		1.610	98.823	1.610	98.823	98.823
Other:	New pipe next to nail	1.097		1.083		

General Notes:
 GPS next to rebar in pipe.
 No observed flow, high backwater.

Field Personnel:	DB, SM	Trip Date:	14-Sep-11
Data Entry Personnel:	TK	Date:	22-Sep-11
Data Check Personnel:	DW	Date:	28-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: November 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
				(m/s)	(m/s)	(m/s)	(m)				(m)	(m/s)	(m/s)	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	11:50
End Time (MST):	12:15
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear, Breezy, -4C

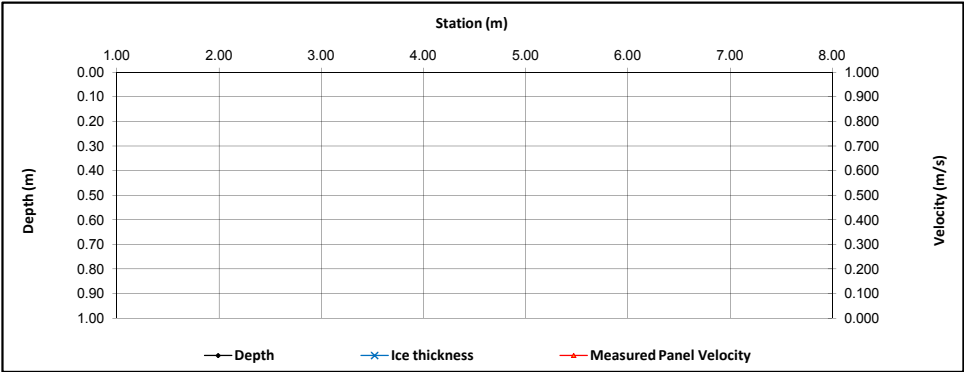
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		1.618
Battery (Main):	14.75	
Battery (Aux):	-	
Datalogger Clock:	11:56	
Laptop Clock:	11:55	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	4.00	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in log	1.350	100.721	1.338	100.721	-
Bench Mark 2:	Rebar in PVC pipe	1.469	100.657	1.457	100.657	-
Top of Ice:		1.683	100.388	1.673	100.386	100.387
Water Level:		1.683	100.443	1.673	100.441	100.442
Transducer Reading:		1.618	98.825	1.618	98.823	98.824
Other (BM3):	Pipe	1.193		1.181		

General Notes:

-Flow was not measured due to beaver dam influence
-See Photos

Field Personnel:	SM, GB	Trip Date:	5-Nov-11
Data Entry Personnel:	DW	Date:	14-Nov-11
Data Check Personnel:	VS	Date:	24-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S10 - Wapasu Creek at Canterra Road

UTM Location: 490350 E, 6355500 N

Site Visit Date: November 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	12.00	0.00	0.00	0.000	0.000	0.000	1.0	12.00	11.00	1.00	0.43	0.001	0.001	0.43	0.000	2%
1	10.00	1.95	0.23		0.004	0.001	1.0	11.00	9.80	1.20	1.72	0.003	0.003	2.06	0.005	29%
2	9.60	1.89	0.23		-0.004	0.009	1.0	9.80	9.35	0.45	1.66	0.003	0.003	0.75	0.002	11%
3	9.10	1.80	0.27		0.003	0.006	1.0	9.35	8.88	0.48	1.53	0.005	0.005	0.73	0.003	18%
4	8.65	1.80	0.27		0.001	0.006	1.0	8.88	8.43	0.45	1.53	0.004	0.004	0.69	0.002	14%
5	8.20	1.70	0.30		-0.001	0.002	1.0	8.43	7.93	0.50	1.40	0.001	0.001	0.70	0.000	2%
6	7.65	1.50	0.30		0.006	0.004	1.0	7.93	7.40	0.52	1.20	0.005	0.005	0.63	0.003	18%
7	7.15	1.30	0.30		0.003	-0.005	1.0	7.40	6.93	0.48	1.00	-0.001	-0.001	0.48	0.000	-3%
8	6.70	0.80	0.27	0.004			0.9	6.93	6.45	0.48	0.53	0.004	0.004	0.25	0.001	5%
9	6.20	0.65	0.25	-0.002			0.9	6.45	5.95	0.50	0.40	-0.002	-0.002	0.20	0.000	-2%
10	5.70	0.70	0.23	0.002			0.9	5.95	4.60	1.35	0.47	0.002	0.002	0.63	0.001	6%
LB	3.50	0.00	0.00	0.000	0.000	0.000	1.0	4.60	3.50	1.10	0.12	0.001	0.001	0.13	0.000	0%
Total Flow														0.018		

Measurement Details:

Start Time (MST):	12:50
End Time (MST):	14:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Overcast, 6C

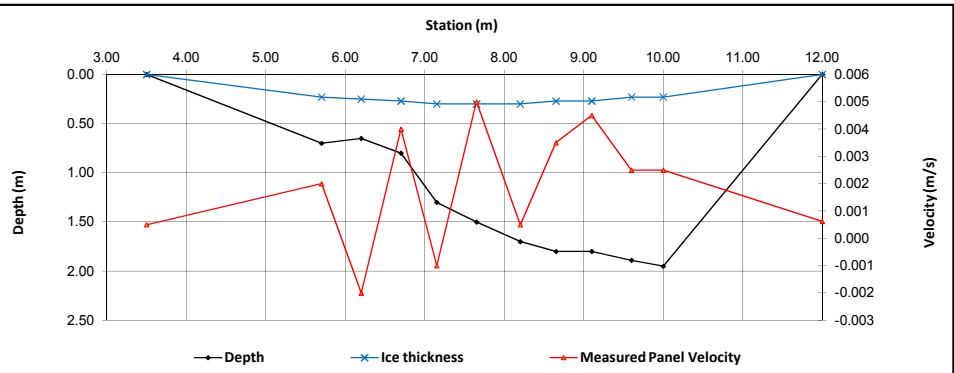
Flow characteristics:

Total Flow:	0.018	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	7.68	(m ²)
Wetted Width:	6.40	(m)
Hydraulic Depth:	1.199	(m)
Mean Velocity:	0.002	(m/s)
Froude Number:	0.001	

Datalogger Details:

	Before	After
Transducer Reading:		1.561
Battery (Main):	13.29	
Battery (Aux):	-	
Datalogger Clock:	12:56	
Laptop Clock:	12:56	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	4.10	
Memory Used:	-	
Dessicant:	good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree	1.070	100.721	1.056	100.721	-
Bench Mark 2:	Rebar in PVC pipe	1.359	100.657	1.344	100.657	-
Top of Ice:		1.564	100.227	1.548	100.229	100.228
Water Level:		1.609	100.407	1.594	100.407	100.407
Transducer Reading:		1.561	98.846	1.561	98.846	98.846
Other:						

General Notes:

Drilled 10 holes in middle of river; no distinct velocities measured (i.e. >0.01m/s), hence further drilling and measuring stopped. Note that there was essentially no flow during most of the open-water period due to beaver activity in area.

Field Personnel:	SM, DB	Trip Date:	27-Nov-11
Data Entry Personnel:	DW	Date:	18-Jan-12
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: February 14, 2011



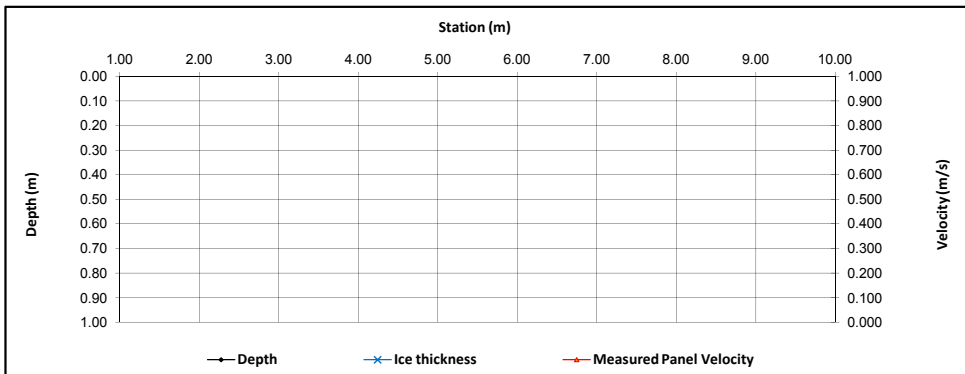
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	16:20
End Time (MST):	16:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Partly cloudy

Flow characteristics:	
Total Flow:	(m ³ /s)
Perceived Measurement Quality:	-
Cross Section Area:	0.00 (m ²)
Wetted Width:	0.00 (m)
Hydraulic Depth:	- (m)
Mean Velocity:	- (m/s)
Froude Number:	-

Datalogger Details:	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 No Datalogger installed in Winter



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake		242.081		242.081	-
Bench Mark 2:	Rebar w/flagging		242.382		242.382	-
Top of Ice:						
Water Level:			242.081		242.081	242.081
Transducer Reading:						
Other:						

General Notes:
 Drilled three holes - dry. One hole had some slush.

Field Personnel:	SG, BL	Trip Date:	14-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: March 10, 2011



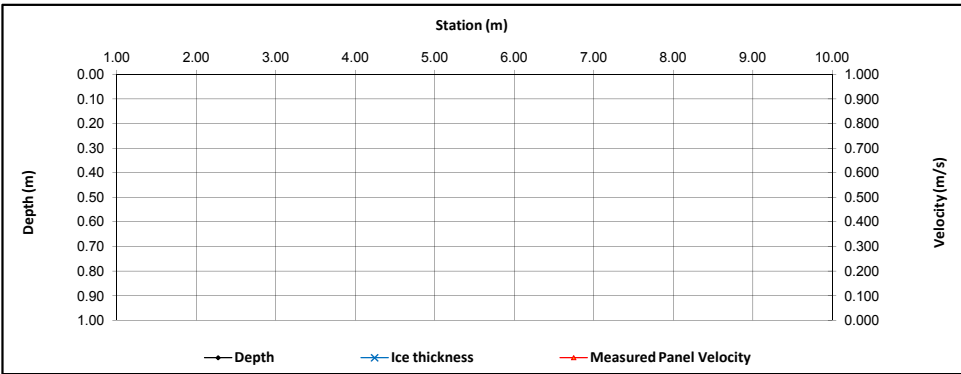
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:	
Start Time (MST):	16:10
End Time (MST):	16:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Light snow, -17 °C

Flow characteristics:		
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 No Datalogger installed in Winter



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake		242.081		242.081	-
Bench Mark 2:	Rebar w/flagging		242.382		242.382	-
Top of Ice:						
Water Level:			242.081		242.081	242.081
Transducer Reading:						
Other:						

General Notes:
 Drilled two holes - dry. Layer of water half way in ice column - filling in hole and draining.

Field Personnel:	GB, PL	Trip Date:	10-Mar-11
Data Entry Personnel:	CM	Date:	21-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: April 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	3.10	0.00	0.00	0.000	0.000	0.000	1.0	3.10	3.15	0.05	0.03	0.002	0.002	0.00	0.000	0%
1	3.20	0.10		0.006			1.0	3.15	3.35	0.20	0.10	0.006	0.006	0.02	0.000	0%
2	3.50	0.20		0.298			1.0	3.35	3.65	0.30	0.20	0.298	0.298	0.06	0.018	3%
3	3.80	0.30		0.173			1.0	3.65	3.95	0.30	0.30	0.173	0.173	0.09	0.016	2%
4	4.10	0.18		0.476			1.0	3.95	4.25	0.30	0.18	0.476	0.476	0.05	0.026	4%
5	4.40	0.28		0.247			1.0	4.25	4.55	0.30	0.28	0.247	0.247	0.08	0.021	3%
6	4.70	0.20		0.600			1.0	4.55	4.85	0.30	0.20	0.600	0.600	0.06	0.036	6%
7	5.00	0.30		0.430			1.0	4.85	5.15	0.30	0.30	0.430	0.430	0.09	0.039	6%
8	5.30	0.29		0.484			1.0	5.15	5.45	0.30	0.29	0.484	0.484	0.09	0.042	7%
9	5.60	0.30		0.447			1.0	5.45	5.75	0.30	0.30	0.447	0.447	0.09	0.040	6%
10	5.90	0.30		0.365			1.0	5.75	6.05	0.30	0.30	0.365	0.365	0.09	0.033	5%
11	6.20	0.31		0.355			1.0	6.05	6.35	0.30	0.31	0.355	0.355	0.09	0.033	5%
12	6.50	0.35		0.356			1.0	6.35	6.65	0.30	0.35	0.356	0.356	0.11	0.037	6%
13	6.80	0.40		0.461			1.0	6.65	6.95	0.30	0.40	0.461	0.461	0.12	0.055	9%
14	7.10	0.38		0.592			1.0	6.95	7.25	0.30	0.38	0.592	0.592	0.11	0.067	11%
15	7.40	0.38		0.643			1.0	7.25	7.55	0.30	0.38	0.643	0.643	0.11	0.073	12%
16	7.70	0.33		0.495			1.0	7.55	7.85	0.30	0.33	0.495	0.495	0.10	0.049	8%
17	8.00	0.30		0.387			1.0	7.85	8.15	0.30	0.30	0.387	0.387	0.09	0.035	5%
18	8.30	0.20		0.245			1.0	8.15	8.45	0.30	0.20	0.245	0.245	0.06	0.015	2%
19	8.60	0.06		0.006			1.0	8.45	8.75	0.30	0.06	0.006	0.006	0.02	0.000	0%
20	8.90	0.05		0.000			1.0	8.75	8.93	0.18	0.05	0.000	0.000	0.01	0.000	0%
Right	8.95	0.00	0.00	0.000	0.000	0.000	1.0	8.93	8.95	0.02	0.01	0.000	0.000	0.00	0.000	0%
Total Flow														0.635		

Measurement Details:

Start Time (MST):	14:00
End Time (MST):	14:20
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Clear, 11 °C

Flow characteristics:

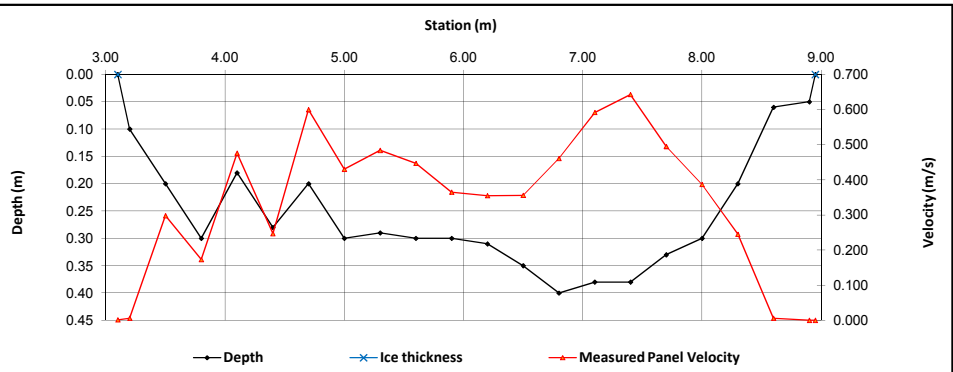
Total Flow:	0.635	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.55	(m ²)
Wetted Width:	5.85	(m)
Hydraulic Depth:	0.265	(m)
Mean Velocity:	0.410	(m/s)
Froude Number:	0.255	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

No Datalogger installed in Winter



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	0.610	242.081	0.575	242.081	-
Bench Mark 2:	Rebar w/flagging	0.342	242.382	0.302	242.382	-
Top of Ice:						
Water Level:		1.795	240.896	1.760	240.896	240.896
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	5-Apr-11
Data Entry Personnel:	CM	Date:	6-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: April 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	16.40	0.00	0.00	0.000	0.000	0.000	1.0	16.40	16.25	0.15	0.07	0.013	0.013	0.01	0.000	0%
1	16.10	0.28		0.050			1.0	16.25	15.95	0.30	0.28	0.050	0.050	0.08	0.004	0%
2	15.80	0.28		0.747			1.0	15.95	15.65	0.30	0.28	0.747	0.747	0.08	0.063	4%
3	15.50	0.31		0.878			1.0	15.65	15.35	0.30	0.31	0.878	0.878	0.09	0.082	5%
4	15.20	0.42		0.886			1.0	15.35	15.05	0.30	0.42	0.886	0.886	0.13	0.112	6%
5	14.90	0.46		0.686			1.0	15.05	14.75	0.30	0.46	0.686	0.686	0.14	0.095	5%
6	14.60	0.48		0.615			1.0	14.75	14.45	0.30	0.48	0.615	0.615	0.14	0.089	5%
7	14.30	0.42		0.360			1.0	14.45	14.15	0.30	0.42	0.360	0.360	0.13	0.045	3%
8	14.00	0.49		0.810			1.0	14.15	13.85	0.30	0.49	0.810	0.810	0.15	0.119	7%
9	13.70	0.54		0.783			1.0	13.85	13.55	0.30	0.54	0.783	0.783	0.16	0.127	7%
10	13.40	0.62		0.607			1.0	13.55	13.25	0.30	0.62	0.607	0.607	0.19	0.113	7%
11	13.10	0.55		0.771			1.0	13.25	12.95	0.30	0.55	0.771	0.771	0.17	0.127	7%
12	12.80	0.58		0.825			1.0	12.95	12.65	0.30	0.58	0.825	0.825	0.17	0.144	8%
13	12.50	0.56		0.711			1.0	12.65	12.35	0.30	0.56	0.711	0.711	0.17	0.119	7%
14	12.20	0.58		0.824			1.0	12.35	12.05	0.30	0.58	0.824	0.824	0.17	0.143	8%
15	11.90	0.60		0.800			1.0	12.05	11.75	0.30	0.60	0.800	0.800	0.18	0.144	8%
16	11.60	0.60		0.589			1.0	11.75	11.45	0.30	0.60	0.589	0.589	0.18	0.106	6%
17	11.30	0.51		0.572			1.0	11.45	11.15	0.30	0.51	0.572	0.572	0.15	0.088	5%
18	11.00	0.38		0.061			1.0	11.15	10.85	0.30	0.38	0.061	0.061	0.11	0.007	0%
19	10.70	0.22		0.169			1.0	10.85	10.60	0.25	0.22	0.169	0.169	0.06	0.009	1%
Right	10.50	0.00	0.00	0.000	0.000	0.000	1.0	10.60	10.50	0.10	0.06	0.042	0.042	0.01	0.000	0%
Total Flow															1.735	

Measurement Details:

Start Time (MST):	13:30
End Time (MST):	14:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, 10°C

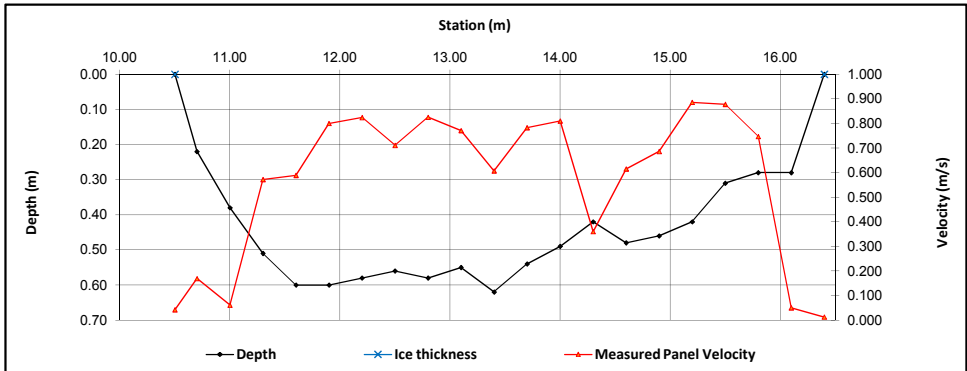
Flow characteristics:

Total Flow:	1.735	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	2.67	(m ²)
Wetted Width:	5.65	(m)
Hydraulic Depth:	0.472	(m)
Mean Velocity:	0.650	(m/s)
Froude Number:	0.302	

Datalogger Details:

	Before	After
Transducer Reading:		0.358
Battery (Main):	11.34	
Battery (Aux):	13.50	
Datalogger Clock:	14:39	
Laptop Clock:	14:39	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	5.31	
Memory Used:	0%	
Dessicant:	New	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	1.232	242.081	1.216	242.081	-
Bench Mark 2:	Rebar w/flagging	0.964	242.382	0.948	242.382	-
Top of Ice:						
Water Level:		2.248	241.065	2.228	241.069	241.067
Transducer Reading:		0.358	240.707	0.358	240.711	240.709
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	26-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: June 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TR	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	0.60	0.60	0.06	0.051	0.051	0.04	0.002	1%
1	1.20	0.24		0.204			1.0	0.60	1.33	0.72	0.24	0.204	0.204	0.17	0.035	13%
2	1.45	0.18		0.291			1.0	1.33	1.58	0.25	0.18	0.291	0.291	0.05	0.013	5%
3	1.70	0.30		0.301			1.0	1.58	1.83	0.25	0.30	0.301	0.301	0.08	0.023	8%
4	1.95	0.29		0.281			1.0	1.83	2.08	0.25	0.29	0.281	0.281	0.07	0.020	8%
5	2.20	0.28		0.324			1.0	2.08	2.33	0.25	0.28	0.324	0.324	0.07	0.023	8%
6	2.45	0.24		0.245			1.0	2.33	2.58	0.25	0.24	0.245	0.245	0.06	0.015	5%
7	2.70	0.28		0.200			1.0	2.58	2.83	0.25	0.28	0.200	0.200	0.07	0.014	5%
8	2.95	0.28		0.329			1.0	2.83	3.08	0.25	0.28	0.329	0.329	0.07	0.023	9%
9	3.20	0.22		0.308			1.0	3.08	3.33	0.25	0.22	0.308	0.308	0.06	0.017	6%
10	3.45	0.24		0.169			1.0	3.33	3.58	0.25	0.24	0.169	0.169	0.06	0.010	4%
11	3.70	0.28		0.224			1.0	3.58	3.83	0.25	0.28	0.224	0.224	0.07	0.016	6%
12	3.95	0.30		0.193			1.0	3.83	4.08	0.25	0.30	0.193	0.193	0.08	0.014	5%
13	4.20	0.23		0.048			1.0	4.08	4.33	0.25	0.23	0.048	0.048	0.06	0.003	1%
14	4.45	0.20		0.216			1.0	4.33	4.58	0.25	0.20	0.216	0.216	0.05	0.011	4%
15	4.70	0.22		0.224			1.0	4.58	4.83	0.25	0.22	0.224	0.224	0.06	0.012	5%
16	4.95	0.22		0.222			1.0	4.83	5.08	0.25	0.22	0.222	0.222	0.06	0.012	5%
17	5.20	0.20		0.081			1.0	5.08	5.33	0.25	0.20	0.081	0.081	0.05	0.004	2%
18	5.45	0.13		0.022			1.0	5.33	5.58	0.25	0.13	0.022	0.022	0.03	0.001	0%
19	5.70	0.11		-0.003			1.0	5.58	5.75	0.18	0.11	-0.003	-0.003	0.02	0.000	0%
Right	5.80	0.00	0.00	0.000	0.000	0.000	1.0	5.75	5.80	0.05	0.03	-0.001	-0.001	0.00	0.000	0%
Total Flow															0.268	

Measurement Details:

Start Time (MST):	14:30
End Time (MST):	15:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Smoke, 25 deg C

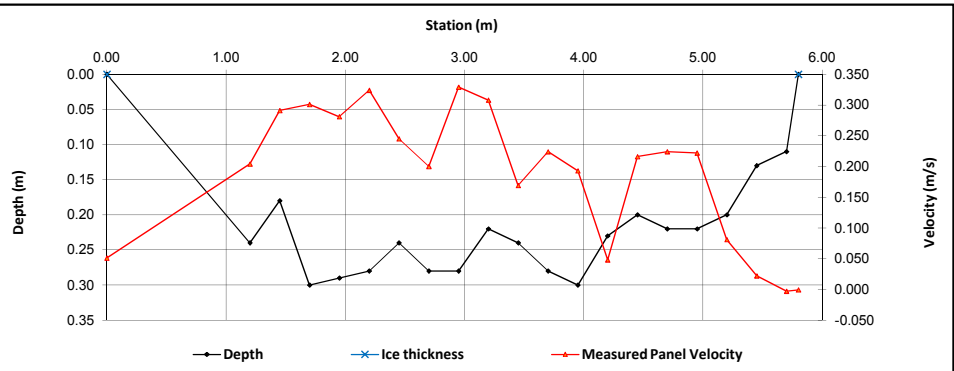
Flow characteristics:

Total Flow:	0.268	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.25	(m ²)
Wetted Width:	5.80	(m)
Hydraulic Depth:	0.216	(m)
Mean Velocity:	0.214	(m/s)
Froude Number:	0.147	

Datalogger Details:

	Before	After
Transducer Reading:		0.182
Battery (Main):	100%	
Battery (Aux):	85%	
Datalogger Clock:	13:34	
Laptop Clock:	13:35	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	17.43	
Memory Used:	42%	
Dessicant:	New	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	0.656	242.081	0.649	242.081	-
Bench Mark 2:	Rebar w/flagging	0.366	242.382	0.358	242.382	-
Top of Ice:						
Water Level:		1.843	240.894	1.831	240.899	240.897
Transducer Reading:		0.182	240.712	0.182	240.717	240.715
Other:						

General Notes:

Field Personnel:	JO, SM	Trip Date:	14-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	25-Jun-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: August 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.25	0.00	0.00	0.000	0.000	0.000	1.0	3.25	3.38	0.13	0.07	0.024	0.024	0.01	0.000	0%
1	3.50	0.26		0.095			1.0	3.38	3.63	0.25	0.26	0.095	0.095	0.07	0.006	2%
2	3.75	0.34		-0.002			1.0	3.63	3.88	0.25	0.34	-0.002	-0.002	0.09	0.000	0%
3	4.00	0.40		0.039			1.0	3.88	4.13	0.25	0.40	0.039	0.039	0.10	0.004	1%
4	4.25	0.34		0.451			1.0	4.13	4.38	0.25	0.34	0.451	0.451	0.09	0.038	12%
5	4.50	0.32		0.376			1.0	4.38	4.63	0.25	0.32	0.376	0.376	0.08	0.030	9%
6	4.75	0.31		0.367			1.0	4.63	4.88	0.25	0.31	0.367	0.367	0.08	0.028	9%
7	5.00	0.31		0.375			1.0	4.88	5.13	0.25	0.31	0.375	0.375	0.08	0.029	9%
8	5.25	0.28		0.281			1.0	5.13	5.38	0.25	0.28	0.281	0.281	0.07	0.020	6%
9	5.50	0.24		0.270			1.0	5.38	5.63	0.25	0.24	0.270	0.270	0.06	0.016	5%
10	5.75	0.27		0.340			1.0	5.63	5.88	0.25	0.27	0.340	0.340	0.07	0.023	7%
11	6.00	0.24		0.422			1.0	5.88	6.13	0.25	0.24	0.422	0.422	0.06	0.025	8%
12	6.25	0.29		0.425			1.0	6.13	6.38	0.25	0.29	0.425	0.425	0.07	0.031	9%
13	6.50	0.29		0.129			1.0	6.38	6.63	0.25	0.29	0.129	0.129	0.07	0.009	3%
14	6.75	0.30		0.139			1.0	6.63	6.88	0.25	0.30	0.139	0.139	0.08	0.010	3%
15	7.00	0.22		0.366			1.0	6.88	7.13	0.25	0.22	0.366	0.366	0.06	0.020	6%
16	7.25	0.24		0.255			1.0	7.13	7.38	0.25	0.24	0.255	0.255	0.06	0.015	5%
17	7.50	0.20		0.319			1.0	7.38	7.63	0.25	0.20	0.319	0.319	0.05	0.016	5%
18	7.75	0.27		0.142			1.0	7.63	7.88	0.25	0.27	0.142	0.142	0.07	0.010	3%
19	8.00	0.20		0.032			1.0	7.88	8.10	0.23	0.20	0.032	0.032	0.04	0.001	0%
20	8.20	0.19		0.000			1.0	8.10	8.25	0.15	0.19	0.000	0.000	0.03	0.000	0%
LB	8.30	0.00	0.00	0.000	0.000	0.000	1.0	8.25	8.30	0.05	0.05	0.000	0.000	0.00	0.000	0%
Total Flow														0.333		

Measurement Details:

Start Time (MST):	15:20
End Time (MST):	16:20
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Sunny, 17°C

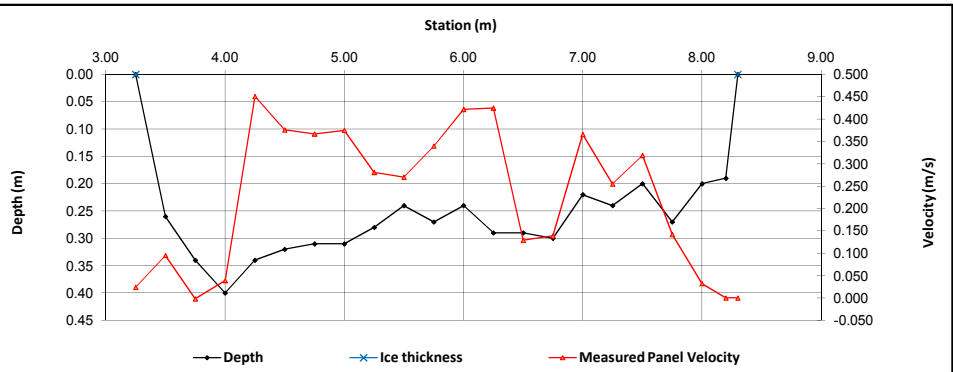
Flow characteristics:

Total Flow:	0.333	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.36	(m ²)
Wetted Width:	5.05	(m)
Hydraulic Depth:	0.270	(m)
Mean Velocity:	0.244	(m/s)
Froude Number:	0.150	

Datalogger Details:

	Before	After
Transducer Reading:		0.215
Battery (Main):	11.34	
Battery (Aux):	12.90	
Datalogger Clock:	15:22	
Laptop Clock:	15:24	
Air Temperature °C:	17	
Air Pressure:	-	
RH:	-	
Water °C:	17.83	
Memory Used:	66%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	1.236	242.081	1.149	242.081	-
Bench Mark 2:	Rebar w/flagging	0.945	242.382	0.858	242.382	-
Top of Ice:						
Water Level:		2.410	240.907	2.325	240.905	240.906
Transducer Reading:		0.215	240.692	0.215	240.690	240.691
Other:						

General Notes:

Field Personnel:	DB, KW	Trip Date:	18-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	SG	Date:	28-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: September 22, 2011



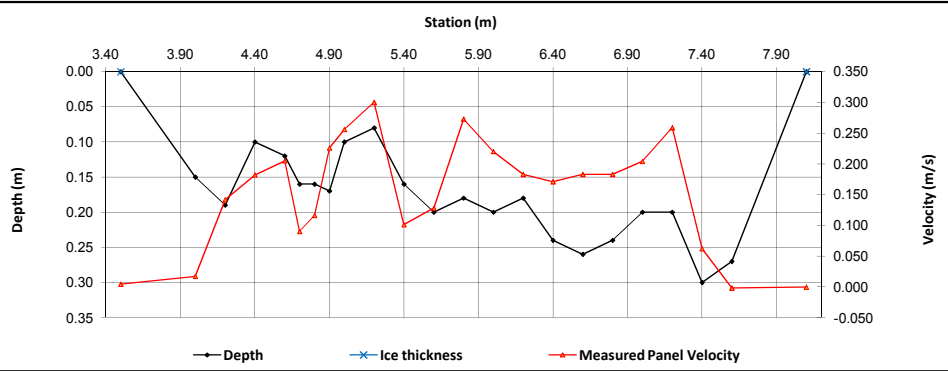
Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.50	3.75	0.25	0.04	0.004	0.004	0.01	0.000	0%
1	4.00	0.15		0.017			1.0	3.75	4.10	0.35	0.15	0.017	0.017	0.05	0.001	1%
2	4.20	0.19		0.142			1.0	4.10	4.30	0.20	0.19	0.142	0.142	0.04	0.005	5%
3	4.40	0.10		0.182			1.0	4.30	4.50	0.20	0.10	0.182	0.182	0.02	0.004	3%
4	4.60	0.12		0.205			1.0	4.50	4.65	0.15	0.12	0.205	0.205	0.02	0.004	3%
5	4.70	0.16		0.090			1.0	4.65	4.75	0.10	0.16	0.090	0.090	0.02	0.001	1%
6	4.80	0.16		0.116			1.0	4.75	4.85	0.10	0.16	0.116	0.116	0.02	0.002	2%
7	4.90	0.17		0.226			1.0	4.85	4.95	0.10	0.17	0.226	0.226	0.02	0.004	3%
8	5.00	0.10		0.256			1.0	4.95	5.10	0.15	0.10	0.256	0.256	0.01	0.004	3%
9	5.20	0.08		0.300			1.0	5.10	5.30	0.20	0.08	0.300	0.300	0.02	0.005	4%
10	5.40	0.16		0.101			1.0	5.30	5.50	0.20	0.16	0.101	0.101	0.03	0.003	3%
11	5.60	0.20		0.128			1.0	5.50	5.70	0.20	0.20	0.128	0.128	0.04	0.005	5%
12	5.80	0.18		0.273			1.0	5.70	5.90	0.20	0.18	0.273	0.273	0.04	0.010	9%
13	6.00	0.20		0.220			1.0	5.90	6.10	0.20	0.20	0.220	0.220	0.04	0.009	8%
14	6.20	0.18		0.183			1.0	6.10	6.30	0.20	0.18	0.183	0.183	0.04	0.007	6%
15	6.40	0.24		0.171			1.0	6.30	6.50	0.20	0.24	0.171	0.171	0.05	0.008	7%
16	6.60	0.26		0.183			1.0	6.50	6.70	0.20	0.26	0.183	0.183	0.05	0.010	9%
17	6.80	0.24		0.183			1.0	6.70	6.90	0.20	0.24	0.183	0.183	0.05	0.009	8%
18	7.00	0.20		0.204			1.0	6.90	7.10	0.20	0.20	0.204	0.204	0.04	0.008	7%
19	7.20	0.20		0.259			1.0	7.10	7.30	0.20	0.20	0.259	0.259	0.04	0.010	9%
20	7.40	0.30		0.062			1.0	7.30	7.50	0.20	0.30	0.062	0.062	0.06	0.004	3%
21	7.60	0.27		-0.002			1.0	7.50	7.85	0.35	0.27	-0.002	-0.002	0.09	0.000	0%
RB	8.10	0.00	0.00	0.000	0.000	0.000	1.0	7.75	8.10	0.35	0.08	-0.001	-0.001	0.03	0.000	0%
Total Flow															0.112	

Measurement Details:	
Start Time (MST):	17:23
End Time (MST):	18:11
Equipment:	ADV
Method:	Wading
River Condition:	low flow, open
Quality/Error (see reverse):	Good
Weather:	-

Flow characteristics:	
Total Flow:	0.112 (m ³ /s)
Perceived Measurement Quality:	Good
Cross Section Area:	0.81 (m ²)
Wetted Width:	4.60 (m)
Hydraulic Depth:	0.176 (m)
Mean Velocity:	0.138 (m/s)
Froude Number:	0.105

Datalogger Details:		Before	After
Transducer Reading:			0.152
Battery (Main):		11.34	
Battery (Aux):		12.27	
Datalogger Clock:		-	
Laptop Clock:		-	
Air Temperature °C:		-	
Air Pressure:		-	
RH:		-	
Water °C:		13.08	
Memory Used:		80%	
Dessicant:		replaced	
Logger# (if Δ):			
PT# (if Δ):			



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	0.644	242.081	0.627	242.081	-
Bench Mark 2:	Rebar w/flagging	0.352	242.382	0.335	242.382	-
Top of Ice:						
Water Level:		1.893	240.832	1.877	240.831	240.832
Transducer Reading:		0.152	240.680	0.152	240.679	240.680
Other:						

General Notes:

Datalogger / Station Notes:

Field Personnel:	SM, GB	Trip Date:	22-Sep-11
Data Entry Personnel:	tk	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: November 4, 2011



Flow Measurement:

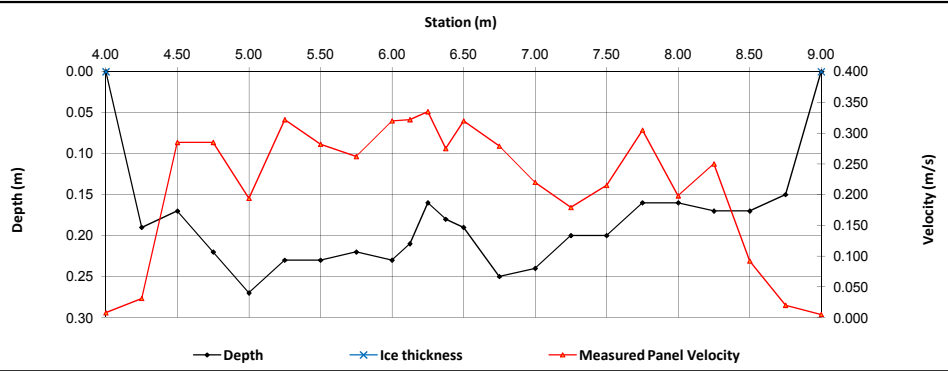
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
R	4.00	0.00	0.00	0.000	0.000	0.000	1.0	4.00	4.13	0.13	0.05	0.008	0.008	0.01	0.000	0%
1	4.25	0.19		0.031			1.0	4.13	4.38	0.25	0.19	0.031	0.031	0.05	0.001	1%
2	4.50	0.17		0.285			1.0	4.38	4.63	0.25	0.17	0.285	0.285	0.04	0.012	5%
3	4.75	0.22		0.285			1.0	4.63	4.88	0.25	0.22	0.285	0.285	0.06	0.016	7%
4	5.00	0.27		0.194			1.0	4.88	5.13	0.25	0.27	0.194	0.194	0.07	0.013	6%
5	5.25	0.23		0.322			1.0	5.13	5.38	0.25	0.23	0.322	0.322	0.06	0.019	8%
6	5.50	0.23		0.282			1.0	5.38	5.63	0.25	0.23	0.282	0.282	0.06	0.016	7%
7	5.75	0.22		0.262			1.0	5.63	5.88	0.25	0.22	0.262	0.262	0.06	0.014	6%
8	6.00	0.23		0.320			1.0	5.88	6.06	0.19	0.23	0.320	0.320	0.04	0.014	6%
9	6.13	0.21		0.322			1.0	6.06	6.19	0.13	0.21	0.322	0.322	0.03	0.008	4%
10	6.25	0.16		0.335			1.0	6.19	6.31	0.13	0.16	0.335	0.335	0.02	0.007	3%
11	6.38	0.18		0.275			1.0	6.31	6.44	0.13	0.18	0.275	0.275	0.02	0.006	3%
12	6.50	0.19		0.320			1.0	6.44	6.63	0.19	0.19	0.320	0.320	0.04	0.011	5%
13	6.75	0.25		0.279			1.0	6.63	6.88	0.25	0.25	0.279	0.279	0.06	0.017	8%
14	7.00	0.24		0.220			1.0	6.88	7.13	0.25	0.24	0.220	0.220	0.06	0.013	6%
15	7.25	0.20		0.179			1.0	7.13	7.38	0.25	0.20	0.179	0.179	0.05	0.009	4%
16	7.50	0.20		0.215			1.0	7.38	7.63	0.25	0.20	0.215	0.215	0.05	0.011	5%
17	7.75	0.16		0.305			1.0	7.63	7.88	0.25	0.16	0.305	0.305	0.04	0.012	5%
18	8.00	0.16		0.198			1.0	7.88	8.13	0.25	0.16	0.198	0.198	0.04	0.008	4%
19	8.25	0.17		0.250			1.0	8.13	8.38	0.25	0.17	0.250	0.250	0.04	0.011	5%
	8.50	0.17		0.092			1.0	8.38	8.63	0.25	0.17	0.092	0.092	0.04	0.004	2%
	8.75	0.15		0.020			1.0	8.63	8.88	0.25	0.15	0.020	0.020	0.04	0.001	0%
L	9.00	0.00	0.00	0.000	0.000	0.000	1.0	8.88	9.00	0.13	0.04	0.005	0.005	0.00	0.000	0%
Total Flow															0.224	

Measurement Details:	
Start Time (MST):	15:00
End Time (MST):	15:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Clear, -6 C

Flow characteristics:		
Total Flow:	0.224	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.97	(m ²)
Wetted Width:	5.00	(m)
Hydraulic Depth:	0.193	(m)
Mean Velocity:	0.232	(m/s)
Froude Number:	0.169	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	100%	0.157
Battery (Aux):	78%	
Datalogger Clock:	15:06	
Laptop Clock:	15:07	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.57	
Memory Used:	25%	
Dessicant:	not replaced	
Logger# (if Δ):	Removed	
PT# (if Δ):		

Datalogger / Station Notes:
 Installed rope for threading new transducer in the spring.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	1.117	242.081	1.099	242.081	-
Bench Mark 2:	Rebar w/flagging	0.824	242.382	0.805	242.382	-
Top of Ice:						
Water Level:		2.354	240.844	2.335	240.845	240.845
Transducer Reading:		0.157	240.687	0.157	240.688	240.688
Other:						

General Notes:
 Removed lakewood and pt
 BM1: 0.19m

Field Personnel:	SM, GB	Trip Date:	4-Nov-11
Data Entry Personnel:	DW	Date:	15-Nov-11
Data Check Personnel:	VS	Date:	23-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S11 - Poplar Creek at Hwy 63
 UTM Location: 472000 E, 6307650 N

Site Visit Date: December 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	8:15
End Time (MST):	8:35
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Overcast, Calm, -10

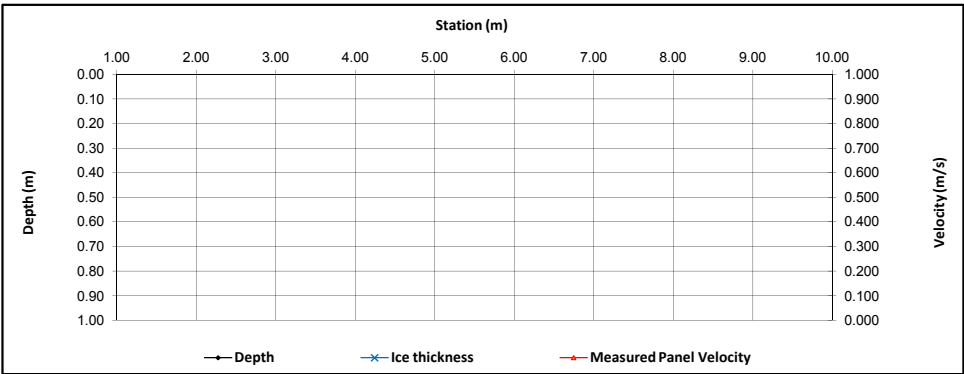
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	ASCM sq. pin nxt to stake	0.733	242.081	0.726	242.081	-
Bench Mark 2:	Rebar w/flagging	0.447	242.382	0.440	242.382	-
Top of Ice:		1.949	240.865	1.942	240.865	240.865
Water Level:		2.067	240.747	2.062	240.745	240.746
Transducer Reading:						
Other:						

General Notes:

Flow was not measured. Holes were drilled in ice but flow was not located. Flow was audible.

Field Personnel:	SM, SG	Trip Date:	5-Dec-11
Data Entry Personnel:	DW	Date:	3-Jan-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S12 - Fort Creek at Highway 63
 UTM Location: 462600 E, 6363400 N

Site Visit Date: April 20, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.60	0.00		0.000	0.000	0.000	1.0	0.60	0.68	0.08	0.01	0.005	0.005	0.00	0.000	0%
1	0.75	0.04		0.020			1.0	0.68	0.83	0.15	0.04	0.020	0.020	0.01	0.000	0%
2	0.90	0.04		0.187			1.0	0.83	0.95	0.13	0.04	0.187	0.187	0.01	0.001	0%
3	1.00	0.08		0.319			1.0	0.95	1.03	0.08	0.08	0.319	0.319	0.01	0.002	1%
4	1.05	0.09		0.263			1.0	1.03	1.13	0.10	0.09	0.263	0.263	0.01	0.002	1%
5	1.20	0.10		0.395			1.0	1.13	1.28	0.15	0.10	0.395	0.395	0.02	0.006	3%
6	1.35	0.12		0.177			1.0	1.28	1.38	0.10	0.12	0.177	0.177	0.01	0.002	1%
7	1.40	0.14		0.414			1.0	1.38	1.45	0.08	0.14	0.414	0.414	0.01	0.004	2%
8	1.50	0.14		0.539			1.0	1.45	1.58	0.13	0.14	0.539	0.539	0.02	0.009	5%
9	1.65	0.16		0.495			1.0	1.58	1.68	0.10	0.16	0.495	0.495	0.02	0.008	4%
10	1.70	0.16		0.588			1.0	1.68	1.75	0.08	0.16	0.588	0.588	0.01	0.007	4%
11	1.80	0.16		0.541			1.0	1.75	1.88	0.13	0.16	0.541	0.541	0.02	0.011	6%
12	1.95	0.16		0.732			1.0	1.88	1.98	0.10	0.16	0.732	0.732	0.02	0.012	6%
13	2.00	0.16		0.597			1.0	1.98	2.05	0.07	0.16	0.597	0.597	0.01	0.007	4%
14	2.10	0.18		0.624			1.0	2.05	2.18	0.13	0.18	0.624	0.624	0.02	0.014	7%
15	2.25	0.18		0.625			1.0	2.18	2.28	0.10	0.18	0.625	0.625	0.02	0.011	6%
16	2.30	0.18		0.631			1.0	2.28	2.35	0.07	0.18	0.631	0.631	0.01	0.009	5%
17	2.40	0.18		0.593			1.0	2.35	2.48	0.13	0.18	0.593	0.593	0.02	0.013	7%
18	2.55	0.20		0.743			1.0	2.48	2.58	0.10	0.20	0.743	0.743	0.02	0.015	8%
19	2.60	0.18		0.757			1.0	2.58	2.65	0.08	0.18	0.757	0.757	0.01	0.010	5%
20	2.70	0.20		0.691			1.0	2.65	2.78	0.13	0.20	0.691	0.691	0.03	0.017	9%
21	2.85	0.19		0.518			1.0	2.78	2.88	0.10	0.19	0.518	0.518	0.02	0.010	5%
22	2.90	0.20		0.535			1.0	2.88	2.95	0.08	0.20	0.535	0.535	0.02	0.008	4%
23	3.00	0.20		0.284			1.0	2.95	3.08	0.13	0.20	0.284	0.284	0.03	0.007	4%
24	3.15	0.14		0.103			1.0	3.08	3.18	0.10	0.14	0.103	0.103	0.01	0.001	1%
25	3.20	0.14		0.122			1.0	3.18	3.25	0.08	0.14	0.122	0.122	0.01	0.001	1%
26	3.30	0.10		0.000			1.0	3.25	3.38	0.13	0.10	0.000	0.000	0.01	0.000	0%
Left	3.45	0.00		0.000	0.000	0.000	1.0	3.38	3.45	0.08	0.03	0.000	0.000	0.00	0.000	0%

Total Flow 0.189

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	14:00
Equipment:	-
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Clear, 8°C

Flow characteristics:

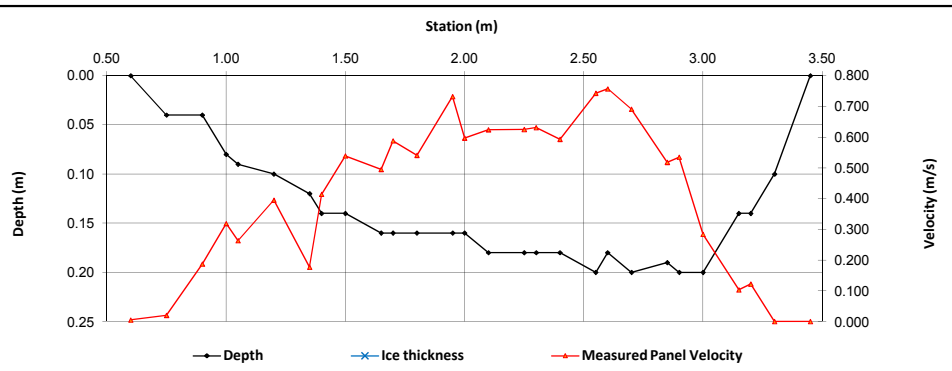
Total Flow:	0.189	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.39	(m ²)
Wetted Width:	2.85	(m)
Hydraulic Depth:	0.137	(m)
Mean Velocity:	0.484	(m/s)
Froude Number:	0.418	

Datalogger Details:

	Before	After
Transducer Reading:	-	-0.004388
Battery (Main):	12.93	
Battery (Aux):	5.44	
Datalogger Clock:	12:58	
Laptop Clock:	13:00	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	0%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):	101878	

Datalogger / Station Notes:

m:0.583989 (b1: -0.131344)



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post closest to road	1.055	98.699	1.049	98.699	-
Bench Mark 2:	Other T-post	1.060	98.702	1.052	98.702	-
Top of Ice:						
Water Level:		2.178	97.576	2.169	97.579	97.578
Transducer Reading:		-0.004	97.580	-0.004	97.583	97.582
Other:						

General Notes:

- PT S/N: 0101878 installed S44's DD400.
- Solar panel not installed due to unsuitable placement
 - 2x 20 Ah batteries placed in parallel (40 Ah total)

Field Personnel:	JO, BL	Trip Date:	20-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S12 - Fort Creek at Highway 63
 UTM Location: 462600 E, 6363400 N

Site Visit Date: June 15, 2011



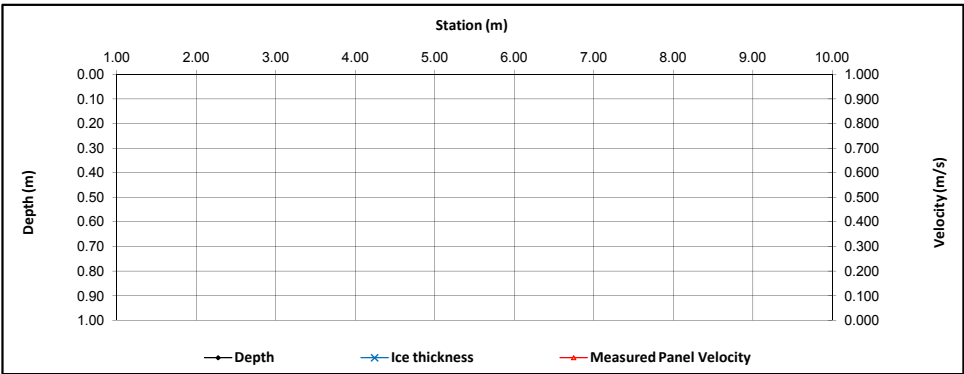
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	-
End Time (MST):	-
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	-

Flow characteristics:		
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post closest to road		98.699		98.699	-
Bench Mark 2:	Other T-post		98.702		98.702	-
Top of Ice:						
Water Level:			98.699		98.699	98.699
Transducer Reading:						
Other:						

General Notes:

Highway 63 closed due to wildfires. No access for non-fire fighting personnel and equipment.

Field Personnel:	JO, SM	Trip Date:	15-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S12 - Fort Creek at Highway 63
 UTM Location: 462600 E, 6363400 N

Site Visit Date: July 25, 2011

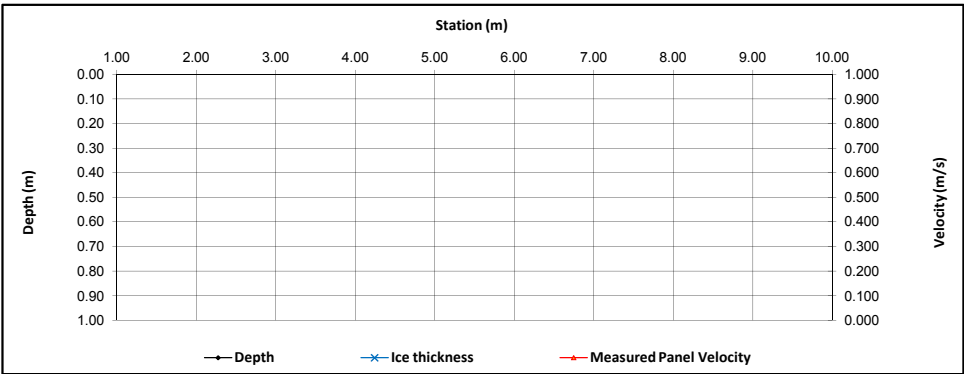


Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	16:45
End Time (MST):	17:00
Equipment:	-
Method:	-
River Condition:	Open
Quality/Error (see reverse):	-
Weather:	Overcast

Flow characteristics:		
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		0.144
Battery (Main):	12.88	
Battery (Aux):	5.44	
Datalogger Clock:	16:36	
Laptop Clock:	16:47	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	4%	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post closest to road		98.699		98.699	-
Bench Mark 2:	Other T-post		98.702		98.702	-
Top of Ice:						
Water Level:			98.699		98.699	98.699
Transducer Reading:		0.144	98.555	0.144	98.555	98.555
Other:						

General Notes:
 Purpose of visit to check on station function after recent forest fires.

Field Personnel:	JO, SM	Trip Date:	15-Jun-11
Data Entry Personnel:	DB	Date:	3-Aug-11
Data Check Personnel:	JP	Date:	26-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S12 - Fort Creek at Highway 63
 UTM Location: 462600 E, 6363400 N

Site Visit Date: August 8, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.28	0.08	0.01	-0.001	-0.001	0.00	0.000	0%
1	0.35	0.05		-0.003			1.0	0.28	0.40	0.13	0.05	-0.003	-0.003	0.01	0.000	0%
2	0.45	0.08		0.002			1.0	0.40	0.50	0.10	0.08	0.002	0.002	0.01	0.000	0%
3	0.55	0.08		0.081			1.0	0.50	0.60	0.10	0.08	0.081	0.081	0.01	0.001	1%
4	0.65	0.09		0.206			1.0	0.60	0.70	0.10	0.09	0.206	0.206	0.01	0.002	4%
5	0.75	0.09		0.353			1.0	0.70	0.80	0.10	0.09	0.353	0.353	0.01	0.003	7%
6	0.85	0.09		0.360			1.0	0.80	0.90	0.10	0.09	0.360	0.360	0.01	0.003	7%
7	0.95	0.07		0.428			1.0	0.90	1.00	0.10	0.07	0.428	0.428	0.01	0.003	7%
8	1.05	0.07		0.329			1.0	1.00	1.10	0.10	0.07	0.329	0.329	0.01	0.002	5%
9	1.15	0.07		0.255			1.0	1.10	1.20	0.10	0.07	0.255	0.255	0.01	0.002	4%
10	1.25	0.07		0.268			1.0	1.20	1.30	0.10	0.07	0.268	0.268	0.01	0.002	4%
11	1.35	0.07		0.265			1.0	1.30	1.40	0.10	0.07	0.265	0.265	0.01	0.002	4%
12	1.45	0.07		0.429			1.0	1.40	1.50	0.10	0.07	0.429	0.429	0.01	0.003	7%
13	1.55	0.07		0.449			1.0	1.50	1.60	0.10	0.07	0.449	0.449	0.01	0.003	7%
14	1.65	0.07		0.508			1.0	1.60	1.70	0.10	0.07	0.508	0.508	0.01	0.004	8%
15	1.75	0.09		0.336			1.0	1.70	1.80	0.10	0.09	0.336	0.336	0.01	0.003	7%
16	1.85	0.11		0.120			1.0	1.80	1.90	0.10	0.11	0.120	0.120	0.01	0.001	3%
17	1.95	0.13		0.086			1.0	1.90	2.00	0.10	0.13	0.086	0.086	0.01	0.001	3%
18	2.05	0.11		0.331			1.0	2.00	2.10	0.10	0.11	0.331	0.331	0.01	0.004	8%
19	2.15	0.07		0.290			1.0	2.10	2.20	0.10	0.07	0.290	0.290	0.01	0.002	5%
20	2.25	0.05		0.467			1.0	2.20	2.33	0.13	0.05	0.467	0.467	0.01	0.003	7%
RB	2.40	0.00	0.00	0.000	0.000	0.000	1.0	2.33	2.40	0.07	0.01	0.117	0.117	0.00	0.000	0%
Total Flow														0.044		

Measurement Details:

Start Time (MST):	13:30
End Time (MST):	14:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Thunderstorms

Flow characteristics:

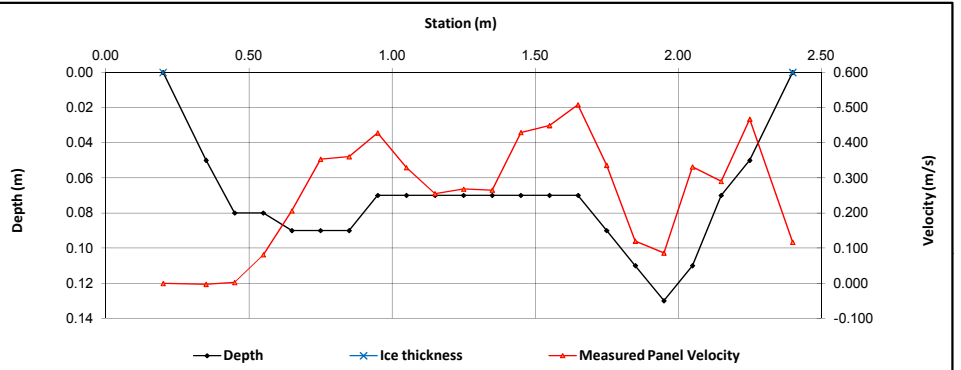
Total Flow:	0.044	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.16	(m ²)
Wetted Width:	2.20	(m)
Hydraulic Depth:	0.075	(m)
Mean Velocity:	0.265	(m/s)
Froude Number:	0.310	

Datalogger Details:

	Before	After
Transducer Reading:	0.0732	0.098
Battery (Main):	12.87	12.79
Battery (Aux):	-	-
Datalogger Clock:	13:22	14:03
Laptop Clock:	13:35	14:03
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	18.7
Memory Used:	4%	-
Dessicant:	Replaced	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:

Installed CR800 datalogger



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post closest to road	0.789	98.699	0.752	98.699	-
Bench Mark 2:	Other	1.182	98.702	1.165	98.702	-
Top of Ice:						
Water Level:		2.090	97.398	2.075	97.376	97.387
Transducer Reading:		0.098	97.300	0.098	97.278	97.289
Other:						

General Notes:

New station installed

Field Personnel:	SG, SM	Trip Date:	8-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S12 - Fort Creek at Highway 63
 UTM Location: 462600 E, 6363400 N

Site Visit Date: September 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	0.10	0.00	0.00	0.000	0.000	0.000	1.0	0.10	0.20	0.10	0.03	-0.003	-0.003	0.00	0.000	0%
1	0.30	0.10		-0.011			1.0	0.20	0.35	0.15	0.10	-0.011	-0.011	0.02	0.000	0%
2	0.40	0.10		0.071			1.0	0.35	0.45	0.10	0.10	0.071	0.071	0.01	0.001	1%
3	0.50	0.10		0.262			1.0	0.45	0.55	0.10	0.10	0.262	0.262	0.01	0.003	4%
4	0.60	0.10		0.219			1.0	0.55	0.65	0.10	0.10	0.219	0.219	0.01	0.002	3%
5	0.70	0.10		0.370			1.0	0.65	0.75	0.10	0.10	0.370	0.370	0.01	0.004	5%
6	0.80	0.10		0.448			1.0	0.75	0.85	0.10	0.10	0.448	0.448	0.01	0.004	6%
7	0.90	0.09		0.514			1.0	0.85	0.95	0.10	0.09	0.514	0.514	0.01	0.005	6%
8	1.00	0.08		0.445			1.0	0.95	1.05	0.10	0.08	0.445	0.445	0.01	0.004	5%
9	1.10	0.08		0.352			1.0	1.05	1.15	0.10	0.08	0.352	0.352	0.01	0.003	4%
10	1.20	0.08		0.303			1.0	1.15	1.25	0.10	0.08	0.303	0.303	0.01	0.002	3%
11	1.30	0.08		0.415			1.0	1.25	1.35	0.10	0.08	0.415	0.415	0.01	0.003	5%
12	1.40	0.07		0.481			1.0	1.35	1.45	0.10	0.07	0.481	0.481	0.01	0.003	5%
13	1.50	0.08		0.528			1.0	1.45	1.55	0.10	0.08	0.528	0.528	0.01	0.004	6%
14	1.60	0.10		0.350			1.0	1.55	1.65	0.10	0.10	0.350	0.350	0.01	0.004	5%
15	1.70	0.10		0.491			1.0	1.65	1.75	0.10	0.10	0.491	0.491	0.01	0.005	7%
16	1.80	0.10		0.449			1.0	1.75	1.85	0.10	0.10	0.449	0.449	0.01	0.004	6%
17	1.90	0.14		0.401			1.0	1.85	1.95	0.10	0.14	0.401	0.401	0.01	0.006	8%
18	2.00	0.12		0.391			1.0	1.95	2.05	0.10	0.12	0.391	0.391	0.01	0.005	7%
19	2.10	0.10		0.423			1.0	2.05	2.15	0.10	0.10	0.423	0.423	0.01	0.004	6%
20	2.20	0.08		0.405			1.0	2.15	2.30	0.15	0.08	0.405	0.405	0.01	0.005	7%
21	2.30	0.06		0.316			1.0	2.25	2.30	0.05	0.06	0.316	0.316	0.00	0.001	1%
RB	2.40	0.00	0.00	0.000	0.000	0.000	1.0	2.30	2.40	0.10	0.02	0.079	0.079	0.00	0.000	0%

Total Flow 0.071

Measurement Details:

Start Time (MST):	13:05
End Time (MST):	13:51
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

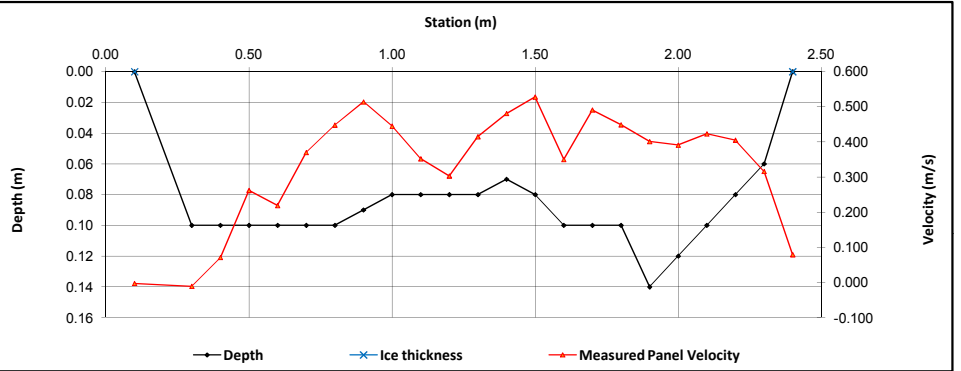
Flow characteristics:

Total Flow:	0.071	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.21	(m ²)
Wetted Width:	2.30	(m)
Hydraulic Depth:	0.090	(m)
Mean Velocity:	0.345	(m/s)
Froude Number:	0.368	

Datalogger Details:

	Before	After
Transducer Reading:		0.177
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:		
Laptop Clock:	12:05	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	11.40	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post closest to road	0.724	98.699	0.710	98.699	-
Bench Mark 2:	Other T-post	0.728	98.702	0.714	98.702	-
Top of Ice:						
Water Level:		1.957	97.466	1.941	97.468	97.467
Transducer Reading:		0.177	97.289	0.177	97.291	97.290
Other:						

General Notes:

Field Personnel:	SM, GB	Trip Date:	22-Sep-11
Data Entry Personnel:	TK	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S12 - Fort Creek at Highway 63
 UTM Location: 462600 E, 6363400 N

Site Visit Date: November 4, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.30	0.10	0.08	0.006	0.006	0.01	0.000	0%
1	0.40	0.30		0.023			1.0	0.30	0.45	0.15	0.30	0.023	0.023	0.05	0.001	2%
2	0.50	0.32		0.108			1.0	0.45	0.55	0.10	0.32	0.108	0.108	0.03	0.003	5%
3	0.60	0.32		0.140			1.0	0.55	0.65	0.10	0.32	0.140	0.140	0.03	0.004	7%
4	0.70	0.30		0.220			1.0	0.65	0.75	0.10	0.30	0.220	0.220	0.03	0.007	10%
5	0.80	0.28		0.238			1.0	0.75	0.83	0.08	0.28	0.238	0.238	0.02	0.005	7%
6	0.85	0.27		0.252			1.0	0.83	0.88	0.05	0.27	0.252	0.252	0.01	0.003	5%
7	0.90	0.26		0.248			1.0	0.88	0.93	0.05	0.26	0.248	0.248	0.01	0.003	5%
8	0.95	0.25		0.273			1.0	0.93	0.98	0.05	0.25	0.273	0.273	0.01	0.003	5%
9	1.00	0.24		0.241			1.0	0.98	1.03	0.05	0.24	0.241	0.241	0.01	0.003	4%
10	1.05	0.23		0.230			1.0	1.03	1.08	0.05	0.23	0.230	0.230	0.01	0.003	4%
11	1.10	0.22		0.230			1.0	1.08	1.13	0.05	0.22	0.230	0.230	0.01	0.003	4%
12	1.15	0.22		0.235			1.0	1.13	1.18	0.05	0.22	0.235	0.235	0.01	0.003	4%
13	1.20	0.20		0.253			1.0	1.18	1.25	0.08	0.20	0.253	0.253	0.02	0.004	6%
14	1.30	0.22		0.233			1.0	1.25	1.35	0.10	0.22	0.233	0.233	0.02	0.005	8%
15	1.40	0.22		0.221			1.0	1.35	1.45	0.10	0.22	0.221	0.221	0.02	0.005	7%
16	1.50	0.22		0.176			1.0	1.45	1.55	0.10	0.22	0.176	0.176	0.02	0.004	6%
17	1.60	0.21		0.147			1.0	1.55	1.65	0.10	0.21	0.147	0.147	0.02	0.003	5%
18	1.70	0.21		0.099			1.0	1.65	1.75	0.10	0.21	0.099	0.099	0.02	0.002	3%
19	1.80	0.20		0.073			1.0	1.75	1.85	0.10	0.20	0.073	0.073	0.02	0.001	2%
20	1.90	0.19		0.058			1.0	1.85	1.95	0.10	0.19	0.058	0.058	0.02	0.001	2%
21	2.00	0.16		0.021			1.0	1.95	2.05	0.10	0.16	0.021	0.021	0.02	0.000	1%
22	2.10	0.12		0.002			1.0	2.05	2.25	0.20	0.12	0.002	0.002	0.02	0.000	0%
R	2.40	0.00	0.00	0.000	0.000	0.000	1.0	2.20	2.40	0.20	0.04	0.005	0.005	0.01	0.000	0%
Total Flow															0.067	

Measurement Details:

Start Time (MST):	12:20
End Time (MST):	13:15
Equipment:	ADV
Method:	Wading
River Condition:	Low, Ice
Quality/Error (see reverse):	Excellent
Weather:	Clear, Calm, -5C

Flow characteristics:

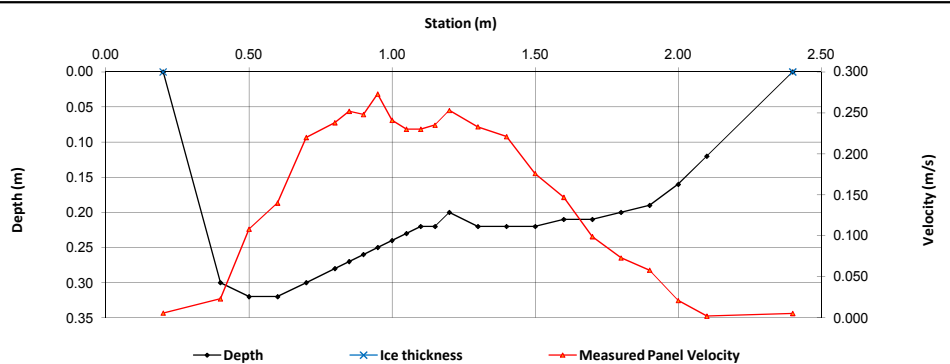
Total Flow:	0.067	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.46	(m ²)
Wetted Width:	2.20	(m)
Hydraulic Depth:	0.210	(m)
Mean Velocity:	0.145	(m/s)
Froude Number:	0.101	

Datalogger Details:

	Before	After
Transducer Reading:		0.244
Battery (Main):	13.16	
Battery (Aux):	-	
Datalogger Clock:	12:27	
Laptop Clock:	12:27	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.30	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Removed CR800, PLS and Battery



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-post closest to road	0.440	98.699	0.413	98.699	-
Bench Mark 2:	Other T-post	0.444	98.702	1.419	98.702	-
Top of Ice:						
Water Level:		1.606	97.533	1.580	97.532	97.533
Transducer Reading:		0.244	97.289	0.244	97.288	97.289
Other:						

General Notes:

BM1: 0.45m
 BM2: 0.48m

Field Personnel:	GB, SM	Trip Date:	4-Nov-11
Data Entry Personnel:	DW	Date:	15-Nov-11
Data Check Personnel:	VS	Date:	23-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: January 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0.00	0.00	0.00	0.000	0.000	0.000	0.9	0.00	2.25	2.25	0.11	0.000	0.000	0.25	0.000	0%
1	4.50	0.95	0.50	-0.001			0.9	2.25	5.00	2.75	0.45	-0.001	-0.001	1.24	-0.001	0%
2	5.50	1.20	0.42	0.086			0.9	5.00	6.00	1.00	0.78	0.086	0.077	0.78	0.060	3%
3	6.50	1.30	0.40	0.158			0.9	6.00	7.00	1.00	0.90	0.158	0.142	0.90	0.128	7%
4	7.50	1.40	0.45	0.168			0.9	7.00	8.00	1.00	0.95	0.168	0.151	0.95	0.144	7%
5	8.50	1.47	0.52	0.129			0.9	8.00	9.00	1.00	0.95	0.129	0.116	0.95	0.110	6%
6	9.50	1.50	0.52	0.121			0.9	9.00	10.25	1.25	0.98	0.121	0.109	1.23	0.133	7%
7	11.00	1.50	0.52	0.104			0.9	10.25	11.60	1.35	0.98	0.104	0.094	1.32	0.124	6%
8	12.20	1.50	0.49	0.173			0.9	11.60	13.00	1.40	1.01	0.173	0.156	1.41	0.220	11%
9	13.80	1.60	0.55	0.216			0.9	13.00	14.40	1.40	1.05	0.216	0.194	1.47	0.286	15%
10	15.00	1.50	0.60	0.190			0.9	14.40	15.75	1.35	0.90	0.190	0.171	1.22	0.208	11%
11	16.50	1.60	0.55	0.200			0.9	15.75	17.25	1.50	1.05	0.200	0.180	1.58	0.284	14%
12	18.00	1.80	0.62	0.000			1.0	17.25	18.75	1.50	1.18	0.000	0.000	1.77	0.000	0%
13	19.50	1.75	0.45	0.076			0.9	18.75	20.00	1.25	1.30	0.076	0.068	1.63	0.111	6%
14	20.50	1.75	0.50	0.061			0.9	20.00	21.25	1.25	1.25	0.061	0.055	1.56	0.086	4%
15	22.00	1.50	0.55	0.041			0.9	21.25	22.50	1.25	0.95	0.041	0.037	1.19	0.044	2%
16	23.00	1.30	0.55	0.031			0.9	22.50	23.75	1.25	0.75	0.031	0.028	0.94	0.026	1%
17	24.50	0.85	0.47	0.005			0.9	23.75	25.25	1.50	0.38	0.005	0.005	0.57	0.003	0%
Right	26.00	0.00	0.00	0.000	0.000	0.000	1.0	25.25	26.00	0.75	0.10	0.001	0.001	0.07	0.000	0%
Total Flow															1.965	

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	16:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	-32°C, Clear

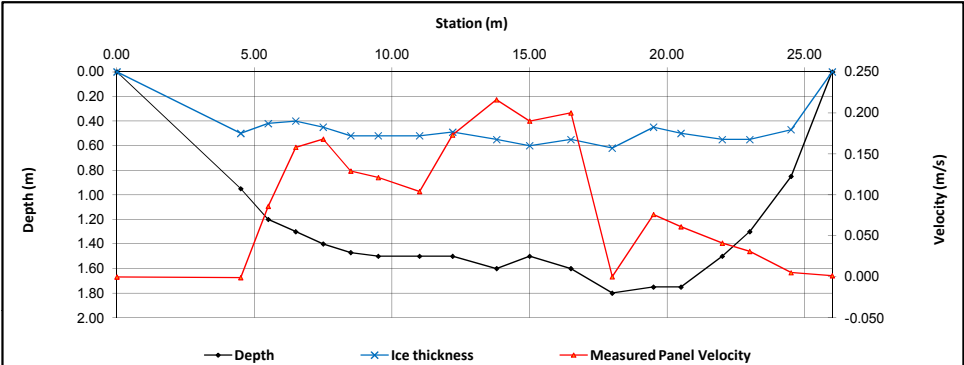
Flow characteristics:

Total Flow:	1.965	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	21.02	(m ²)
Wetted Width:	26.00	(m)
Hydraulic Depth:	0.808	(m)
Mean Velocity:	0.094	(m/s)
Froude Number:	0.033	

Datalogger Details:

	Before	After
Transducer Reading:		1.169
Battery (Main):	13.70	
Battery (Aux):	4.46	
Datalogger Clock:	14:47	
Laptop Clock:	14:57	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.20	
Memory Used:	7%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler		101.930		101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.058	100.000	1.175	100.000	-
Top of Ice:		3.988	97.942	3.109	98.821	98.382
Water Level:		4.050	98.008	3.165	98.010	98.009
Transducer Reading:		1.169	96.839	1.169	96.841	96.840
Other:						

General Notes:

Pipe w/bubbler not used for water level due to icing problems/insufficient time for another setup
Only 0.6 due to ADV sensor head icing.

Field Personnel:	JO, DB	Trip Date:	18-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: February 11, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.50	0.00	0.00	0.000	0.000	0.000	0.9	0.50	0.73	0.23	0.06	0.003	0.002	0.01	0.000	0%
1	0.95	0.90	0.65	0.010			0.9	0.73	1.38	0.65	0.25	0.010	0.009	0.16	0.001	0%
2	1.80	1.10	0.55	-0.004			0.9	1.38	2.30	0.93	0.55	-0.004	-0.004	0.51	-0.002	0%
3	2.80	1.15	0.52	-0.010			0.9	2.30	3.30	1.00	0.63	-0.010	-0.009	0.63	-0.006	0%
4	3.80	1.20	0.44		0.110	0.121	1.0	3.30	4.25	0.95	0.76	0.116	0.116	0.72	0.083	4%
5	4.70	1.27	0.47		0.150	0.176	1.0	4.25	5.10	0.85	0.80	0.163	0.163	0.68	0.111	5%
6	5.50	1.33	0.44		0.139	0.178	1.0	5.10	6.05	0.95	0.89	0.159	0.159	0.85	0.134	6%
7	6.60	1.34	0.54	0.170			0.9	6.05	7.08	1.03	0.80	0.170	0.153	0.82	0.125	6%
8	7.55	1.40	0.53		0.156	0.167	1.0	7.08	8.18	1.10	0.87	0.162	0.162	0.96	0.155	7%
9	8.80	1.39	0.53		0.181	0.139	1.0	8.18	9.43	1.25	0.86	0.160	0.160	1.08	0.172	8%
10	10.05	1.38	0.47		0.177	0.184	1.0	9.43	10.63	1.20	0.91	0.181	0.181	1.09	0.197	9%
11	11.20	1.40	0.55		0.175	0.288	1.0	10.63	11.25	0.63	0.85	0.232	0.232	0.53	0.123	6%
12	11.30	1.40	0.55		0.253	0.222	1.0	11.25	11.80	0.55	0.85	0.238	0.238	0.47	0.111	5%
13	12.30	1.52	0.59		0.163	0.208	1.0	11.80	12.80	1.00	0.93	0.186	0.186	0.93	0.173	8%
14	13.30	1.52	0.59		0.114	0.180	1.0	12.80	13.90	1.10	0.93	0.147	0.147	1.02	0.150	7%
15	14.50	1.62	0.59		0.168	0.202	1.0	13.90	14.90	1.00	1.03	0.185	0.185	1.03	0.191	9%
16	15.30	1.68	0.55		0.117	0.207	1.0	14.90	15.43	0.53	1.13	0.162	0.162	0.59	0.096	4%
17	15.55	1.68	0.55		0.174	0.158	1.0	15.43	15.85	0.42	1.13	0.166	0.166	0.48	0.080	4%
18	16.15	1.80	0.50		0.155	0.156	1.0	15.85	16.23	0.38	1.30	0.156	0.156	0.49	0.076	3%
19	16.30	1.80	0.50		0.143	0.162	1.0	16.23	16.70	0.48	1.30	0.153	0.153	0.62	0.094	4%
20	17.10	1.90	0.49		0.102	0.135	1.0	16.70	17.20	0.50	1.41	0.119	0.119	0.71	0.084	4%
21	17.30	1.90	0.49		0.096	0.104	1.0	17.20	17.73	0.52	1.41	0.100	0.100	0.74	0.074	3%
22	18.15	1.90	0.50		0.031	0.016	1.0	17.73	18.25	0.52	1.40	0.024	0.024	0.73	0.017	1%
23	18.35	1.90	0.50		0.028	0.014	1.0	18.25	18.80	0.55	1.40	0.021	0.021	0.77	0.016	1%
24	19.25	1.50	0.57		-0.004	-0.019	1.0	18.80	19.75	0.95	0.93	-0.012	-0.012	0.88	-0.010	0%
25	20.25	1.30	0.63	-0.061			0.9	19.75	21.13	1.38	0.67	-0.061	-0.055	0.92	-0.051	-2%
Right	22.00	0.00	0.00	0.000	0.000	0.000	1.0	21.13	22.00	0.88	0.17	-0.015	-0.015	0.15	-0.002	0%
Total Flow														2.193		

Measurement Details:

Start Time (MST):	8:15
End Time (MST):	9:40
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Partly cloudy, -9°C

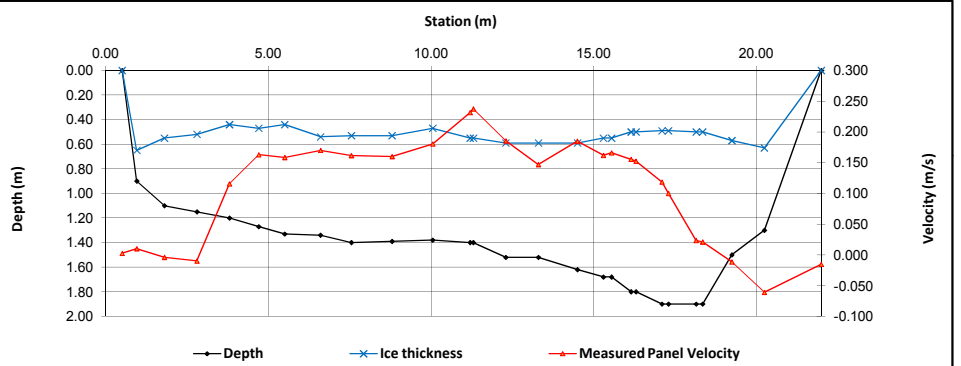
Flow characteristics:

Total Flow:	2.193	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	18.57	(m ²)
Wetted Width:	21.50	(m)
Hydraulic Depth:	0.864	(m)
Mean Velocity:	0.118	(m/s)
Froude Number:	0.041	

Datalogger Details:

	Before	After
Transducer Reading:		1.181
Battery (Main):	12.92	
Battery (Aux):	4.49	
Datalogger Clock:	8:13	
Laptop Clock:	8:27	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.19	
Memory Used:	8%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.387	101.930	0.375	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.212	100.000	2.201	100.000	-
Top of Ice:		4.254	98.063	4.244	98.061	98.062
Water Level:		4.249	98.068	4.239	98.066	98.067
Transducer Reading:		1.181	96.887	1.181	96.885	96.886
Other:						

General Notes:

Field Personnel:	BL, GB	Trip Date:	11-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: March 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	28.50	0.00	0.00	0.000	0.000	0.000	0.9	28.50	27.65	0.85	0.07	-0.002	-0.002	0.06	0.000	0%
1	26.80	0.97	0.68	-0.008			0.9	27.65	26.40	1.25	0.29	-0.008	-0.007	0.36	-0.003	0%
2	26.00	1.08	0.64	0.104			0.9	26.40	25.60	0.80	0.44	0.104	0.094	0.35	0.033	2%
3	25.20	1.11	0.61	0.177			0.9	25.60	24.65	0.95	0.50	0.177	0.159	0.48	0.076	6%
4	24.10	1.18	0.70	0.215			0.9	24.65	23.70	0.95	0.48	0.215	0.194	0.46	0.088	7%
5	23.30	1.28	0.78	0.199			0.9	23.70	22.75	0.95	0.50	0.199	0.179	0.48	0.085	6%
6	22.20	1.32	0.85	0.219			0.9	22.75	21.75	1.00	0.47	0.219	0.197	0.47	0.093	7%
7	21.30	1.30	0.83	0.258			0.9	21.75	20.75	1.00	0.47	0.258	0.232	0.47	0.109	8%
8	20.20	1.40	0.83	0.230			0.9	20.75	19.80	0.95	0.57	0.230	0.207	0.54	0.112	8%
9	19.40	1.44	0.80	0.270			0.9	19.80	19.00	0.80	0.64	0.270	0.243	0.51	0.124	9%
10	18.60	1.46	0.90	0.240			0.9	19.00	18.20	0.80	0.56	0.240	0.216	0.45	0.097	7%
11	17.80	1.46	1.00	0.105			0.9	18.20	17.30	0.90	0.46	0.105	0.095	0.41	0.039	3%
12	16.80	1.50	0.98	0.215			0.9	17.30	16.35	0.95	0.52	0.215	0.194	0.49	0.096	7%
13	15.90	1.50	0.98	0.108			0.9	16.35	15.45	0.90	0.52	0.108	0.097	0.47	0.045	3%
14	15.00	1.66	0.96	0.149			0.9	15.45	14.55	0.90	0.70	0.149	0.134	0.63	0.084	6%
15	14.10	1.82	0.96		0.081	0.198	1.0	14.55	13.70	0.85	0.86	0.140	0.140	0.73	0.102	8%
16	13.30	1.95	0.88		0.061	0.134	1.0	13.70	12.80	0.90	1.07	0.098	0.098	0.96	0.094	7%
17	12.30	2.05	0.82		0.030	0.049	1.0	12.80	11.80	1.00	1.23	0.040	0.040	1.23	0.049	4%
18	11.30	1.41	0.88		0.002	0.097	1.0	11.80	10.65	1.15	0.53	0.050	0.050	0.61	0.030	2%
19	10.00	0.28	0.28		0.000	0.000	1.0	10.65	9.75	0.90	0.00	0.000	0.000	0.00	0.000	0%
Right	9.50	0.00	0.00	0.000	0.000	0.000	1.0	9.75	9.50	0.25	0.00	0.000	0.000	0.00	0.000	0%
Total Flow															1.354	

Measurement Details:

Start Time (MST):	10:30
End Time (MST):	11:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, flurries

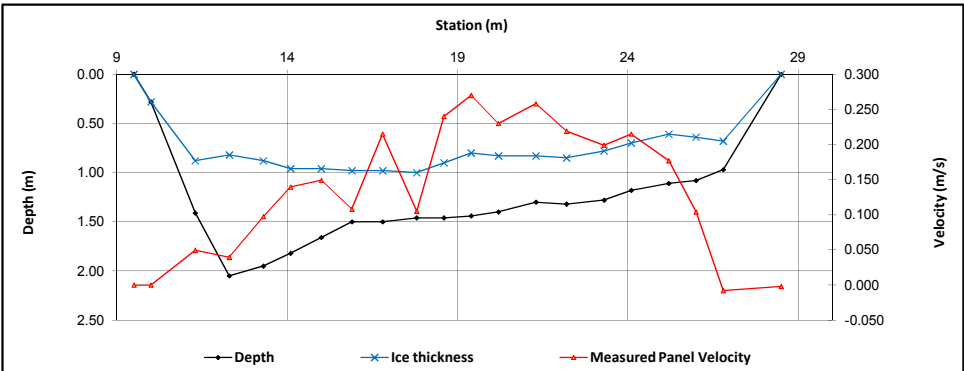
Flow characteristics:

Total Flow:	1.354	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	10.16	(m ²)
Wetted Width:	17.90	(m)
Hydraulic Depth:	0.568	(m)
Mean Velocity:	0.133	(m/s)
Froude Number:	0.056	

Datalogger Details:

	Before	After
Transducer Reading:		1.254
Battery (Main):	4.49	
Battery (Aux):	14.85	
Datalogger Clock:	10:31	
Laptop Clock:	10:38	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.23	
Memory Used:	8%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.415	101.930	0.404	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.238	100.000	2.228	100.000	-
Top of Ice:		4.165	98.180	4.156	98.178	98.179
Water Level:		4.165	98.073	4.156	98.178	98.126
Transducer Reading:		1.254	96.819	1.254	96.924	96.871
Other:						

General Notes:

Field Personnel:	BL, JO	Trip Date:	12-Mar-11
Data Entry Personnel:	DB	Date:	6-Aug-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: April 3, 2011



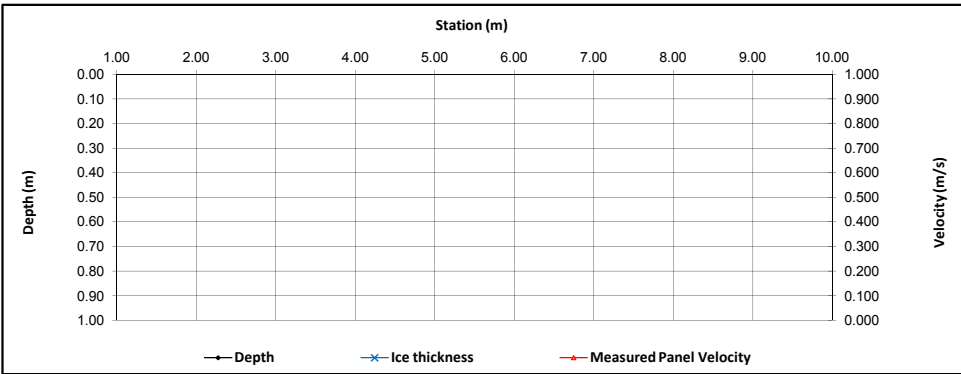
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	14:00
End Time (MST):	15:00
Equipment:	ADV
Method:	Ice
River Condition:	Partially Open
Quality/Error (see reverse):	-
Weather:	Partly cloudy, 4°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		1.278
Battery (Main):	14.44	
Battery (Aux):	4.53	
Datalogger Clock:	13:07	
Laptop Clock:	13:25	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.16	
Memory Used:	10%	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.585	101.930	0.582	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.408	100.000	2.404	100.000	-
Top of Ice:		4.182	98.333	4.178	98.334	98.334
Water Level:		4.300	98.215	4.295	98.217	98.216
Transducer Reading:		1.278	96.937	1.278	96.939	96.938
Other:						

General Notes:
 Flow gauge deemed unsafe. Ice thickness approx 12" but fully saturated with water. Water was filling auger hole before hole completely drilled through, therefore 50% decline in strength. Fill was from below. Ice was able to be removed with a finger at 6" depth. Open, flowing water downstream with large cracks. Water can be heard flowing at gauging station. Middle section of river has sagged significantly.

Field Personnel:	JO, BL	Trip Date:	3-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: April 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	14:05
End Time (MST):	14:20
Equipment:	-
Method:	-
River Condition:	Partially open
Quality/Error (see reverse):	-
Weather:	Light precip, -6°C

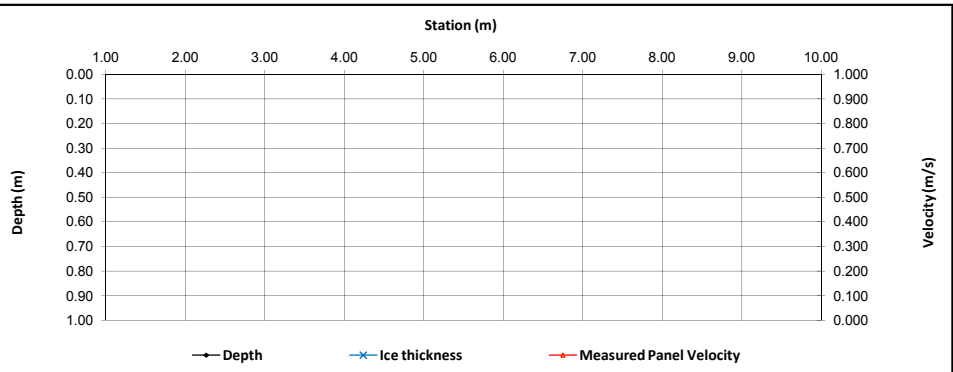
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		1.12
Battery (Main):	14.62	
Battery (Aux):	4.51	
Datalogger Clock:	12:51	
Laptop Clock:	13:12	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.14	
Memory Used:	11%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler		101.930		101.930	
Bench Mark 2:	Rebar w/orange flagging		100.000		100.000	
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:

River ice too thin for gauging and to drill hole for water level. Approximately 1" of ice, 1m from bank.

Field Personnel:	JO, BL	Trip Date:	18-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: June 21, 2011



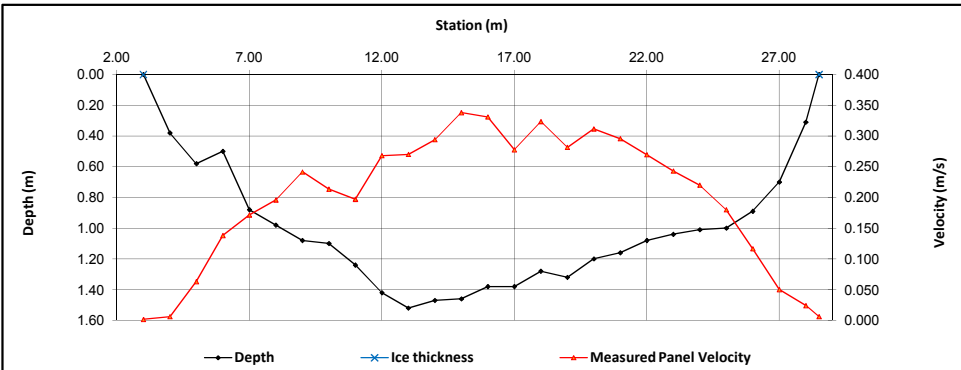
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.50	0.50	0.10	0.002	0.002	0.05	0.000	0%
1	4.00	0.38		0.006			1.0	3.50	4.50	1.00	0.38	0.006	0.006	0.38	0.002	0%
2	5.00	0.58		0.063			1.0	4.50	5.50	1.00	0.58	0.063	0.063	0.58	0.037	1%
3	6.00	0.50		0.138			1.0	5.50	6.50	1.00	0.50	0.138	0.138	0.50	0.069	1%
4	7.00	0.88			0.169	0.174	1.0	6.50	7.50	1.00	0.88	0.172	0.172	0.88	0.151	2%
5	8.00	0.98			0.162	0.230	1.0	7.50	8.50	1.00	0.98	0.196	0.196	0.98	0.192	3%
6	9.00	1.08			0.197	0.286	1.0	8.50	9.50	1.00	1.08	0.242	0.242	1.08	0.261	4%
7	10.00	1.10			0.156	0.271	1.0	9.50	10.50	1.00	1.10	0.214	0.214	1.10	0.235	4%
8	11.00	1.24			0.113	0.281	1.0	10.50	11.50	1.00	1.24	0.197	0.197	1.24	0.244	4%
9	12.00	1.42			0.247	0.289	1.0	11.50	12.50	1.00	1.42	0.268	0.268	1.42	0.381	6%
10	13.00	1.52			0.222	0.318	1.0	12.50	13.50	1.00	1.52	0.270	0.270	1.52	0.410	6%
11	14.00	1.47			0.272	0.316	1.0	13.50	14.50	1.00	1.47	0.294	0.294	1.47	0.432	7%
12	15.00	1.46			0.313	0.363	1.0	14.50	15.50	1.00	1.46	0.338	0.338	1.46	0.493	8%
13	16.00	1.38			0.293	0.369	1.0	15.50	16.50	1.00	1.38	0.331	0.331	1.38	0.457	7%
14	17.00	1.38			0.213	0.342	1.0	16.50	17.50	1.00	1.38	0.278	0.278	1.38	0.383	6%
15	18.00	1.28			0.307	0.340	1.0	17.50	18.50	1.00	1.28	0.324	0.324	1.28	0.414	7%
16	19.00	1.32			0.249	0.314	1.0	18.50	19.50	1.00	1.32	0.282	0.282	1.32	0.372	6%
17	20.00	1.20			0.283	0.340	1.0	19.50	20.50	1.00	1.20	0.312	0.312	1.20	0.374	6%
18	21.00	1.16			0.260	0.331	1.0	20.50	21.50	1.00	1.16	0.296	0.296	1.16	0.343	5%
19	22.00	1.08			0.263	0.276	1.0	21.50	22.50	1.00	1.08	0.270	0.270	1.08	0.291	5%
20	23.00	1.04			0.226	0.260	1.0	22.50	23.50	1.00	1.04	0.243	0.243	1.04	0.253	4%
21	24.00	1.01			0.197	0.243	1.0	23.50	24.50	1.00	1.01	0.220	0.220	1.01	0.222	4%
22	25.00	1.00			0.157	0.203	1.0	24.50	25.50	1.00	1.00	0.180	0.180	1.00	0.180	3%
23	26.00	0.89				0.111	1.0	25.50	26.50	1.00	0.89	0.117	0.117	0.89	0.104	2%
24	27.00	0.70		0.050			1.0	26.50	27.50	1.00	0.70	0.050	0.050	0.70	0.035	1%
25	28.00	0.31		0.024			1.0	27.50	28.25	0.75	0.31	0.024	0.024	0.23	0.006	0%
LB	28.50	0.00	0.00	0.000	0.000	0.000	1.0	25.75	28.50	2.75	0.26	0.006	0.006	0.72	0.004	0%
Total Flow															6.344	

Measurement Details:	
Start Time (MST):	8:45
End Time (MST):	10:15
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Rain 15oC

Flow characteristics:		
Total Flow:	6.344	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	27.05	(m ²)
Wetted Width:	25.50	(m)
Hydraulic Depth:	1.061	(m)
Mean Velocity:	0.235	(m/s)
Froude Number:	0.073	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	4.56	
Battery (Aux):	14.21	
Datalogger Clock:	9:27	
Laptop Clock:	9:47	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	18.70	
Memory Used:	3%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.113	101.930	0.096	101.930	-
Bench Mark 2:	Rebar w/orange flagging	1.909	100.000	1.891	100.000	-
Top of Ice:						
Water Level:		3.960	98.083	3.940	98.086	98.085
Transducer Reading:		0.988	97.095	0.988	97.098	97.097
Other:						

General Notes:

Field Personnel:	DB SM	Trip Date:	21-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: August 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
RB	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.50	4.25	0.75	0.12	0.000	0.000	0.09	0.000	0%
1	5.00	0.48		0.001			1.0	4.25	5.50	1.25	0.48	0.001	0.001	0.60	0.001	0%
2	6.00	0.64		0.340			1.0	5.50	6.50	1.00	0.64	0.340	0.340	0.64	0.218	3%
3	7.00	0.90			0.107	0.134	1.0	6.50	7.50	1.00	0.90	0.121	0.121	0.90	0.108	1%
4	8.00	1.12			0.217	0.233	1.0	7.50	8.50	1.00	1.12	0.225	0.225	1.12	0.252	3%
5	9.00	1.22			0.253	0.264	1.0	8.50	9.50	1.00	1.22	0.259	0.259	1.22	0.315	4%
6	10.00	1.40			0.304	0.303	1.0	9.50	10.50	1.00	1.40	0.304	0.304	1.40	0.425	5%
7	11.00	1.30			0.184	0.286	1.0	10.50	11.50	1.00	1.30	0.235	0.235	1.30	0.306	4%
8	12.00	1.36			0.315	0.341	1.0	11.50	12.50	1.00	1.36	0.328	0.328	1.36	0.446	5%
9	13.00	1.50			0.371	0.381	1.0	12.50	13.50	1.00	1.50	0.376	0.376	1.50	0.564	7%
10	14.00	1.40			0.375	0.440	1.0	13.50	14.50	1.00	1.40	0.408	0.408	1.40	0.571	7%
11	15.00	1.40			0.383	0.441	1.0	14.50	15.50	1.00	1.40	0.412	0.412	1.40	0.577	7%
12	16.00	1.36			0.405	0.464	1.0	15.50	16.50	1.00	1.36	0.435	0.435	1.36	0.591	7%
13	17.00	1.40			0.371	0.513	1.0	16.50	17.50	1.00	1.40	0.442	0.442	1.40	0.619	7%
14	18.00	1.40			0.246	0.476	1.0	17.50	18.50	1.00	1.40	0.361	0.361	1.40	0.505	6%
15	19.00	1.28			0.182	0.451	1.0	18.50	19.50	1.00	1.28	0.317	0.317	1.28	0.405	5%
16	20.00	1.30			0.329	0.529	1.0	19.50	20.50	1.00	1.30	0.429	0.429	1.30	0.558	6%
17	21.00	1.30			0.330	0.483	1.0	20.50	21.50	1.00	1.30	0.407	0.407	1.30	0.528	6%
18	22.00	1.25			0.230	0.417	1.0	21.50	22.50	1.00	1.25	0.324	0.324	1.25	0.404	5%
19	23.00	1.00			0.263	0.405	1.0	22.50	23.50	1.00	1.00	0.334	0.334	1.00	0.334	4%
20	24.00	1.00			0.266	0.349	1.0	23.50	24.50	1.00	1.00	0.308	0.308	1.00	0.308	4%
21	25.00	0.86			0.169	0.333	1.0	24.50	25.50	1.00	0.86	0.251	0.251	0.86	0.216	2%
22	26.00	0.80			0.171	0.303	1.0	25.50	26.50	1.00	0.80	0.237	0.237	0.80	0.190	2%
23	27.00	0.74		0.247			1.0	26.50	27.75	1.25	0.74	0.247	0.247	0.93	0.228	3%
LB	28.50	0.00	0.00	0.000	0.000	0.000	1.0	27.75	28.50	0.75	0.19	0.062	0.062	0.14	0.009	0%
Total Flow															8.677	

Measurement Details:

Start Time (MST):	14:20
End Time (MST):	15:30
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

Flow characteristics:

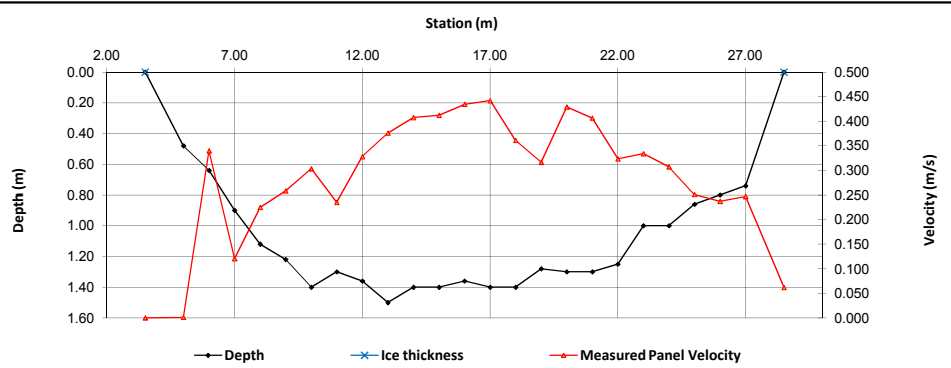
Total Flow:	8.677	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	26.94	(m ²)
Wetted Width:	25.00	(m)
Hydraulic Depth:	1.078	(m)
Mean Velocity:	0.322	(m/s)
Froude Number:	0.099	

Datalogger Details:

	Before	After
Transducer Reading:	-0.624	1.122
Battery (Main):	4.57	13.80
Battery (Aux):	13.95	
Datalogger Clock:	14:01	16:38
Laptop Clock:	14:26	16:38
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	18.88	21.00
Memory Used:	16%	
Dessicant:	replaced	ok
Logger# (if Δ):		15m PLS
PT# (if Δ):		

Datalogger / Station Notes:

New CS800 datalogger/PLS installed due to Optimum PT broken. New installed 15m on limit of PT length.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.445	101.930	0.434	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.242	100.000	2.231	100.000	-
Top of Ice:						
Water Level:		4.187	98.188	4.180	98.184	98.186
Transducer Reading:		1.122	97.066	1.122	97.062	97.064
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	12-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: September 12, 2011



Flow Measurement:

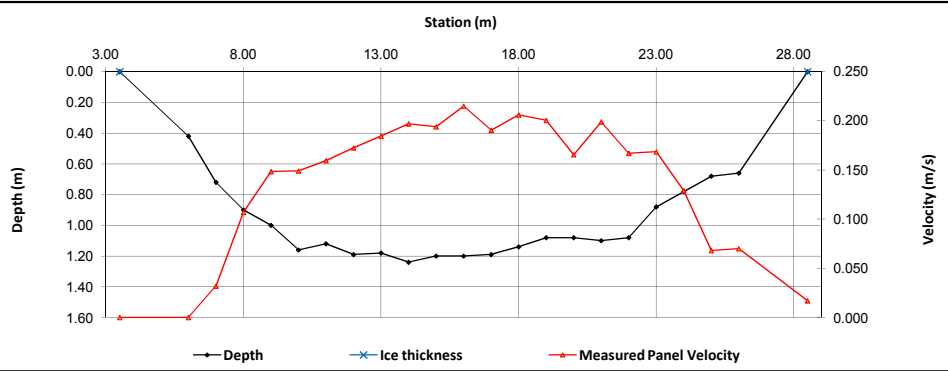
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.50	4.75	1.25	0.11	0.000	0.000	0.13	0.000	0%
1	6.00	0.42		0.000			1.0	4.75	6.50	1.75	0.42	0.000	0.000	0.74	0.000	0%
2	7.00	0.72		0.032			1.0	6.50	7.50	1.00	0.72	0.032	0.032	0.72	0.023	1%
3	8.00	0.90			0.084	0.130	1.0	7.50	8.50	1.00	0.90	0.107	0.107	0.90	0.096	3%
4	9.00	1.00			0.149	0.148	1.0	8.50	9.50	1.00	1.00	0.149	0.149	1.00	0.149	4%
5	10.00	1.16			0.158	0.140	1.0	9.50	10.50	1.00	1.16	0.149	0.149	1.16	0.173	5%
6	11.00	1.12			0.163	0.156	1.0	10.50	11.50	1.00	1.12	0.160	0.160	1.12	0.179	5%
7	12.00	1.19			0.178	0.167	1.0	11.50	12.50	1.00	1.19	0.173	0.173	1.19	0.205	6%
8	13.00	1.18			0.159	0.210	1.0	12.50	13.50	1.00	1.18	0.185	0.185	1.18	0.218	6%
9	14.00	1.24			0.200	0.194	1.0	13.50	14.50	1.00	1.24	0.197	0.197	1.24	0.244	7%
10	15.00	1.20			0.177	0.211	1.0	14.50	15.50	1.00	1.20	0.194	0.194	1.20	0.233	7%
11	16.00	1.20			0.207	0.223	1.0	15.50	16.50	1.00	1.20	0.215	0.215	1.20	0.258	8%
12	17.00	1.19			0.167	0.214	1.0	16.50	17.50	1.00	1.19	0.191	0.191	1.19	0.227	7%
13	18.00	1.14			0.185	0.227	1.0	17.50	18.50	1.00	1.14	0.206	0.206	1.14	0.235	7%
14	19.00	1.08			0.167	0.234	1.0	18.50	19.50	1.00	1.08	0.201	0.201	1.08	0.217	6%
15	20.00	1.08			0.123	0.208	1.0	19.50	20.50	1.00	1.08	0.166	0.166	1.08	0.179	5%
16	21.00	1.10			0.167	0.231	1.0	20.50	21.50	1.00	1.10	0.199	0.199	1.10	0.219	6%
17	22.00	1.08			0.118	0.216	1.0	21.50	22.50	1.00	1.08	0.167	0.167	1.08	0.180	5%
18	23.00	0.88			0.142	0.195	1.0	22.50	23.50	1.00	0.88	0.169	0.169	0.88	0.148	4%
19	24.00	0.78				0.088	1.0	23.50	24.50	1.00	0.78	0.129	0.129	0.78	0.101	3%
20	25.00	0.68		0.068			1.0	24.50	25.50	1.00	0.68	0.068	0.068	0.68	0.046	1%
21	26.00	0.66		0.070			1.0	25.50	27.25	1.75	0.66	0.070	0.070	1.16	0.081	2%
LB	28.50	0.00	0.00	0.000	0.000	0.000	1.0	26.75	28.50	1.75	0.17	0.017	0.017	0.30	0.005	0%
Total Flow															3.415	

Measurement Details:	
Start Time (MST):	15:01
End Time (MST):	16:00
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	-

Flow characteristics:		
Total Flow:	3.415	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	22.24	(m ²)
Wetted Width:	25.00	(m)
Hydraulic Depth:	0.890	(m)
Mean Velocity:	0.154	(m/s)
Froude Number:	0.052	

Datalogger Details:		
Transducer Reading:	Before	After
		0.942
Battery (Main):	13.82	
Battery (Aux):	-	
Datalogger Clock:	3:02	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	14.50	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
Campbell Sci enclosure installed. Values checked afterwards.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.282	101.930	0.273	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.078	100.000	2.068	100.000	-
Top of Ice:						
Water Level:		4.206	98.006	4.198	98.005	98.006
Transducer Reading:		0.942	97.064	0.942	97.063	97.064
Other:						

General Notes:
Moved CR800 Logger to Campbell Sci enclosure.

Field Personnel:	SM, DB	Trip Date:	12-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: November 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	13:00
Equipment:	-
Method:	-
River Condition:	Full Ice Cover, low
Quality/Error (see reverse):	-
Weather:	Overcast, calm, 0°C

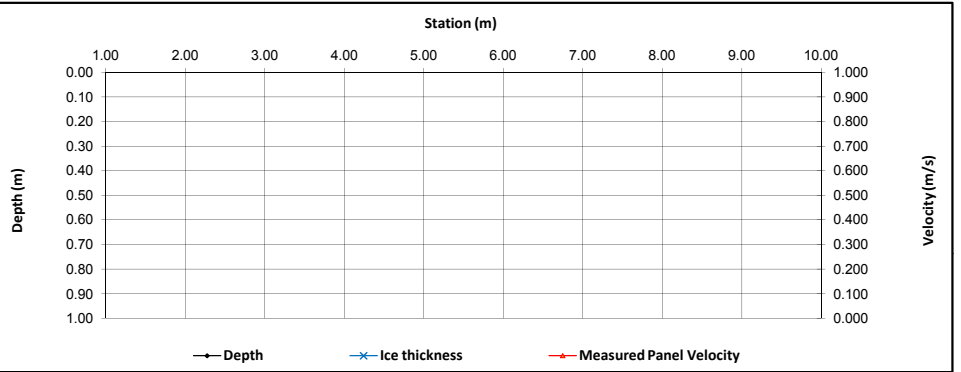
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading (m):		0.88
Battery (Main):	13.44	
Battery (Aux):	-	
Datalogger Clock:	12:34	
Laptop Clock:	12:34	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.262	101.930	0.243	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.057	100.000	2.038	100.000	-
Top of Ice:		4.230	97.962	4.213	97.960	97.961
Water Level:		4.238	97.954	4.222	97.951	97.953
Transducer Reading:		0.880	97.074	0.880	97.071	97.073
Other:						

General Notes:

Ice cover 2.5" thick. No flow measurement performed, see photos
TSS sampled at bridge, left
BM2: 0.55m

Field Personnel:	SM, GB	Trip Date:	3-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S14A - Ells River at the CNRL Bridge

UTM Location: 455748 E, 6344947 N

Site Visit Date: November 29, 2011



Flow Measurement:

Measured Data								Calculated Data							
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Effective	Measured	Average	Pannel	Pannel	Pannel	Percent of	
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Pannel	Pannel	Pannel	Area	Discharge	Discharge	total flow	
			(m)	Depth	Depth	Depth	Factor	Start	End	Width	(m ²)	(m ³ /s)	(m ³ /s)		
				(m/s)	(m/s)	(m/s)	(m)	(m)	(m)	(m)	(m ²)	(m ³ /s)	(m ³ /s)		
R	7.00	0.00	0.00	0.000	0.000	0.000	0.9	7.00	7.45	0.45	0.04	0.003	0.002	0.00	
1	7.90	0.50	0.33	0.010			0.9	7.45	8.45	1.00	0.17	0.010	0.009	0.17	
2	9.00	0.92	0.35	0.060			0.9	8.45	9.45	1.00	0.57	0.060	0.054	0.57	
3	9.90	1.45	0.35		0.090	0.080	1.0	9.45	10.45	1.00	1.10	0.085	0.085	1.10	
4	11.00	1.70	0.35		0.110	0.110	1.0	10.45	11.50	1.05	1.35	0.110	0.110	1.42	
5	12.00	1.72	0.36		0.120	0.120	1.0	11.50	12.50	1.00	1.36	0.120	0.120	1.36	
6	13.00	1.64	0.36		0.120	0.080	1.0	12.50	13.50	1.00	1.28	0.100	0.100	1.28	
7	14.00	1.48	0.36		0.090	0.010	1.0	13.50	14.50	1.00	1.12	0.050	0.050	1.12	
8	15.00	1.54	0.36		0.110	0.010	1.0	14.50	15.50	1.00	1.18	0.060	0.060	1.18	
9	16.00	1.51	0.35		0.130	0.000	1.0	15.50	16.50	1.00	1.16	0.065	0.065	1.16	
10	17.00	1.50	0.35		0.150	0.000	1.0	16.50	17.50	1.00	1.15	0.075	0.075	1.15	
11	18.00	1.51	0.34		0.160	-0.010	1.0	17.50	18.50	1.00	1.17	0.075	0.075	1.17	
12	19.00	1.52	0.35		0.130	0.070	1.0	18.50	19.50	1.00	1.17	0.100	0.100	1.17	
13	20.00	1.51	0.35		0.150	0.000	1.0	19.50	20.50	1.00	1.16	0.075	0.075	1.16	
14	21.00	1.58	0.35		0.150	0.000	1.0	20.50	21.50	1.00	1.23	0.075	0.075	1.23	
15	22.00	1.38	0.35		0.140	0.000	1.0	21.50	22.50	1.00	1.03	0.070	0.070	1.03	
16	23.00	1.35	0.36		0.130	0.010	1.0	22.50	23.50	1.00	0.99	0.070	0.070	0.99	
17	24.00	1.32	0.36		0.140	0.030	1.0	23.50	24.50	1.00	0.96	0.085	0.085	0.96	
18	25.00	1.32	0.41		0.120	0.150	1.0	24.50	25.50	1.00	0.91	0.135	0.135	0.91	
19	26.00	1.18	0.35		0.050	0.090	1.0	25.50	26.50	1.00	0.83	0.070	0.070	0.83	
20	27.00	1.04	0.35	0.070			0.9	26.50	28.10	1.60	0.69	0.070	0.063	1.10	
L	29.20	0.00	0.00	0.000	0.000	0.000	1.0	28.10	29.20	1.10	0.17	0.018	0.018	0.19	
Total Flow												1.722			

Measurement Details:

Start Time (MST):	10:40
End Time (MST):	12:30
Equipment:	MARSH
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Excellent
Weather:	Clear, Calm, -5C

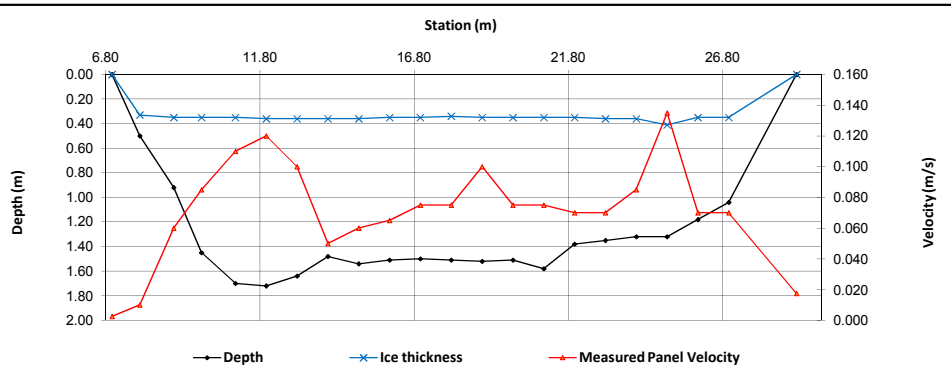
Flow characteristics:

Total Flow:	1.722	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	21.27	(m ²)
Wetted Width:	22.20	(m)
Hydraulic Depth:	0.958	(m)
Mean Velocity:	0.081	(m/s)
Froude Number:	0.026	

Datalogger Details:

	Before	After
Transducer Reading:		0.992
Battery (Main):	12.99	
Battery (Aux):	-	
Datalogger Clock:	10:43	
Laptop Clock:	10:43	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Top of pipe w/bubbler	0.497	101.930	0.484	101.930	-
Bench Mark 2:	Rebar w/orange flagging	2.295	100.000	2.282	100.000	-
Top of Ice:		4.364	98.063	4.350	98.064	98.064
Water Level:		4.378	98.049	4.363	98.051	98.050
Transducer Reading:		0.992	97.057	0.992	97.059	97.058
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	29-Nov-11
Data Entry Personnel:	DW	Date:	6-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S15A - Tar River near the Mouth
 UTM Location: 458395 E, 6353391 N

Site Visit Date: April 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0.65	0.00		0.000	0.000	0.000	1.0	0.65	0.68	0.03	0.02	0.003	0.003	0.00	0.000	0%
1	0.70	0.08		0.013			1.0	0.68	0.78	0.10	0.08	0.013	0.013	0.01	0.000	0%
2	0.85	0.12		0.017			1.0	0.78	0.93	0.15	0.12	0.017	0.017	0.02	0.000	0%
3	1.00	0.16		0.101			1.0	0.93	1.08	0.15	0.16	0.101	0.101	0.02	0.002	1%
4	1.15	0.14		0.125			1.0	1.08	1.23	0.15	0.14	0.125	0.125	0.02	0.003	1%
5	1.30	0.15		0.118			1.0	1.23	1.38	0.15	0.15	0.118	0.118	0.02	0.003	1%
6	1.45	0.14		0.107			1.0	1.38	1.53	0.15	0.14	0.107	0.107	0.02	0.002	1%
7	1.60	0.14		0.165			1.0	1.53	1.68	0.15	0.14	0.165	0.165	0.02	0.003	1%
8	1.75	0.14		0.153			1.0	1.68	1.83	0.15	0.14	0.153	0.153	0.02	0.003	1%
9	1.90	0.19		0.135			1.0	1.83	1.98	0.15	0.19	0.135	0.135	0.03	0.004	2%
10	2.05	0.22		0.274			1.0	1.98	2.13	0.15	0.22	0.274	0.274	0.03	0.009	4%
11	2.20	0.24		0.241			1.0	2.13	2.28	0.15	0.24	0.241	0.241	0.04	0.009	3%
12	2.35	0.24		0.233			1.0	2.28	2.43	0.15	0.24	0.233	0.233	0.04	0.008	3%
13	2.50	0.27		0.272			1.0	2.43	2.58	0.15	0.27	0.272	0.272	0.04	0.011	4%
14	2.65	0.29		0.242			1.0	2.58	2.73	0.15	0.29	0.242	0.242	0.04	0.011	4%
15	2.80	0.30		0.258			1.0	2.73	2.88	0.15	0.30	0.258	0.258	0.05	0.012	5%
16	2.95	0.32		0.238			1.0	2.88	3.03	0.15	0.32	0.238	0.238	0.05	0.011	5%
17	3.10	0.35		0.318			1.0	3.03	3.18	0.15	0.35	0.318	0.318	0.05	0.017	7%
18	3.25	0.35		0.342			1.0	3.18	3.33	0.15	0.35	0.342	0.342	0.05	0.018	7%
19	3.40	0.34		0.359			1.0	3.33	3.48	0.15	0.34	0.359	0.359	0.05	0.018	7%
20	3.55	0.34		0.382			1.0	3.48	3.63	0.15	0.34	0.382	0.382	0.05	0.019	8%
21	3.70	0.32		0.394			1.0	3.63	3.78	0.15	0.32	0.394	0.394	0.05	0.019	8%
22	3.85	0.30		0.299			1.0	3.78	3.93	0.15	0.30	0.299	0.299	0.04	0.013	5%
23	4.00	0.30		0.276			1.0	3.93	4.08	0.15	0.30	0.276	0.276	0.05	0.012	5%
24	4.15	0.32		0.201			1.0	4.08	4.23	0.15	0.32	0.201	0.201	0.05	0.010	4%
25	4.30	0.34		0.176			1.0	4.23	4.38	0.15	0.34	0.176	0.176	0.05	0.009	4%
26	4.45	0.38		0.089			1.0	4.38	4.53	0.15	0.38	0.089	0.089	0.06	0.005	2%
27	4.60	0.34		0.118			1.0	4.53	4.68	0.15	0.34	0.118	0.118	0.05	0.006	2%
28	4.75	0.37		0.114			1.0	4.68	4.83	0.15	0.37	0.114	0.114	0.06	0.006	3%
29	4.90	0.36		0.015			1.0	4.83	4.98	0.15	0.36	0.015	0.015	0.05	0.001	0%
30	5.05	0.26		0.057			1.0	4.98	5.24	0.27	0.26	0.057	0.057	0.07	0.004	2%
Right	5.43	0.00		0.000	0.000	0.000	1.0	5.24	5.43	0.19	0.07	0.014	0.014	0.01	0.000	0%
Total Flow															0.250	

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	12:15
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Light snow, -6°C

Flow characteristics:

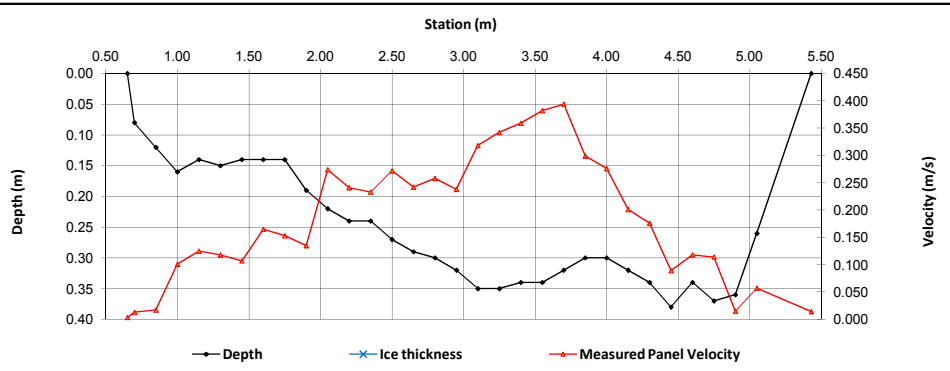
Total Flow:	0.250	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.21	(m ²)
Wetted Width:	4.78	(m)
Hydraulic Depth:	0.253	(m)
Mean Velocity:	0.206	(m/s)
Froude Number:	0.131	

Datalogger Details:

	Before	After
Transducer Reading:		0.000
Battery (Main):	14.94	
Battery (Aux):	-	
Datalogger Clock:	10:07	
Laptop Clock:	10:07	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-2.20	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Pt placed in water 1030h logger time.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in root nr. Solar panel	2.245	100.912	2.242	100.912	-
Bench Mark 2:	Nail in stump of fallen tree	3.112	100.000	3.105	100.000	-
Top of Ice:						
Water Level:		4.990	98.167	4.995	98.159	98.163
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	18-Apr-11
Data Entry Personnel:	CM	Date:	2-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S15A - Tar River near the Mouth
 UTM Location: (458450 E, 6353440 N)

Site Visit Date: August 12, 2011



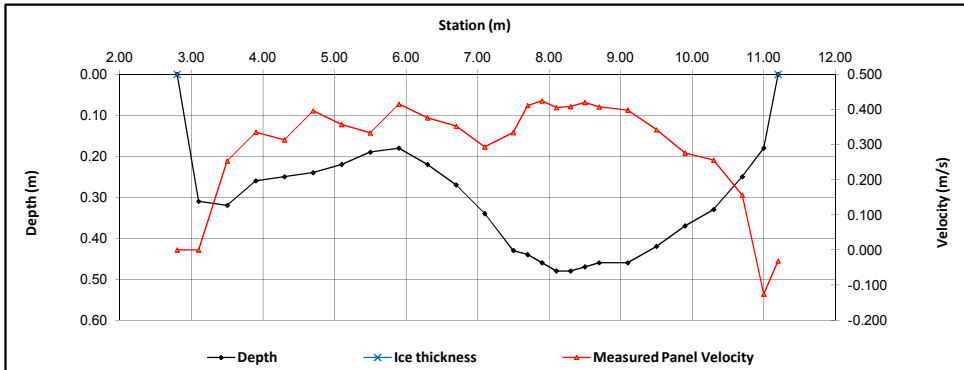
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	2.80	0.00	0.00	0.000	0.000	0.000	1.0	2.80	2.95	0.15	0.08	0.000	0.000	0.01	0.000	0%
1	3.10	0.31		0.000			1.0	2.95	3.30	0.35	0.31	0.000	0.000	0.11	0.000	0%
2	3.50	0.32		0.253			1.0	3.30	3.70	0.40	0.32	0.253	0.253	0.13	0.032	4%
3	3.90	0.26		0.335			1.0	3.70	4.10	0.40	0.26	0.335	0.335	0.10	0.035	4%
4	4.30	0.25		0.313			1.0	4.10	4.50	0.40	0.25	0.313	0.313	0.10	0.031	4%
5	4.70	0.24		0.396			1.0	4.50	4.90	0.40	0.24	0.396	0.396	0.10	0.038	5%
6	5.10	0.22		0.357			1.0	4.90	5.30	0.40	0.22	0.357	0.357	0.09	0.031	4%
7	5.50	0.19		0.333			1.0	5.30	5.70	0.40	0.19	0.333	0.333	0.08	0.025	3%
8	5.90	0.18		0.415			1.0	5.70	6.10	0.40	0.18	0.415	0.415	0.07	0.030	4%
9	6.30	0.22		0.376			1.0	6.10	6.50	0.40	0.22	0.376	0.376	0.09	0.033	4%
10	6.70	0.27		0.352			1.0	6.50	6.90	0.40	0.27	0.352	0.352	0.11	0.038	5%
11	7.10	0.34		0.293			1.0	6.90	7.30	0.40	0.34	0.293	0.293	0.14	0.040	5%
12	7.50	0.43		0.334			1.0	7.30	7.60	0.30	0.43	0.334	0.334	0.13	0.043	5%
13	7.70	0.44		0.411			1.0	7.60	7.80	0.20	0.44	0.411	0.411	0.09	0.036	4%
14	7.90	0.46		0.424			1.0	7.80	8.00	0.20	0.46	0.424	0.424	0.09	0.039	5%
15	8.10	0.48		0.405			1.0	8.00	8.20	0.20	0.48	0.405	0.405	0.10	0.039	5%
16	8.30	0.48		0.408			1.0	8.20	8.40	0.20	0.48	0.408	0.408	0.10	0.039	5%
17	8.50	0.47		0.420			1.0	8.40	8.60	0.20	0.47	0.420	0.420	0.09	0.039	5%
18	8.70	0.46		0.407			1.0	8.60	8.90	0.30	0.46	0.407	0.407	0.14	0.056	7%
19	9.10	0.46		0.398			1.0	8.90	9.30	0.40	0.46	0.398	0.398	0.18	0.073	9%
20	9.50	0.42		0.342			1.0	9.30	9.70	0.40	0.42	0.342	0.342	0.17	0.057	7%
21	9.90	0.37		0.276			1.0	9.70	10.10	0.40	0.37	0.276	0.276	0.15	0.041	5%
22	10.30	0.33		0.256			1.0	10.10	10.50	0.40	0.33	0.256	0.256	0.13	0.034	4%
23	10.70	0.25		0.156			1.0	10.50	10.85	0.35	0.25	0.156	0.156	0.09	0.014	2%
24	11.00	0.18		-0.126			1.0	10.85	11.10	0.25	0.18	-0.126	-0.126	0.05	-0.006	-1%
RB	11.20	0.00	0.00	0.000	0.000	0.000	1.0	11.10	11.20	0.10	0.05	-0.032	-0.032	0.00	0.000	0%
Total Flow															0.839	

Measurement Details:	
Start Time (MST):	11:30
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Fair
Weather:	Sunny

Flow characteristics:		
Total Flow:	0.839	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	2.62	(m ²)
Wetted Width:	8.40	(m)
Hydraulic Depth:	0.312	(m)
Mean Velocity:	0.321	(m/s)
Froude Number:	0.183	

Datalogger Details:		
	Before	After
Transducer Reading:		0.589
Battery (Main):	0.58	
Battery (Aux):	-	
Datalogger Clock:	12:25	
Laptop Clock:	12:25	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	18.30	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 Antenna Strength: RSSI - 77-80. Laird OK. Ping test OK.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	BM 3m to S of post	0.968	100.000	0.963	100.000	-
Bench Mark 2:	BM 2m to E of post	1.154	100.000	1.150	100.000	-
Top of Ice:						
Water Level:		4.288	96.680	4.287	96.676	96.678
Transducer Reading:		0.589	96.091	0.589	96.087	96.089
Other:						

General Notes:
 Some tidying needed (dismantle directional antenna, insert post for laird)

Field Personnel:	DB, SM	Trip Date:	12-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S15A - Tar River near the Mouth
 UTM Location: (458450 E, 6353440 N)

Site Visit Date: 12 September, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	3.60	0.00	0.00	0.000	0.000	0.000	1.0	3.60	3.75	0.15	0.05	0.001	0.001	0.01	0.000	0%
1	3.90	0.18		0.003			1.0	3.75	4.05	0.30	0.18	0.003	0.003	0.05	0.000	0%
2	4.20	0.20		0.118			1.0	4.05	4.35	0.30	0.20	0.118	0.118	0.06	0.007	3%
3	4.50	0.23		0.111			1.0	4.35	4.65	0.30	0.23	0.111	0.111	0.07	0.008	4%
4	4.80	0.26		0.123			1.0	4.65	4.95	0.30	0.26	0.123	0.123	0.08	0.010	4%
5	5.10	0.24		0.160			1.0	4.95	5.25	0.30	0.24	0.160	0.160	0.07	0.012	5%
6	5.40	0.22		0.070			1.0	5.25	5.55	0.30	0.22	0.070	0.070	0.07	0.005	2%
7	5.70	0.22		0.133			1.0	5.55	5.85	0.30	0.22	0.133	0.133	0.07	0.009	4%
8	6.00	0.20		0.230			1.0	5.85	6.15	0.30	0.20	0.230	0.230	0.06	0.014	6%
9	6.30	0.23		0.222			1.0	6.15	6.45	0.30	0.23	0.222	0.222	0.07	0.015	7%
10	6.60	0.20		0.276			1.0	6.45	6.75	0.30	0.20	0.276	0.276	0.06	0.017	8%
11	6.90	0.16		0.248			1.0	6.75	7.05	0.30	0.16	0.248	0.248	0.05	0.012	5%
12	7.20	0.14		0.217			1.0	7.05	7.35	0.30	0.14	0.217	0.217	0.04	0.009	4%
13	7.50	0.12		0.265			1.0	7.35	7.65	0.30	0.12	0.265	0.265	0.04	0.010	4%
14	7.80	0.10		0.226			1.0	7.65	7.95	0.30	0.10	0.226	0.226	0.03	0.007	3%
15	8.10	0.09		0.238			1.0	7.95	8.25	0.30	0.09	0.238	0.238	0.03	0.006	3%
16	8.40	0.09		0.019			1.0	8.25	8.55	0.30	0.09	0.019	0.019	0.03	0.001	0%
17	8.70	0.14		0.142			1.0	8.55	8.85	0.30	0.14	0.142	0.142	0.04	0.006	3%
18	9.00	0.18		0.191			1.0	8.85	9.15	0.30	0.18	0.191	0.191	0.05	0.010	5%
19	9.30	0.21		0.168			1.0	9.15	9.45	0.30	0.21	0.168	0.168	0.06	0.011	5%
20	9.60	0.20		0.230			1.0	9.45	9.75	0.30	0.20	0.230	0.230	0.06	0.014	6%
21	9.90	0.19		0.240			1.0	9.75	10.05	0.30	0.19	0.240	0.240	0.06	0.014	6%
22	10.20	0.18		0.213			1.0	10.05	10.35	0.30	0.18	0.213	0.213	0.05	0.012	5%
23	10.50	0.16		0.152			1.0	10.35	10.65	0.30	0.16	0.152	0.152	0.05	0.007	3%
24	10.80	0.12		0.144			1.0	10.65	10.95	0.30	0.12	0.144	0.144	0.04	0.005	2%
RB	11.10	0.00	0.00	0.000	0.000	0.000	1.0	10.95	11.10	0.15	0.03	0.036	0.036	0.00	0.000	0%
Total Flow															0.218	

Measurement Details:

Start Time (MST):	12:00
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, showers, 15°C

Flow characteristics:

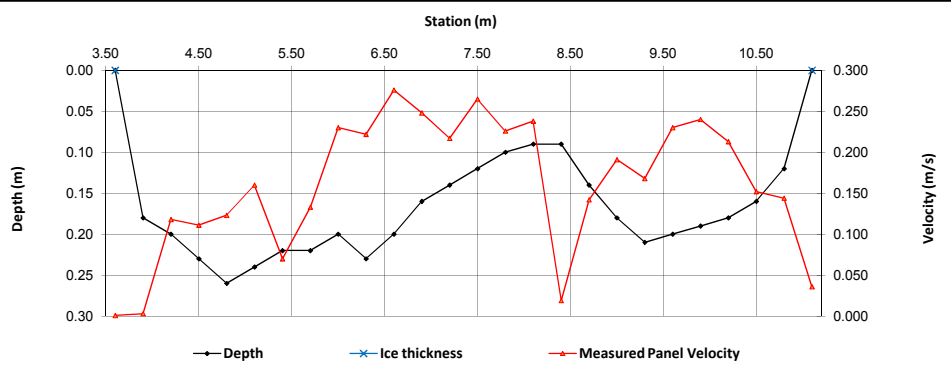
Total Flow:	0.218	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.29	(m ²)
Wetted Width:	7.50	(m)
Hydraulic Depth:	0.172	(m)
Mean Velocity:	0.169	(m/s)
Froude Number:	0.130	

Datalogger Details:

	Before	After
Transducer Reading:		0.278
Battery (Main):	13.30	
Battery (Aux):	-	
Datalogger Clock:	12:31	
Laptop Clock:	12:31	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	12.80	
Memory Used:	-	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Moved Antenna



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	BM 3m to S of post	0.927	100.000	0.916	100.000	-
Bench Mark 2:	BM 2m to E of post	1.113	100.000	1.104	100.000	-
Top of Ice:						
Water Level:		4.533	96.394	4.521	96.395	96.395
Transducer Reading:		0.278	96.116	0.278	96.117	96.117
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	12-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S15A - Tar River near the Mouth
 UTM Location: (458450 E, 6353440 N)

Site Visit Date: November 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	3.54	0.00	0.00	0.000	0.000	0.000	1.0	3.54	3.77	0.23	0.04	-0.002	-0.002	0.01	0.000	0%
1	4.00	0.16		-0.008			1.0	3.77	4.20	0.43	0.16	-0.008	-0.008	0.07	-0.001	0%
2	4.40	0.18		0.002			1.0	4.20	4.60	0.40	0.18	0.002	0.002	0.07	0.000	0%
3	4.80	0.20		0.083			1.0	4.60	5.00	0.40	0.20	0.083	0.083	0.08	0.007	4%
4	5.20	0.24		0.103			1.0	5.00	5.40	0.40	0.24	0.103	0.103	0.10	0.010	5%
5	5.60	0.22		0.119			1.0	5.40	5.80	0.40	0.22	0.119	0.119	0.09	0.010	6%
6	6.00	0.22		0.149			1.0	5.80	6.10	0.30	0.22	0.149	0.149	0.07	0.010	5%
7	6.20	0.30		0.136			1.0	6.10	6.30	0.20	0.30	0.136	0.136	0.06	0.008	4%
8	6.40	0.31		0.141			1.0	6.30	6.50	0.20	0.31	0.141	0.141	0.06	0.009	5%
9	6.60	0.32		0.195			1.0	6.50	6.70	0.20	0.32	0.195	0.195	0.06	0.012	7%
10	6.80	0.31		0.224			1.0	6.70	6.90	0.20	0.31	0.224	0.224	0.06	0.014	7%
11	7.00	0.27		0.199			1.0	6.90	7.10	0.20	0.27	0.199	0.199	0.05	0.011	6%
12	7.20	0.22		0.194			1.0	7.10	7.30	0.20	0.22	0.194	0.194	0.04	0.009	5%
13	7.40	0.22		0.179			1.0	7.30	7.50	0.20	0.22	0.179	0.179	0.04	0.008	4%
14	7.60	0.18		0.147			1.0	7.50	7.80	0.30	0.18	0.147	0.147	0.05	0.008	4%
15	8.00	0.15		0.171			1.0	7.80	8.20	0.40	0.15	0.171	0.171	0.06	0.010	5%
16	8.40	0.18		0.113			1.0	8.20	8.60	0.40	0.18	0.113	0.113	0.07	0.008	4%
17	8.80	0.20		0.090			1.0	8.60	9.00	0.40	0.20	0.090	0.090	0.08	0.007	4%
18	9.20	0.22		0.121			1.0	9.00	9.40	0.40	0.22	0.121	0.121	0.09	0.011	6%
19	9.60	0.24		0.139			1.0	9.40	9.80	0.40	0.24	0.139	0.139	0.10	0.013	7%
20	10.00	0.24		0.151			1.0	9.80	10.20	0.40	0.24	0.151	0.151	0.10	0.014	8%
21	10.40	0.20		0.116			1.0	10.20	10.60	0.40	0.20	0.116	0.116	0.08	0.009	5%
22	10.80	0.18		0.012			1.0	10.60	11.10	0.50	0.18	0.012	0.012	0.09	0.001	1%
R	11.40	0.00	0.00	0.000	0.000	0.000	1.0	11.10	11.40	0.30	0.05	0.003	0.003	0.01	0.000	0%
Total Flow															0.189	

Measurement Details:

Start Time (MST):	9:25
End Time (MST):	10:20
Equipment:	ADV
Method:	Wading
River Condition:	low, open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, Calm, OC

Flow characteristics:

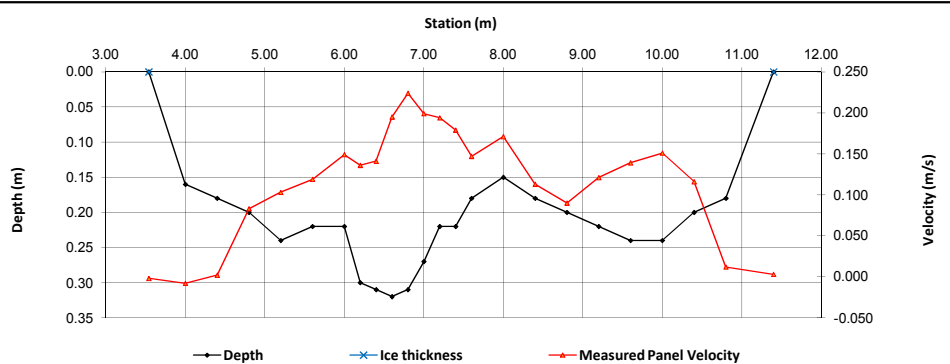
Total Flow:	0.189	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.60	(m ²)
Wetted Width:	7.86	(m)
Hydraulic Depth:	0.203	(m)
Mean Velocity:	0.118	(m/s)
Froude Number:	0.084	

Datalogger Details:

	Before	After
Transducer Reading:		0.311
Battery (Main):	12.58	
Battery (Aux):	-	
Datalogger Clock:	9:56	
Laptop Clock:	9:56	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.7	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

CR800, PLS, Battery, Modem.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	BM 3m to S of post	1.077	100.000	1.056	100.000	-
Bench Mark 2:	BM 2m to E of post	1.264	100.000	1.243	100.000	-
Top of Ice:						
Water Level:		4.640	96.437	4.618	96.438	96.438
Transducer Reading:		0.311	96.126	0.311	96.127	96.127
Other:						

General Notes:

Partial ice cover on river.

BM1: 0.2m
 BM2: 0.21m

Field Personnel:	SM, GB	Trip Date:	3-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S16A - Calumet River Upland Tributary

UTM Location:

Site Visit Date: April 24, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	1.20	0.00	0.00	0.000	0.000	0.000	1.0	1.20	1.25	0.05	0.06	-0.008	-0.008	0.00	0.000	0%
1	1.30	0.24		-0.033			1.0	1.25	1.38	0.13	0.24	-0.033	-0.033	0.03	-0.001	0%
2	1.45	0.27		0.094			1.0	1.38	1.53	0.15	0.27	0.094	0.094	0.04	0.004	1%
3	1.60	0.37		0.822			1.0	1.53	1.68	0.15	0.37	0.822	0.822	0.06	0.046	10%
4	1.75	0.32		0.714			1.0	1.68	1.83	0.15	0.32	0.714	0.714	0.05	0.034	8%
5	1.90	0.34		0.494			1.0	1.83	1.98	0.15	0.34	0.494	0.494	0.05	0.025	6%
6	2.05	0.35		0.652			1.0	1.98	2.13	0.15	0.35	0.652	0.652	0.05	0.034	8%
7	2.20	0.34		0.678			1.0	2.13	2.28	0.15	0.34	0.678	0.678	0.05	0.035	8%
8	2.35	0.27		1.093			1.0	2.28	2.43	0.15	0.27	1.093	1.093	0.04	0.044	10%
9	2.50	0.24		0.867			1.0	2.43	2.58	0.15	0.24	0.867	0.867	0.04	0.031	7%
10	2.65	0.34		0.448			1.0	2.58	2.73	0.15	0.34	0.448	0.448	0.05	0.023	5%
11	2.80	0.39		0.742			1.0	2.73	2.88	0.15	0.39	0.742	0.742	0.06	0.043	10%
12	2.95	0.39		0.377			1.0	2.88	3.03	0.15	0.39	0.377	0.377	0.06	0.022	5%
13	3.10	0.37		0.279			1.0	3.03	3.18	0.15	0.37	0.279	0.279	0.06	0.015	4%
14	3.25	0.33		0.435			1.0	3.18	3.33	0.15	0.33	0.435	0.435	0.05	0.022	5%
15	3.40	0.32		0.348			1.0	3.33	3.48	0.15	0.32	0.348	0.348	0.05	0.017	4%
16	3.55	0.32		0.217			1.0	3.48	3.63	0.15	0.32	0.217	0.217	0.05	0.010	2%
17	3.70	0.34		0.205			1.0	3.63	3.78	0.15	0.34	0.205	0.205	0.05	0.010	2%
18	3.85	0.36		0.292			1.0	3.78	3.93	0.15	0.36	0.292	0.292	0.05	0.016	4%
19	4.00	0.35		0.156			1.0	3.93	4.08	0.15	0.35	0.156	0.156	0.05	0.008	2%
20	4.15	0.34		0.029			1.0	4.08	4.23	0.15	0.34	0.029	0.029	0.05	0.001	0%
21	4.30	0.30		-0.003			1.0	4.23	4.40	0.18	0.30	-0.003	-0.003	0.05	0.000	0%
Right	4.50	0.00	0.00	0.000	0.000	0.000	1.0	4.40	4.50	0.10	0.08	-0.001	-0.001	0.01	0.000	0%
Total Flow															0.440	

Measurement Details:

Start Time (MST):	7:55
End Time (MST):	9:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Sunny, 5°C

Flow characteristics:

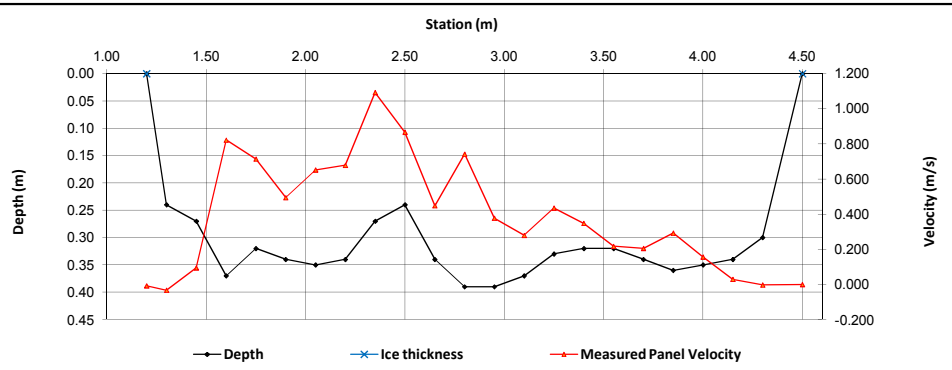
Total Flow:	0.440	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.05	(m ²)
Wetted Width:	3.30	(m)
Hydraulic Depth:	0.317	(m)
Mean Velocity:	0.421	(m/s)
Froude Number:	0.239	

Datalogger Details:

	Before	After
Transducer Reading:		0.717
Battery (Main):	5.44	
Battery (Aux):	12.77	
Datalogger Clock:	10:28	
Laptop Clock:	10:29	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	0%	
Dessicant:	New	
Logger# (if Δ):	2059	
PT# (if Δ):	45186	

Datalogger / Station Notes:

m=1.406178, b=0.0



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in root of logger tree	1.157	100.000	1.119	100.000	-
Bench Mark 2:	Pipe in ground	1.632	99.525	1.594	99.525	-
Top of Ice:						
Water Level:		2.832	98.325	2.795	98.324	98.325
Transducer Reading:		0.717	97.608	0.717	97.607	97.608
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	24-Apr-11
Data Entry Personnel:	CM	Date:	3-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S16A - Calumet River Upland Tributary

UTM Location:

Site Visit Date: July 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:

Start Time (MST):	-
End Time (MST):	-
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	-

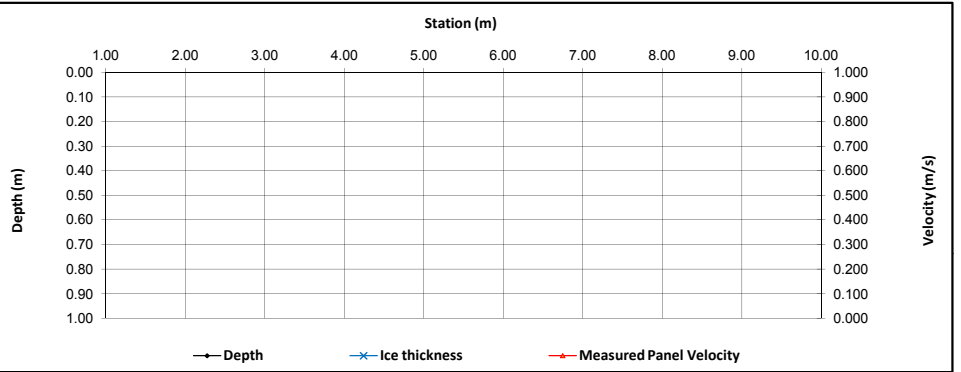
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.691
Battery (Main):	12.72	
Battery (Aux):	-	
Datalogger Clock:	8:43	
Laptop Clock:	8:43	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	12.20	
Memory Used:	-	
Dessicant:	New	
Logger# (if Δ):	18200	
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in root of logger tree		100.000		100.000	-
Bench Mark 2:	Pipe in ground		100.000		100.000	-
Top of Ice:						
Water Level:			100.000		100.000	100.000
Transducer Reading:		0.691	99.309	0.691	99.309	99.309
Other:						

General Notes:

Purpose of trip was to check station function after fires, and to upgrade station to Campbell Scientific hardware. Some damage to hardware installed here due to fires.

Field Personnel:	DB, SM	Trip Date:	27-Jul-11
Data Entry Personnel:	JP	Date:	5-Aug-11
Data Check Personnel:	DB	Date:	25-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S16A - Calumet River Upland Tributary

UTM Location: 458130E, 6362062N

Site Visit Date: August 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.60	0.00	0.00	0.000	0.000	0.000	1.0	0.60	0.70	0.10	0.07	0.021	0.021	0.01	0.000	0%
1	0.80	0.28		0.084			1.0	0.70	0.90	0.20	0.28	0.084	0.084	0.06	0.005	2%
2	1.00	0.29		0.068			1.0	0.90	1.10	0.20	0.29	0.068	0.068	0.06	0.004	2%
3	1.20	0.27		0.227			1.0	1.10	1.30	0.20	0.27	0.227	0.227	0.05	0.012	5%
4	1.40	0.27		0.339			1.0	1.30	1.50	0.20	0.27	0.339	0.339	0.05	0.018	8%
5	1.60	0.24		0.217			1.0	1.50	1.70	0.20	0.24	0.217	0.217	0.05	0.010	5%
6	1.80	0.28		0.132			1.0	1.70	1.90	0.20	0.28	0.132	0.132	0.06	0.007	3%
7	2.00	0.26		0.108			1.0	1.90	2.10	0.20	0.26	0.108	0.108	0.05	0.006	2%
8	2.20	0.25		0.100			1.0	2.10	2.28	0.18	0.25	0.100	0.100	0.04	0.004	2%
9	2.35	0.27		0.379			1.0	2.28	2.43	0.15	0.27	0.379	0.379	0.04	0.015	7%
10	2.50	0.24		0.243			1.0	2.43	2.58	0.15	0.24	0.243	0.243	0.04	0.009	4%
11	2.65	0.24		0.219			1.0	2.58	2.73	0.15	0.24	0.219	0.219	0.04	0.008	3%
12	2.80	0.25		0.534			1.0	2.73	2.88	0.15	0.25	0.534	0.534	0.04	0.020	9%
13	2.95	0.24		0.488			1.0	2.88	3.03	0.15	0.24	0.488	0.488	0.04	0.018	8%
14	3.10	0.25		0.364			1.0	3.03	3.18	0.15	0.25	0.364	0.364	0.04	0.014	6%
15	3.25	0.27		0.711			1.0	3.18	3.33	0.15	0.27	0.711	0.711	0.04	0.029	12%
16	3.40	0.26		0.545			1.0	3.33	3.48	0.15	0.26	0.545	0.545	0.04	0.021	9%
17	3.55	0.24		0.489			1.0	3.48	3.63	0.15	0.24	0.489	0.489	0.04	0.018	8%
18	3.70	0.22		0.373			1.0	3.63	3.78	0.15	0.22	0.373	0.373	0.03	0.012	5%
19	3.85	0.19		0.006			1.0	3.78	3.93	0.15	0.19	0.006	0.006	0.03	0.000	0%
LB	4.00	0.00	0.00	0.000	0.000	0.000	1.0	3.93	4.00	0.08	0.05	0.002	0.002	0.00	0.000	0%
Total Flow															0.231	

Measurement Details:

Start Time (MST):	15:50
End Time (MST):	18:35
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast

Flow characteristics:

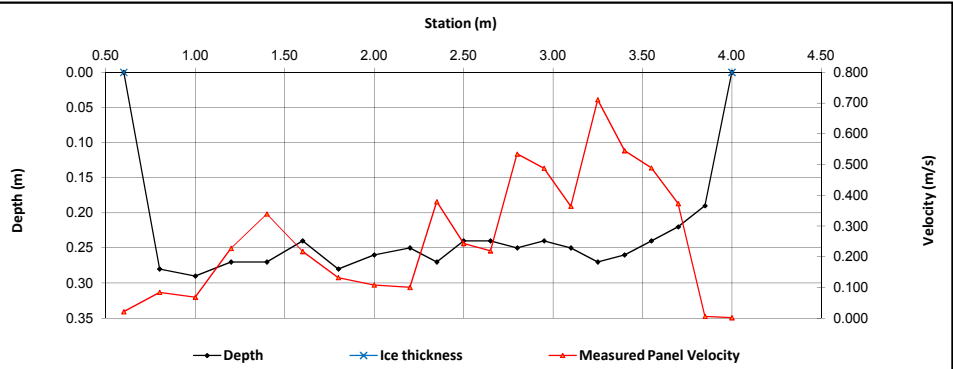
Total Flow:	0.231	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.83	(m ²)
Wetted Width:	3.40	(m)
Hydraulic Depth:	0.245	(m)
Mean Velocity:	0.277	(m/s)
Froude Number:	0.179	

Datalogger Details:

	Before	After
Transducer Reading:		0.652
Battery (Main):	12.41	
Battery (Aux):	-	
Datalogger Clock:	15:50	
Laptop Clock:	15:50	
Air Temperature °C:	15	
Air Pressure:	-	
RH:	-	
Water °C:	17.10	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Replaced solar panel & controller.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in root of logger tree	1.071	100.000	1.057	100.000	-
Bench Mark 2:	New 3/4" pipe installed Aug. 2011	1.107	99.964	1.096	99.961	-
Top of Ice:						
Water Level:		2.767	98.304	2.753	98.304	98.304
Transducer Reading:		0.652	97.652	0.652	97.652	97.652
Other:						

General Notes:

TSS@2.4m

Field Personnel:	DB, KW	Trip Date:	14-Aug-11
Data Entry Personnel:	JP	Date:	28-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S16A - Calumet River Upland Tributary
 UTM Location: 458130E, 6362062N

Site Visit Date: September 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1	0.40	0.00	0.00	0.000	0.000	0.000	1.0	0.40	0.45	0.05	0.07	0.002	0.002	0.00	0.000	0%
2	0.50	0.26		0.009			1.0	0.45	0.55	0.10	0.26	0.009	0.009	0.03	0.000	1%
3	0.60	0.35		0.005			1.0	0.55	0.65	0.10	0.35	0.005	0.005	0.03	0.000	1%
4	0.70	0.36		0.009			1.0	0.65	0.75	0.10	0.36	0.009	0.009	0.04	0.000	1%
5	0.80	0.29		0.017			1.0	0.75	0.85	0.10	0.29	0.017	0.017	0.03	0.000	2%
6	0.90	0.30		0.021			1.0	0.85	0.95	0.10	0.30	0.021	0.021	0.03	0.001	2%
7	1.00	0.30		0.038			1.0	0.95	1.05	0.10	0.30	0.038	0.038	0.03	0.001	4%
8	1.10	0.30		0.050			1.0	1.05	1.15	0.10	0.30	0.050	0.050	0.03	0.002	5%
9	1.20	0.30		0.066			1.0	1.15	1.25	0.10	0.30	0.066	0.066	0.03	0.002	7%
10	1.30	0.30		0.062			1.0	1.25	1.35	0.10	0.30	0.062	0.062	0.03	0.002	7%
11	1.40	0.32		0.074			1.0	1.35	1.43	0.07	0.32	0.074	0.074	0.02	0.002	6%
12	1.45	0.32		0.091			1.0	1.43	1.48	0.05	0.32	0.091	0.091	0.02	0.001	5%
13	1.50	0.32		0.099			1.0	1.48	1.53	0.05	0.32	0.099	0.099	0.02	0.002	6%
14	1.55	0.32		0.086			1.0	1.53	1.58	0.05	0.32	0.086	0.086	0.02	0.001	5%
15	1.60	0.32		0.076			1.0	1.58	1.65	0.07	0.32	0.076	0.076	0.02	0.002	7%
16	1.70	0.30		0.069			1.0	1.65	1.75	0.10	0.30	0.069	0.069	0.03	0.002	7%
17	1.80	0.27		0.022			1.0	1.75	1.85	0.10	0.27	0.022	0.022	0.03	0.001	2%
18	1.90	0.27		0.023			1.0	1.85	1.95	0.10	0.27	0.023	0.023	0.03	0.001	2%
19	2.00	0.24		0.031			1.0	1.95	2.05	0.10	0.24	0.031	0.031	0.02	0.001	3%
20	2.10	0.28		0.051			1.0	2.05	2.15	0.10	0.28	0.051	0.051	0.03	0.001	5%
21	2.20	0.28		0.045			1.0	2.15	2.25	0.10	0.28	0.045	0.045	0.03	0.001	5%
22	2.30	0.26		0.043			1.0	2.25	2.35	0.10	0.26	0.043	0.043	0.03	0.001	4%
23	2.40	0.22		0.057			1.0	2.35	2.45	0.10	0.22	0.057	0.057	0.02	0.001	5%
24	2.50	0.22		0.040			1.0	2.45	2.55	0.10	0.22	0.040	0.040	0.02	0.001	3%
25	2.60	0.20		0.036			1.0	2.55	2.65	0.10	0.20	0.036	0.036	0.02	0.001	3%
	2.70	0.20		0.030			1.0	2.65	2.78	0.13	0.20	0.030	0.030	0.03	0.001	3%
	2.85	0.00	0.00	0.000	0.000	0.000	1.0	2.78	2.85	0.07	0.05	0.008	0.008	0.00	0.000	0%
Total Flow														0.028		

Measurement Details:

Start Time (MST):	13:20
End Time (MST):	14:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	-

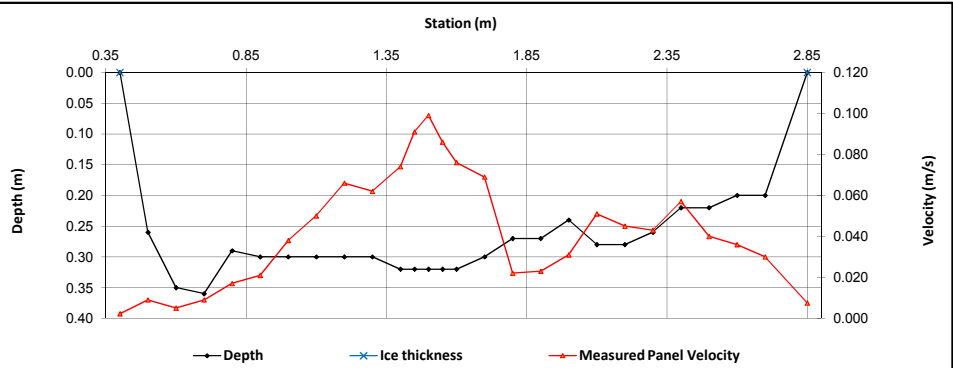
Flow characteristics:

Total Flow:	0.028	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.66	(m ²)
Wetted Width:	2.45	(m)
Hydraulic Depth:	0.269	(m)
Mean Velocity:	0.042	(m/s)
Froude Number:	0.026	

Datalogger Details:

	Before	After
Transducer Reading:	0.513	
Battery (Main):	14.00	
Battery (Aux):	-	
Datalogger Clock:	13:22	
Laptop Clock:	13:22	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	9.50	
Memory Used:	-	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree with logger	0.967	100.000	0.958	100.000	-
Bench Mark 2:	New 3/4 pipe	0.999	99.968	0.989	99.969	-
Top of Ice:						
Water Level:		2.796	98.171	2.787	98.171	98.171
Transducer Reading:		0.513	97.658	0.513	97.658	97.658
Other:	Pipe 4m East of Bm2	1.412		1.402		

General Notes:

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S16A - Calumet River Upland Tributary
 UTM Location: 458130E, 6362062N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.30	0.10	0.04	0.000	0.000	0.00	0.000	0%
1	0.40	0.14		0.001			1.0	0.30	0.50	0.20	0.14	0.001	0.001	0.03	0.000	0%
2	0.60	0.20		0.055			1.0	0.50	0.70	0.20	0.20	0.055	0.055	0.04	0.002	3%
3	0.80	0.21		0.126			1.0	0.70	0.90	0.20	0.21	0.126	0.126	0.04	0.005	7%
4	1.00	0.16		0.151			1.0	0.90	1.10	0.20	0.16	0.151	0.151	0.03	0.005	7%
5	1.20	0.25		0.119			1.0	1.10	1.30	0.20	0.25	0.119	0.119	0.05	0.006	8%
6	1.40	0.26		0.217			1.0	1.30	1.45	0.15	0.26	0.217	0.217	0.04	0.008	12%
7	1.50	0.22		0.241			1.0	1.45	1.55	0.10	0.22	0.241	0.241	0.02	0.005	7%
8	1.60	0.25		0.204			1.0	1.55	1.65	0.10	0.25	0.204	0.204	0.03	0.005	7%
9	1.70	0.26		0.112			1.0	1.65	1.75	0.10	0.26	0.112	0.112	0.03	0.003	4%
10	1.80	0.29		0.251			1.0	1.75	1.85	0.10	0.29	0.251	0.251	0.03	0.007	10%
11	1.90	0.26		0.318			1.0	1.85	1.95	0.10	0.26	0.318	0.318	0.03	0.008	12%
12	2.00	0.27		0.236			1.0	1.95	2.05	0.10	0.27	0.236	0.236	0.03	0.006	9%
13	2.10	0.30		0.129			1.0	2.05	2.15	0.10	0.30	0.129	0.129	0.03	0.004	5%
14	2.20	0.27		0.034			1.0	2.15	2.25	0.10	0.27	0.034	0.034	0.03	0.001	1%
15	2.30	0.30		-0.021			1.0	2.25	2.35	0.10	0.30	-0.021	-0.021	0.03	-0.001	-1%
16	2.40	0.32		0.024			1.0	2.35	2.45	0.10	0.32	0.024	0.024	0.03	0.001	1%
17	2.50	0.34		0.009			1.0	2.45	2.55	0.10	0.34	0.009	0.009	0.03	0.000	0%
18	2.60	0.34		0.087			1.0	2.55	2.65	0.10	0.34	0.087	0.087	0.03	0.003	4%
19	2.70	0.29		0.048			1.0	2.65	2.75	0.10	0.29	0.048	0.048	0.03	0.001	2%
20	2.80	0.30		-0.002			1.0	2.75	2.90	0.15	0.30	-0.002	-0.002	0.05	0.000	0%
LB	3.00	0.00	0.00	0.000	0.000	0.000	1.0	2.90	3.00	0.10	0.08	-0.001	-0.001	0.01	0.000	0%
Total Flow														0.071		

Measurement Details:

Start Time (MST):	13:45
End Time (MST):	14:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast, 5°C

Flow characteristics:

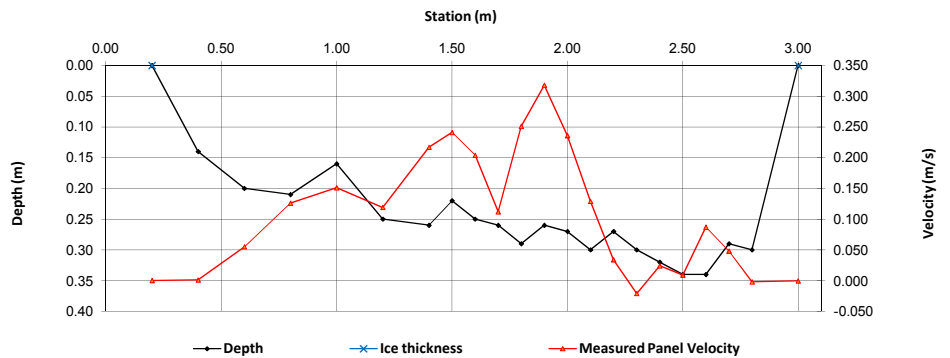
Total Flow:	0.071	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.66	(m ²)
Wetted Width:	2.80	(m)
Hydraulic Depth:	0.235	(m)
Mean Velocity:	0.109	(m/s)
Froude Number:	0.072	

Datalogger Details:

	Before	After
Transducer Reading:		0.561
Battery (Main):	13.69	
Battery (Aux):	-	
Datalogger Clock:	13:51	
Laptop Clock:	13:51	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

PLS, CR800, Battery removed.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in root of logger tree		100.000		100.000	-
Bench Mark 2:	New 3/4" Pipe	1.090	99.965	1.075	99.965	-
Top of Ice:						
Water Level:		2.851	98.204	2.832	98.208	98.206
Transducer Reading:		0.561	97.643	0.561	97.647	97.645
Other:	BM 3: Pipe	1.503		1.488		

General Notes:

BM Heights

BM1: 0.51 m
 BM3: 0.45 m
 PLS wright left at the base of the tree

Field Personnel:	SM, DW	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	14-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S19 - Tar River Lowland Tributary near the mouth
 UTM Location: 457315 E, 6352863 N

Site Visit Date: April 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	13:30
Equipment:	-
Method:	-
River Condition:	Flooded ice
Quality/Error (see reverse):	-
Weather:	Partly cloudy, -5°C

Flow characteristics:

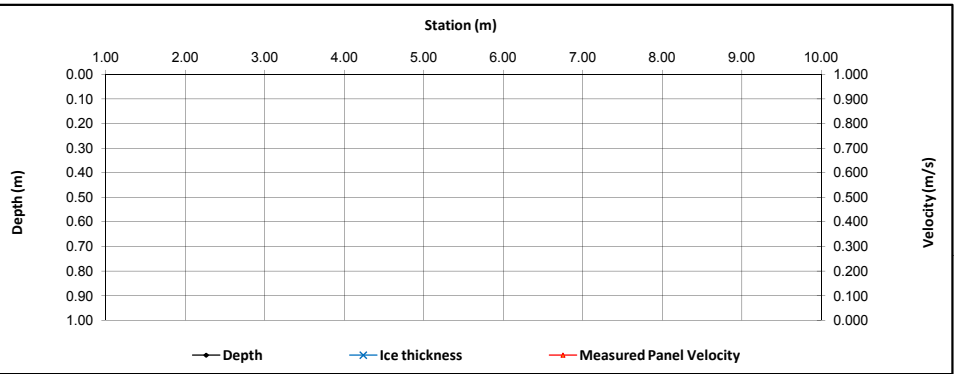
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:	-0.002	
Battery (Main):	14.53	
Battery (Aux):	5.44	
Datalogger Clock:	12:17	
Laptop Clock:	12:17	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	6%	
Dessicant:	Changed	
Logger# (if Δ):	DD 2078	
PT# (if Δ):		

Datalogger / Station Notes:

Note: precipitation gauge was tested giving 0.08 mm of rainfall @ 1320 h. Logger turned on @ 1305 h with PT S/N 0101352: b=0.8492210 a=-0.0336368



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/pink flagging		101.748		101.748	-
Bench Mark 2:	2" pipe 5m east of BM1		101.355		101.355	-
Top of Ice:						
Water Level:			101.748		101.748	101.748
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	18-Apr-11
Data Entry Personnel:	CM	Date:	3-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S19 - Tar River Lowland Tributary near the mouth
 UTM Location: 457315 E, 6352863 N

Site Visit Date: June 24, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.15	0.00	0.00	0.000	0.000	0.000	1.0	0.15	0.18	0.03	0.08	-0.017	-0.017	0.00	0.000	0%
1	0.20	0.30		-0.066			1.0	0.18	0.25	0.08	0.30	-0.066	-0.066	0.02	-0.001	-4%
2	0.30	0.31		-0.001			1.0	0.25	0.33	0.08	0.31	-0.001	-0.001	0.02	0.000	0%
3	0.35	0.30		0.188			1.0	0.33	0.38	0.05	0.30	0.188	0.188	0.02	0.003	8%
4	0.40	0.29		0.080			1.0	0.38	0.43	0.05	0.29	0.080	0.080	0.01	0.001	3%
5	0.45	0.28		0.266			1.0	0.43	0.48	0.05	0.28	0.266	0.266	0.01	0.004	11%
6	0.50	0.28		0.308			1.0	0.48	0.53	0.05	0.28	0.308	0.308	0.01	0.004	13%
7	0.55	0.26		0.315			1.0	0.53	0.58	0.05	0.26	0.315	0.315	0.01	0.004	12%
8	0.60	0.25		0.271			1.0	0.58	0.63	0.05	0.25	0.271	0.271	0.01	0.003	10%
9	0.65	0.24		0.249			1.0	0.63	0.68	0.05	0.24	0.249	0.249	0.01	0.003	9%
10	0.70	0.22		0.270			1.0	0.68	0.73	0.05	0.22	0.270	0.270	0.01	0.003	9%
11	0.75	0.21		0.205			1.0	0.73	0.78	0.05	0.21	0.205	0.205	0.01	0.002	6%
12	0.80	0.19		0.253			1.0	0.78	0.83	0.05	0.19	0.253	0.253	0.01	0.002	7%
13	0.85	0.17		0.255			1.0	0.83	0.88	0.05	0.17	0.255	0.255	0.01	0.002	6%
14	0.90	0.16		0.193			1.0	0.88	0.93	0.05	0.16	0.193	0.193	0.01	0.002	5%
15	0.95	0.14		0.112			1.0	0.93	0.98	0.05	0.14	0.112	0.112	0.01	0.001	2%
16	1.00	0.14		0.060			1.0	0.98	1.03	0.05	0.14	0.060	0.060	0.01	0.000	1%
17	1.05	0.13		0.001			1.0	1.03	1.08	0.05	0.13	0.001	0.001	0.01	0.000	0%
RB	1.10	0.00	0.00	0.000	0.000	0.000	1.0	1.08	1.10	0.02	0.03	0.000	0.000	0.00	0.000	0%
Total Flow															0.033	

Measurement Details:

Start Time (MST):	10:40
End Time (MST):	11:20
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast

Flow characteristics:

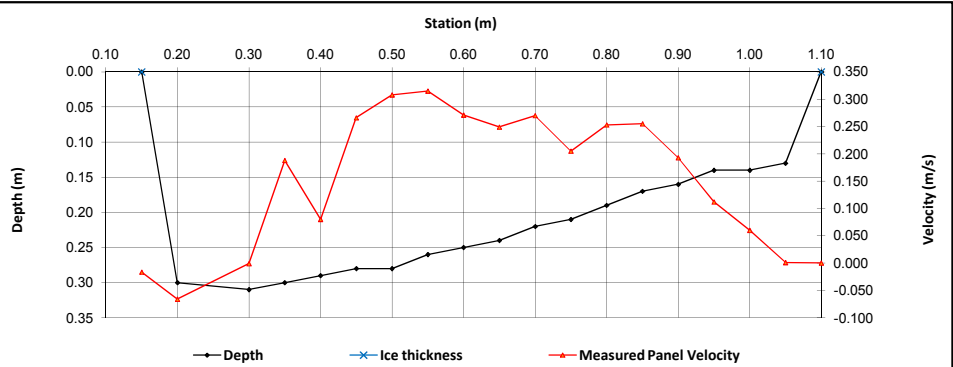
Total Flow:	0.033	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.21	(m ²)
Wetted Width:	0.95	(m)
Hydraulic Depth:	0.223	(m)
Mean Velocity:	0.158	(m/s)
Froude Number:	0.107	

Datalogger Details:

	Before	After
Transducer Reading:		0.728
Battery (Main):	14.18	
Battery (Aux):	5.44	
Datalogger Clock:	10:29	
Laptop Clock:	10:35	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	9%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):	101352	

Datalogger / Station Notes:

New datalogger installed. Precipitation 42.7mm.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/pink flagging	1.152	101.748	1.118	101.748	-
Bench Mark 2:	2" pipe 5m east of BM1	1.232	101.355	1.195	101.355	-
Top of Ice:						
Water Level:		1.565	101.335	1.526	101.340	101.338
Transducer Reading:		0.728	100.607	0.728	100.612	100.610
Other:						

General Notes:

Field Personnel:	DB SM	Trip Date:	24-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S19 - Tar River Lowland Tributary near the mouth

UTM Location: 457315 E, 6352863 N

Site Visit Date: August 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	0.40	0.00	0.00	0.000	0.000	0.000	1.0	0.40	0.43	0.03	0.06	0.001	0.001	0.00	0.000	0%
1	0.45	0.24		0.005			1.0	0.43	0.48	0.05	0.24	0.005	0.005	0.01	0.000	1%
2	0.50	0.25		-0.001			1.0	0.48	0.53	0.05	0.25	-0.001	-0.001	0.01	0.000	0%
3	0.55	0.29		-0.003			1.0	0.53	0.58	0.05	0.29	-0.003	-0.003	0.01	0.000	-1%
4	0.60	0.27		0.073			1.0	0.58	0.63	0.05	0.27	0.073	0.073	0.01	0.001	19%
5	0.65	0.27		0.044			1.0	0.63	0.68	0.05	0.27	0.044	0.044	0.01	0.001	11%
6	0.70	0.29		0.041			1.0	0.68	0.73	0.05	0.29	0.041	0.041	0.01	0.001	11%
7	0.75	0.28		0.044			1.0	0.73	0.78	0.05	0.28	0.044	0.044	0.01	0.001	12%
8	0.80	0.21		0.045			1.0	0.78	0.83	0.05	0.21	0.045	0.045	0.01	0.000	9%
9	0.85	0.20		0.070			1.0	0.83	0.88	0.05	0.20	0.070	0.070	0.01	0.001	13%
10	0.90	0.21		0.029			1.0	0.88	0.93	0.05	0.21	0.029	0.029	0.01	0.000	6%
11	0.95	0.20		0.010			1.0	0.93	0.98	0.05	0.20	0.010	0.010	0.01	0.000	2%
12	1.00	0.18		0.062			1.0	0.98	1.03	0.05	0.18	0.062	0.062	0.01	0.001	11%
13	1.05	0.17		-0.001			1.0	1.03	1.08	0.05	0.17	-0.001	-0.001	0.01	0.000	0%
14	1.10	0.15		0.034			1.0	1.08	1.15	0.07	0.15	0.034	0.034	0.01	0.000	7%
RB	1.20	0.00	0.00	0.000	0.000	0.000	1.0	1.15	1.20	0.05	0.04	0.000	0.000	0.00	0.000	0%
Total Flow															0.005	

Measurement Details:

Start Time (MST):	13:30
End Time (MST):	14:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Fair
Weather:	Sunny

Flow characteristics:

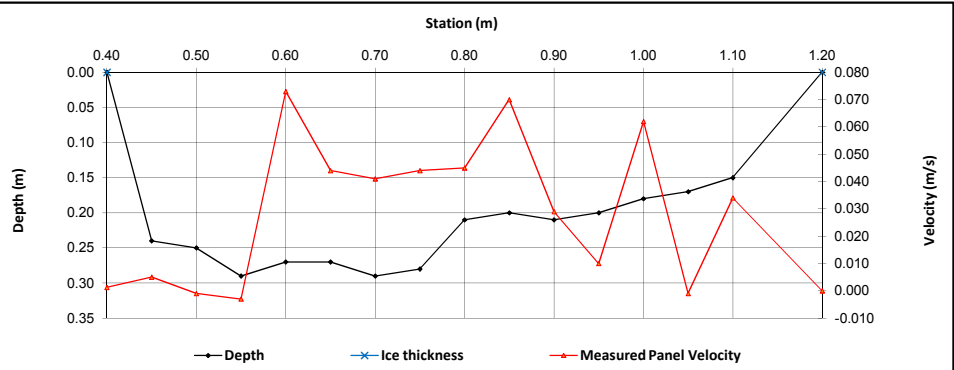
Total Flow:	0.005	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	0.17	(m ²)
Wetted Width:	0.80	(m)
Hydraulic Depth:	0.210	(m)
Mean Velocity:	0.032	(m/s)
Froude Number:	0.022	

Datalogger Details:

	Before	After
Transducer Reading:		0.673
Battery (Main):	5.44	
Battery (Aux):	13.75	
Datalogger Clock:	13:06	
Laptop Clock:	13:17	
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	7%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Rainfall sum: 79.4 mm



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/pink flagging	0.912	101.748	0.907	101.748	-
Bench Mark 2:	2" pipe 5m east of BM1	0.988	101.355	0.983	101.355	-
Top of Ice:						
Water Level:		1.373	101.287	1.370	101.285	101.286
Transducer Reading:		0.673	100.614	0.673	100.612	100.613
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	12-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S19 - Tar River Lowland Tributary near the mouth
 UTM Location: 457315 E, 6352863 N

Site Visit Date: September 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.65	0.00	0.00	0.000	0.000	0.000	1.0	0.65	0.68	0.03	0.05	0.001	0.001	0.00	0.000	0%
1	0.70	0.20		0.002			1.0	0.68	0.73	0.05	0.20	0.002	0.002	0.01	0.000	1%
2	0.75	0.20		0.007			1.0	0.73	0.78	0.05	0.20	0.007	0.007	0.01	0.000	2%
3	0.80	0.20		0.018			1.0	0.78	0.83	0.05	0.20	0.018	0.018	0.01	0.000	6%
4	0.85	0.21		0.019			1.0	0.83	0.88	0.05	0.21	0.019	0.019	0.01	0.000	7%
5	0.90	0.21		0.018			1.0	0.88	0.93	0.05	0.21	0.018	0.018	0.01	0.000	7%
6	0.95	0.22		0.016			1.0	0.93	0.98	0.05	0.22	0.016	0.016	0.01	0.000	6%
7	1.00	0.22		0.019			1.0	0.98	1.03	0.05	0.22	0.019	0.019	0.01	0.000	7%
8	1.05	0.22		0.023			1.0	1.03	1.08	0.05	0.22	0.023	0.023	0.01	0.000	9%
9	1.10	0.23		0.021			1.0	1.08	1.13	0.05	0.23	0.021	0.021	0.01	0.000	9%
10	1.15	0.23		0.019			1.0	1.13	1.18	0.05	0.23	0.019	0.019	0.01	0.000	8%
11	1.20	0.24		0.019			1.0	1.18	1.23	0.05	0.24	0.019	0.019	0.01	0.000	8%
12	1.25	0.24		0.019			1.0	1.23	1.28	0.05	0.24	0.019	0.019	0.01	0.000	8%
13	1.30	0.24		0.021			1.0	1.28	1.33	0.05	0.24	0.021	0.021	0.01	0.000	9%
14	1.35	0.23		0.014			1.0	1.33	1.38	0.05	0.23	0.014	0.014	0.01	0.000	6%
15	1.40	0.22		0.009			1.0	1.38	1.43	0.05	0.22	0.009	0.009	0.01	0.000	4%
16	1.45	0.22		0.009			1.0	1.43	1.48	0.05	0.22	0.009	0.009	0.01	0.000	4%
RB	1.50	0.00	0.00	0.000	0.000	0.000	1.0	1.48	1.50	0.02	0.06	0.002	0.002	0.00	0.000	0%
Total Flow															0.003	

Measurement Details:

Start Time (MST):	9:59
End Time (MST):	11:00
Equipment:	ADV
Method:	Wading
River Condition:	Low; open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, light rain

Flow characteristics:

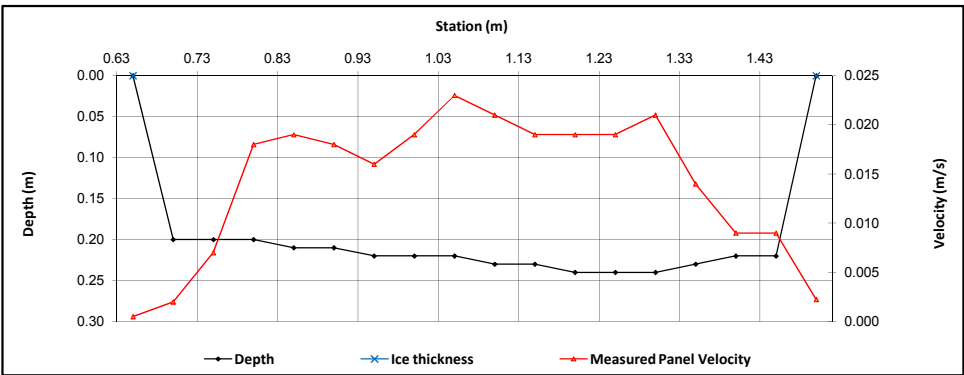
Total Flow:	0.003	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.18	(m ²)
Wetted Width:	0.85	(m)
Hydraulic Depth:	0.211	(m)
Mean Velocity:	0.016	(m/s)
Froude Number:	0.011	

Datalogger Details:

	Before	After
Transducer Reading:		0.683
Battery (Main):	5.44	
Battery (Aux):	14.38	
Rain Before (mm)	83	
Datalogger Clock:	9:45	
Laptop Clock:	10:02	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	15%	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

TBRG found blocked and unlevel, fixed.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/pink flagging	1.176	101.748	1.167	101.748	-
Bench Mark 2:	2" pipe 5m east of BM1	1.252	101.355	1.243	101.355	-
Top of Ice:						
Water Level:		1.588	101.336	1.577	101.338	101.337
Transducer Reading:		0.683	100.653	0.683	100.655	100.654
Other:						

General Notes:

GPS above BM2 (pipe).
 BM2 - 35 cm

Field Personnel:	DB, SM	12-Sep-11
Data Entry Personnel:	TK	23-Sep-11
Data Check Personnel:	DW	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S19 - Tar River Lowland Tributary near the mouth
 UTM Location: 457315 E, 6352863 N

Site Visit Date: November 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	0.30	0.00	0.00	0.000	0.000	0.000	1.0	0.30	0.34	0.04	0.05	0.014	0.014	0.00	0.000	0%
1	0.38	0.20		0.057			1.0	0.34	0.40	0.06	0.20	0.057	0.057	0.01	0.001	8%
2	0.42	0.20		0.070			1.0	0.40	0.44	0.04	0.20	0.070	0.070	0.01	0.001	7%
3	0.46	0.20		0.065			1.0	0.44	0.48	0.04	0.20	0.065	0.065	0.01	0.001	6%
4	0.50	0.20		0.071			1.0	0.48	0.52	0.04	0.20	0.071	0.071	0.01	0.001	7%
5	0.54	0.20		0.069			1.0	0.52	0.56	0.04	0.20	0.069	0.069	0.01	0.001	6%
6	0.58	0.20		0.065			1.0	0.56	0.60	0.04	0.20	0.065	0.065	0.01	0.001	6%
7	0.62	0.22		0.063			1.0	0.60	0.63	0.03	0.22	0.063	0.063	0.01	0.000	5%
8	0.64	0.20		0.067			1.0	0.63	0.65	0.02	0.20	0.067	0.067	0.00	0.000	3%
9	0.66	0.22		0.058			1.0	0.65	0.67	0.02	0.22	0.058	0.058	0.00	0.000	3%
10	0.68	0.22		0.064			1.0	0.67	0.69	0.02	0.22	0.064	0.064	0.00	0.000	3%
11	0.70	0.22		0.067			1.0	0.69	0.71	0.02	0.22	0.067	0.067	0.00	0.000	3%
12	0.72	0.22		0.062			1.0	0.71	0.73	0.02	0.22	0.062	0.062	0.00	0.000	3%
13	0.74	0.22		0.067			1.0	0.73	0.75	0.02	0.22	0.067	0.067	0.00	0.000	3%
14	0.76	0.20		0.067			1.0	0.75	0.77	0.02	0.20	0.067	0.067	0.00	0.000	3%
15	0.78	0.21		0.056			1.0	0.77	0.80	0.03	0.21	0.056	0.056	0.01	0.000	4%
16	0.82	0.21		0.058			1.0	0.80	0.84	0.04	0.21	0.058	0.058	0.01	0.000	6%
17	0.86	0.20		0.057			1.0	0.84	0.88	0.04	0.20	0.057	0.057	0.01	0.000	5%
18	0.90	0.22		0.050			1.0	0.88	0.92	0.04	0.22	0.050	0.050	0.01	0.000	5%
19	0.94	0.22		0.050			1.0	0.92	0.96	0.04	0.22	0.050	0.050	0.01	0.000	5%
20	0.98	0.21		0.040			1.0	0.96	1.00	0.04	0.21	0.040	0.040	0.01	0.000	4%
21	1.02	0.21		0.037			1.0	1.00	1.04	0.04	0.21	0.037	0.037	0.01	0.000	3%
R	1.05	0.00	0.00	0.000	0.000	0.000	1.0	1.04	1.05	0.01	0.05	0.009	0.009	0.00	0.000	0%
Total Flow															0.009	

Measurement Details:

Start Time (MST):	10:40
End Time (MST):	11:30
Equipment:	ADV
Method:	Wading
River Condition:	Ice Cover
Quality/Error (see reverse):	Excellent
Weather:	Overcast, calm, 2°C

Flow characteristics:

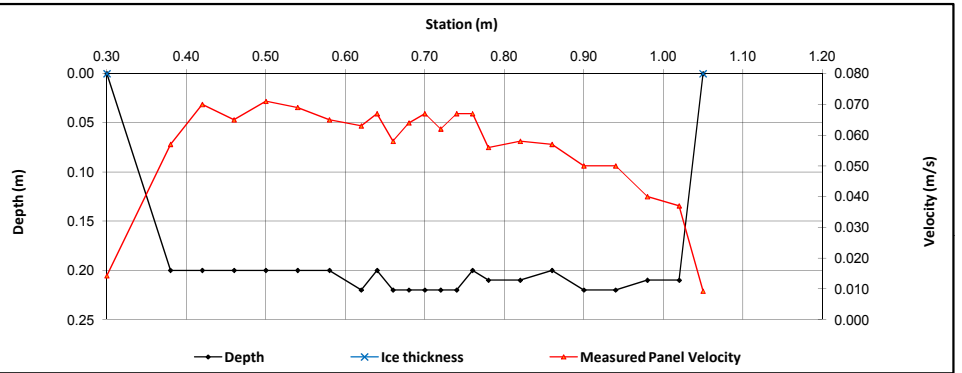
Total Flow:	0.009	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.15	(m ²)
Wetted Width:	0.75	(m)
Hydraulic Depth:	0.197	(m)
Mean Velocity:	0.058	(m/s)
Froude Number:	0.042	

Datalogger Details:

Transducer Reading:	Before	After
		0.83
Battery (Main):	5.44	
Battery (Aux):	13.06	
Datalogger Clock:	10:24	
Laptop Clock:	10:44	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	15%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Removed pd-400, PT, Batt winterized precip gauge.
 Rainfall before: 123 mm.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/pink flagging	1.070	101.748	1.053	101.748	-
Bench Mark 2:	2" pipe 5m east of BM1	1.145	101.355	1.128	101.355	-
Top of Ice:						
Water Level:		1.345	101.473	1.327	101.474	101.474
Transducer Reading:		0.830	100.643	0.830	100.644	100.644
Other:						

General Notes:

Full ice cover at station, see photos.
 PT weight left at base of logger box pole.
 BM2 Height 0.39m

Field Personnel:	SM, GB	Trip Date:	3-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S20 - Muqeg River Upland
 UTM Location: 49178 E, 6354787 N

Site Visit Date: April 21, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	9.60	0.00		0.000	0.000	0.000	1.0	9.60	9.55	0.05	0.25	0.000	0.000	0.01	0.000	0%
1	9.50	0.98			0.003	-0.001	1.0	9.55	9.35	0.20	0.98	0.001	0.001	0.20	0.000	0%
2	9.20	1.00			0.020	0.023	1.0	9.35	9.05	0.30	1.00	0.022	0.022	0.30	0.006	2%
3	8.90	0.98			0.017	0.021	1.0	9.05	8.75	0.30	0.98	0.019	0.019	0.29	0.006	2%
4	8.60	0.85			0.032	0.016	1.0	8.75	8.45	0.30	0.85	0.024	0.024	0.26	0.006	2%
5	8.30	1.02			0.026	0.019	1.0	8.45	8.15	0.30	1.02	0.023	0.023	0.31	0.007	2%
6	8.00	0.88			0.057	0.054	1.0	8.15	7.85	0.30	0.88	0.056	0.056	0.26	0.015	5%
7	7.70	0.94			0.051	0.073	1.0	7.85	7.55	0.30	0.94	0.062	0.062	0.28	0.017	6%
8	7.40	0.94			0.048	0.006	1.0	7.55	7.25	0.30	0.94	0.027	0.027	0.28	0.008	3%
9	7.10	0.72		0.082			1.0	7.25	6.95	0.30	0.72	0.082	0.082	0.22	0.018	6%
10	6.80	0.78			0.080	0.086	1.0	6.95	6.65	0.30	0.78	0.083	0.083	0.23	0.019	7%
11	6.50	0.88			0.080	0.080	1.0	6.65	6.35	0.30	0.88	0.080	0.080	0.26	0.021	7%
12	6.20	1.02			0.065	0.083	1.0	6.35	6.05	0.30	1.02	0.074	0.074	0.31	0.023	8%
13	5.90	1.02			0.073	0.081	1.0	6.05	5.75	0.30	1.02	0.077	0.077	0.31	0.024	8%
14	5.60	1.00			0.071	0.078	1.0	5.75	5.45	0.30	1.00	0.075	0.075	0.30	0.022	8%
15	5.30	0.94			0.072	0.060	1.0	5.45	5.15	0.30	0.94	0.066	0.066	0.28	0.019	7%
16	5.00	1.00			0.049	0.068	1.0	5.15	4.85	0.30	1.00	0.059	0.059	0.30	0.018	6%
17	4.70	0.94			0.057	0.058	1.0	4.85	4.50	0.35	0.94	0.058	0.058	0.33	0.019	7%
18	4.30	0.86			0.050	0.047	1.0	4.50	4.15	0.35	0.86	0.049	0.049	0.30	0.015	5%
19	4.00	0.80			0.028	0.047	1.0	4.15	3.85	0.30	0.80	0.038	0.038	0.24	0.009	3%
20	3.70	0.70		0.041			1.0	3.85	3.55	0.30	0.70	0.041	0.041	0.21	0.009	3%
21	3.40	0.50		0.024			1.0	3.55	3.30	0.25	0.50	0.024	0.024	0.13	0.003	1%
22	3.20	0.46		0.007			1.0	3.30	3.10	0.20	0.46	0.007	0.007	0.09	0.001	0%
LB	3.00	0.00		0.000	0.000	0.000	1.0	3.10	3.00	0.10	0.12	0.002	0.002	0.01	0.000	0%
Total Flow															0.283	

Measurement Details:

Start Time (MST):	14:00
End Time (MST):	16:00
Equipment:	ADV
Method:	-
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 3°C

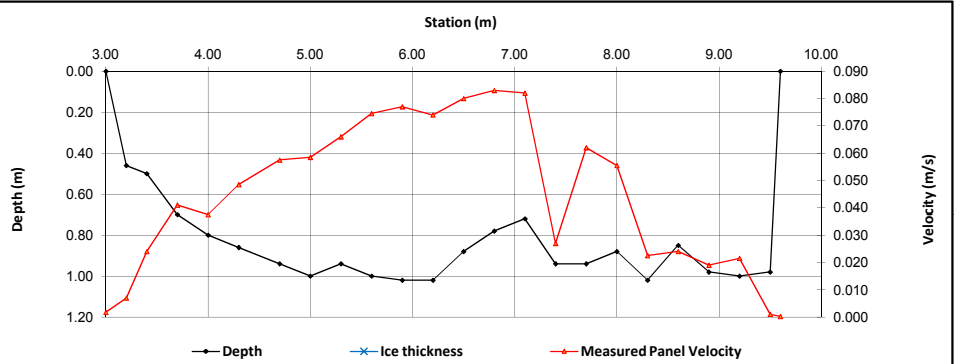
Flow characteristics:

Total Flow:	0.283	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	5.71	(m ²)
Wetted Width:	6.45	(m)
Hydraulic Depth:	0.885	(m)
Mean Velocity:	0.050	(m/s)
Froude Number:	0.017	

Datalogger Details:

	Before	After
Transducer Reading:		0.791
Battery (Main):	14.97	
Battery (Aux):	4.17	
Datalogger Clock:	15:38	
Laptop Clock:	15:39	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	41%	
Dessicant:	New	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar	1.345	327.811	1.335	327.811	-
Bench Mark 2:	T-post near logger	0.202	328.976	0.190	328.976	-
Top of Ice:						
Water Level:		2.665	326.491	2.651	326.495	326.493
Transducer Reading:		0.791	325.700	0.791	325.704	325.702
Other:						

General Notes:

Field Personnel:	DB, BL	Trip Date:	21-Apr-11
Data Entry Personnel:	CM	Date:	3-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S20 - Muqeg River Upland
 UTM Location: 49178 E, 6354787 N

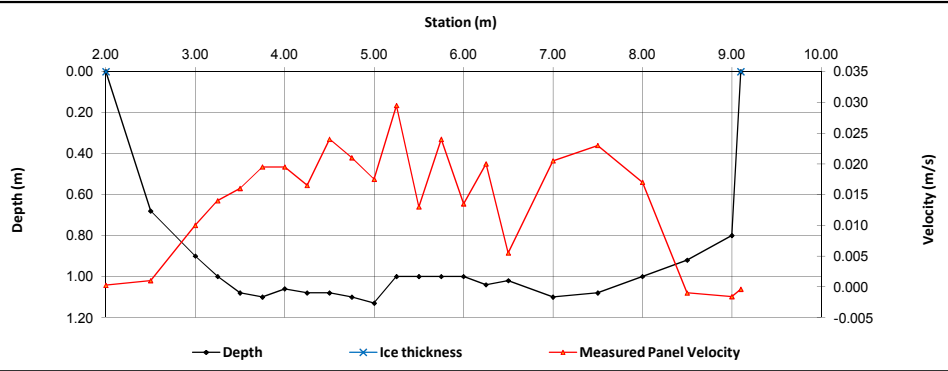
Site Visit Date: June 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	2.00	0.00	0.00	0.000	0.000	0.000	1.0	2.00	2.25	0.25	0.17	0.000	0.000	0.04	0.000	0%
1	2.50	0.68			-0.002	0.004	1.0	2.25	2.75	0.50	0.68	0.001	0.001	0.34	0.000	0%
2	3.00	0.90			0.004	0.016	1.0	2.75	3.13	0.38	0.90	0.010	0.010	0.34	0.003	3%
3	3.25	1.00			0.016	0.012	1.0	3.13	3.38	0.25	1.00	0.014	0.014	0.25	0.004	3%
4	3.50	1.08			0.010	0.022	1.0	3.38	3.63	0.25	1.08	0.016	0.016	0.27	0.004	4%
5	3.75	1.10			0.008	0.031	1.0	3.63	3.88	0.25	1.10	0.020	0.020	0.28	0.005	5%
6	4.00	1.06			0.019	0.020	1.0	3.88	4.13	0.25	1.06	0.020	0.020	0.27	0.005	5%
7	4.25	1.08			0.019	0.014	1.0	4.13	4.38	0.25	1.08	0.017	0.017	0.27	0.004	4%
8	4.50	1.08			0.023	0.025	1.0	4.38	4.63	0.25	1.08	0.024	0.024	0.27	0.006	6%
9	4.75	1.10			0.017	0.025	1.0	4.63	4.88	0.25	1.10	0.021	0.021	0.28	0.006	6%
10	5.00	1.13			0.020	0.015	1.0	4.88	5.13	0.25	1.13	0.018	0.018	0.28	0.005	5%
11	5.25	1.00			0.013	0.046	1.0	5.13	5.38	0.25	1.00	0.030	0.030	0.25	0.007	7%
12	5.50	1.00			0.018	0.008	1.0	5.38	5.63	0.25	1.00	0.013	0.013	0.25	0.003	3%
13	5.75	1.00			0.013	0.035	1.0	5.63	5.88	0.25	1.00	0.024	0.024	0.25	0.006	6%
14	6.00	1.00			0.004	0.023	1.0	5.88	6.13	0.25	1.00	0.014	0.014	0.25	0.003	3%
15	6.25	1.04			0.009	0.031	1.0	6.13	6.38	0.25	1.04	0.020	0.020	0.26	0.005	5%
16	6.50	1.02			0.005	0.006	1.0	6.38	6.75	0.38	1.02	0.006	0.006	0.38	0.002	2%
17	7.00	1.10			0.008	0.033	1.0	6.75	7.25	0.50	1.10	0.021	0.021	0.55	0.011	11%
18	7.50	1.08			0.013	0.033	1.0	7.25	7.75	0.50	1.08	0.023	0.023	0.54	0.012	12%
19	8.00	1.00			0.015	0.019	1.0	7.75	8.25	0.50	1.00	0.017	0.017	0.50	0.009	8%
20	8.50	0.92			-0.007	0.005	1.0	8.25	8.75	0.50	0.92	-0.001	-0.001	0.46	0.000	0%
21	9.00	0.80			-0.002	-0.001	1.0	8.75	9.05	0.30	0.80	-0.002	-0.002	0.24	0.000	0%
LB	9.10	0.00	0.00	0.000	0.000	0.000	1.0	9.05	9.10	0.05	0.20	0.000	0.000	0.01	0.000	0%
Total Flow															0.102	

Measurement Details:	
Start Time (MST):	9:30
End Time (MST):	11:30
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Cloudy, 14 deg C



Flow characteristics:		
Total Flow:	0.102	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	6.82	(m ²)
Wetted Width:	7.10	(m)
Hydraulic Depth:	0.961	(m)
Mean Velocity:	0.015	(m/s)
Froude Number:	0.005	

Datalogger Details:		
	Before	After
Transducer Reading:		0.946
Battery (Main):	14.65	
Battery (Aux):	-	
Datalogger Clock:	8:34	
Laptop Clock:	8:36	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	48%	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar	1.187	327.811	1.182	327.811	-
Bench Mark 2:	T-post near logger	0.042	328.976	0.035	328.976	-
Top of Ice:						
Water Level:		2.430	326.588	2.425	326.586	326.587
Transducer Reading:		0.946	325.642	0.946	325.640	325.641
Other:						

General Notes:

Field Personnel:	JO, SM	Trip Date:	17-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S20 - Muqeg River Upland
 UTM Location: 49178 E, 6354787 N

Site Visit Date: August 10, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
RB	5.20	0.00	0.00	0.000	0.000	0.000	1.0	5.20	5.30	0.10	0.20	0.001	0.001	0.02	0.000	0%
1	5.40	0.80			0.003	0.008	1.0	5.30	5.65	0.35	0.80	0.006	0.006	0.28	0.002	4%
2	5.90	1.08			0.004	0.002	1.0	5.65	6.05	0.40	1.08	0.003	0.003	0.43	0.001	4%
3	6.20	1.18			0.011	-0.004	1.0	6.05	6.35	0.30	1.18	0.004	0.004	0.35	0.001	3%
4	6.50	1.26			0.011	-0.006	1.0	6.35	6.65	0.30	1.26	0.003	0.003	0.38	0.001	3%
5	6.80	1.28			0.006	0.008	1.0	6.65	6.95	0.30	1.28	0.007	0.007	0.38	0.003	7%
6	7.10	1.26			0.005	0.003	1.0	6.95	7.25	0.30	1.26	0.004	0.004	0.38	0.002	4%
7	7.40	1.22			-0.001	-0.004	1.0	7.25	7.55	0.30	1.22	-0.003	-0.003	0.37	-0.001	-3%
8	7.70	1.26			0.004	0.004	1.0	7.55	7.85	0.30	1.26	0.004	0.004	0.38	0.002	4%
9	8.00	1.26			0.017	0.026	1.0	7.85	8.15	0.30	1.26	0.022	0.022	0.38	0.008	22%
10	8.30	1.30			-0.041	0.004	1.0	8.15	8.45	0.30	1.30	-0.019	-0.019	0.39	-0.007	-20%
11	8.60	1.00			0.015	0.033	1.0	8.45	8.75	0.30	1.00	0.024	0.024	0.30	0.007	20%
12	8.90	0.96			0.026	0.007	1.0	8.75	9.05	0.30	0.96	0.017	0.017	0.29	0.005	13%
13	9.20	0.97			0.004	0.010	1.0	9.05	9.35	0.30	0.97	0.007	0.007	0.29	0.002	6%
14	9.50	1.28			0.008	0.017	1.0	9.35	9.65	0.30	1.28	0.013	0.013	0.38	0.005	13%
15	9.80	1.26			-0.001	0.004	1.0	9.65	9.95	0.30	1.26	0.002	0.002	0.38	0.001	2%
16	10.10	1.26			0.003	0.003	1.0	9.95	10.25	0.30	1.26	0.003	0.003	0.38	0.001	3%
17	10.40	1.10			-0.001	0.007	1.0	10.25	10.55	0.30	1.10	0.003	0.003	0.33	0.001	3%
18	10.70	1.28			0.003	0.004	1.0	10.55	10.85	0.30	1.28	0.004	0.004	0.38	0.001	4%
19	11.00	1.25			0.003	0.005	1.0	10.85	11.15	0.30	1.25	0.004	0.004	0.38	0.002	4%
20	11.30	1.26			0.007	-0.002	1.0	11.15	11.50	0.35	1.26	0.003	0.003	0.44	0.001	3%
LB	11.70	0.00	0.00	0.000	0.000	0.000	1.0	11.50	11.70	0.20	0.32	0.001	0.001	0.06	0.000	0%
Total Flow															0.036	

Measurement Details:

Start Time (MST):	8:30
End Time (MST):	9:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Sunny

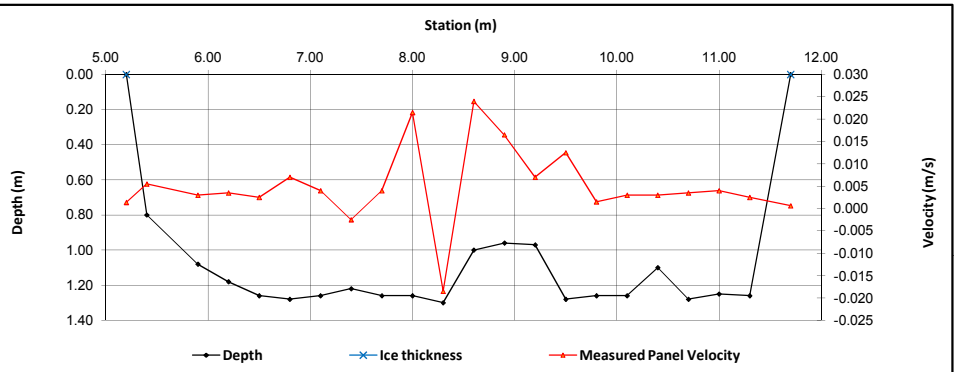
Flow characteristics:

Total Flow:	0.036	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	7.35	(m ²)
Wetted Width:	6.50	(m)
Hydraulic Depth:	1.131	(m)
Mean Velocity:	0.005	(m/s)
Froude Number:	0.001	

Datalogger Details:

	Before	After
Transducer Reading:		1.115
Battery (Main):	14.50	
Battery (Aux):	4.28	
Datalogger Clock:	8:31	
Laptop Clock:	8:36	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	56%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar	4.291	327.811	4.276	327.811	-
Bench Mark 2:	T-post near logger	3.140	328.976	3.123	328.976	-
Top of Ice:						
Water Level:		5.347	326.755	5.328	326.759	326.757
Transducer Reading:		1.115	325.640	1.115	325.644	325.642
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	10-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S20 - Muqeg River Upland
 UTM Location: 49178 E, 6354787 N

Site Visit Date: September 14, 2011



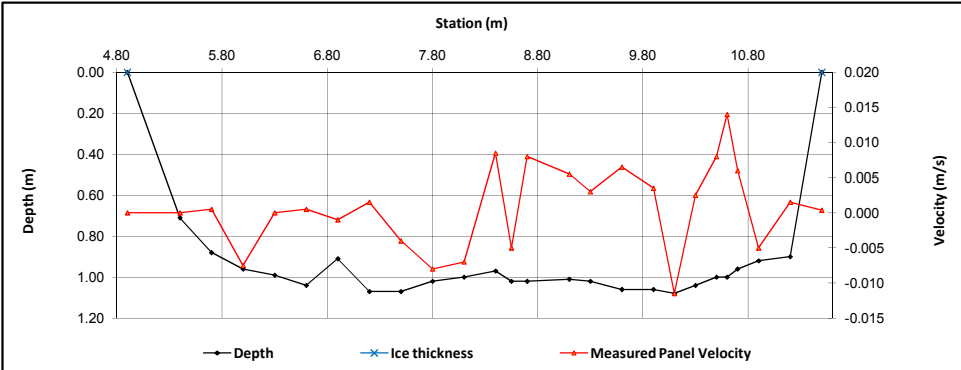
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	4.90	0.00	0.00	0.000	0.000	0.000	1.0	4.90	5.15	0.25	0.18	0.000	0.000	0.04	0.000	0%
1	5.40	0.71		0.000			1.0	5.15	5.55	0.40	0.71	0.000	0.000	0.28	0.000	0%
2	5.70	0.88			0.003	-0.002	1.0	5.55	5.85	0.30	0.88	0.001	0.001	0.26	0.000	6%
3	6.00	0.96			-0.009	-0.006	1.0	5.85	6.15	0.30	0.96	-0.008	-0.008	0.29	-0.002	-106%
4	6.30	0.99			0.000	0.012	1.0	6.15	6.45	0.30	0.99	0.000	0.000	0.30	0.000	0%
5	6.60	1.04			-0.006	0.007	1.0	6.45	6.75	0.30	1.04	0.001	0.001	0.31	0.000	8%
6	6.90	0.91			-0.001	-0.001	1.0	6.75	7.05	0.30	0.91	-0.001	-0.001	0.27	0.000	-13%
7	7.20	1.07			-0.007	0.010	1.0	7.05	7.35	0.30	1.07	0.002	0.002	0.32	0.000	24%
8	7.50	1.07			0.006	-0.014	1.0	7.35	7.65	0.30	1.07	-0.004	-0.004	0.32	-0.001	-63%
9	7.80	1.02			-0.002	-0.014	1.0	7.65	7.95	0.30	1.02	-0.008	-0.008	0.31	-0.002	-120%
10	8.10	1.00			-0.005	-0.009	1.0	7.95	8.25	0.30	1.00	-0.007	-0.007	0.30	-0.002	-103%
11	8.40	0.97			0.009	0.008	1.0	8.25	8.48	0.23	0.97	0.009	0.009	0.22	0.002	91%
12	8.55	1.02			-0.012	0.002	1.0	8.48	8.63	0.15	1.02	-0.005	-0.005	0.15	-0.001	-38%
13	8.70	1.02			0.013	0.003	1.0	8.63	8.90	0.27	1.02	0.008	0.008	0.28	0.002	110%
14	9.10	1.01			0.005	0.006	1.0	8.90	9.20	0.30	1.01	0.006	0.006	0.30	0.002	82%
15	9.30	1.02			-0.001	0.007	1.0	9.20	9.45	0.25	1.02	0.003	0.003	0.26	0.001	38%
16	9.60	1.06			0.011	0.002	1.0	9.45	9.75	0.30	1.06	0.007	0.007	0.32	0.002	102%
17	9.90	1.06			0.007	0.000	1.0	9.75	10.00	0.25	1.06	0.004	0.004	0.27	0.001	46%
18	10.10	1.08			-0.020	-0.003	1.0	10.00	10.20	0.20	1.08	-0.012	-0.012	0.22	-0.002	-122%
19	10.30	1.04			0.001	0.004	1.0	10.20	10.40	0.20	1.04	0.003	0.003	0.21	0.001	26%
20	10.50	1.00			0.006	0.010	1.0	10.40	10.55	0.15	1.00	0.008	0.008	0.15	0.001	59%
21	10.80	1.00			0.015	0.013	1.0	10.55	10.65	0.10	1.00	0.014	0.014	0.10	0.001	69%
22	10.70	0.96			0.005	0.007	1.0	10.65	10.80	0.15	0.96	0.006	0.006	0.14	0.001	43%
23	10.90	0.92			-0.015	0.005	1.0	10.80	11.05	0.25	0.92	-0.005	-0.005	0.23	-0.001	-57%
24	11.20	0.90			0.003	0.000	1.0	11.05	11.35	0.30	0.90	0.002	0.002	0.27	0.000	20%
LB	11.50	0.00	0.00	0.000	0.000	0.000	1.0	11.35	11.50	0.15	0.23	0.000	0.000	0.03	0.000	1%
Total Flow															0.002	

Measurement Details:	
Start Time (MST):	8:20
End Time (MST):	9:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Sunny, -6°C

Flow characteristics:		
Total Flow:	0.002	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	6.15	(m ²)
Wetted Width:	6.60	(m)
Hydraulic Depth:	0.933	(m)
Mean Velocity:	0.000	(m/s)
Froude Number:	0.000	

Datalogger Details:		
	Before	After
Transducer Reading:		0.899
Battery (Main):	4.26	
Battery (Aux):	14.80	
Datalogger Clock:	8:20	
Laptop Clock:	8:23	
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	60%	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar	1.383	327.811	1.362	327.811	-
Bench Mark 2:	T-post near logger	0.217	328.976	0.197	328.976	-
Top of Ice:						
Water Level:		2.650	326.544	2.628	326.545	326.545
Transducer Reading:		0.899	325.645	0.899	325.646	325.646
Other:						

General Notes:
 Low water level; minimal flow.

Field Personnel:	DB, SM	Trip Date:	14-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S20 - Mukeg River Upland
 UTM Location: 49178 E, 6354787 N

Site Visit Date: November 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
				(m/s)	(m/s)	(m/s)	(m)				(m)	(m/s)	(m/s)	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	13:45
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear, Breezy, -4°C

Flow characteristics:

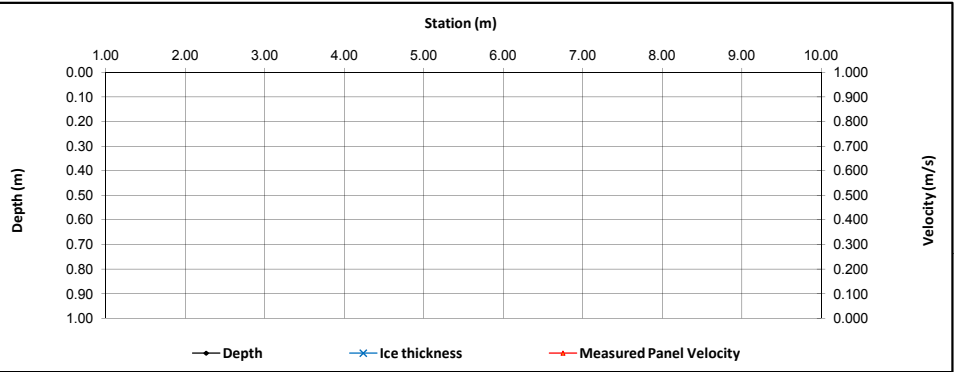
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.900
Battery (Main):	4.22	
Battery (Aux):	15.10	
Datalogger Clock:	13:04	
Laptop Clock:	13:12	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	67%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Removed DD-128, PT, Battery



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar	1.230	327.811	1.256	327.811	-
Bench Mark 2:	T-post near logger	0.064	328.976	0.091	328.976	-
Top of Ice:		2.416	326.625	2.443	326.624	326.625
Water Level:		2.421	326.620	2.450	326.617	326.619
Transducer Reading:		0.900	325.720	0.900	325.717	325.719
Other:						

General Notes:

BM1: 0.76m
 BM2: 0.71m
 Flow measurement not performed due to ice safety concerns.

Field Personnel:	SM, GB	Trip Date:	5-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S22 - Muskeg Creek near the mouth

UTM Location: 481036 E, 6348856 N

Site Visit Date: April 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.70	0.00		0.000	0.000	0.000	1.0	0.70	0.85	0.15	0.04	0.005	0.005	0.01	0.000	0%
1	1.00	0.16		0.020			1.0	0.85	1.25	0.40	0.16	0.020	0.020	0.06	0.001	0%
2	1.50	0.22		0.046			1.0	1.25	1.75	0.50	0.22	0.046	0.046	0.11	0.005	1%
3	2.00	0.24		0.323			1.0	1.75	2.13	0.38	0.24	0.323	0.323	0.09	0.029	6%
4	2.25	0.28		0.245			1.0	2.13	2.38	0.25	0.28	0.245	0.245	0.07	0.017	3%
5	2.50	0.34		0.209			1.0	2.38	2.63	0.25	0.34	0.209	0.209	0.09	0.018	3%
6	2.75	0.36		0.373			1.0	2.63	2.88	0.25	0.36	0.373	0.373	0.09	0.034	7%
7	3.00	0.38		0.371			1.0	2.88	3.13	0.25	0.38	0.371	0.371	0.10	0.035	7%
8	3.25	0.38		0.314			1.0	3.13	3.38	0.25	0.38	0.314	0.314	0.10	0.030	6%
9	3.50	0.42		0.325			1.0	3.38	3.63	0.25	0.42	0.325	0.325	0.11	0.034	7%
10	3.75	0.40		0.308			1.0	3.63	3.88	0.25	0.40	0.308	0.308	0.10	0.031	6%
11	4.00	0.42		0.333			1.0	3.88	4.13	0.25	0.42	0.333	0.333	0.11	0.035	7%
12	4.25	0.40		0.285			1.0	4.13	4.38	0.25	0.40	0.285	0.285	0.10	0.029	6%
13	4.50	0.40		0.389			1.0	4.38	4.63	0.25	0.40	0.389	0.389	0.10	0.039	8%
14	4.75	0.42		0.413			1.0	4.63	4.88	0.25	0.42	0.413	0.413	0.11	0.043	8%
15	5.00	0.40		0.391			1.0	4.88	5.13	0.25	0.40	0.391	0.391	0.10	0.039	8%
16	5.25	0.44		0.305			1.0	5.13	5.38	0.25	0.44	0.305	0.305	0.11	0.034	7%
17	5.50	0.48		0.278			1.0	5.38	5.63	0.25	0.48	0.278	0.278	0.12	0.033	6%
18	5.75	0.44		0.204			1.0	5.63	5.88	0.25	0.44	0.204	0.204	0.11	0.022	4%
19	6.00	0.35		0.066			1.0	5.88	6.13	0.25	0.35	0.066	0.066	0.09	0.006	1%
20	6.25	0.26		0.010			1.0	6.13	6.48	0.35	0.26	0.010	0.010	0.09	0.001	0%
Left	6.70	0.00		0.000	0.000	0.000	1.0	6.48	6.70	0.23	0.07	0.003	0.003	0.01	0.000	0%
Total Flow														0.515		

Measurement Details:

Start Time (MST):	7:50
End Time (MST):	8:35
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 2°C

Flow characteristics:

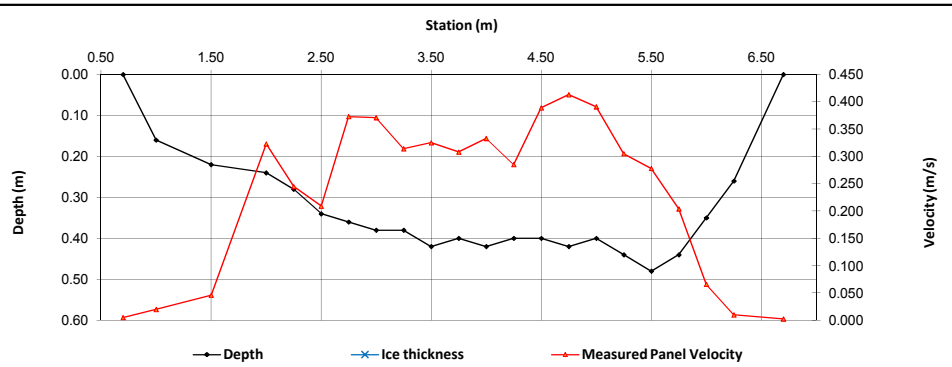
Total Flow:	0.515	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.95	(m ²)
Wetted Width:	6.00	(m)
Hydraulic Depth:	0.326	(m)
Mean Velocity:	0.264	(m/s)
Froude Number:	0.148	

Datalogger Details:

	Before	After
Transducer Reading:		0.976
Battery (Main):	5.44	
Battery (Aux):	14.62	
Datalogger Clock:	8:06	
Laptop Clock:	8:06	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	0%	
Dessicant:	New	
Logger# (if Δ):	1909	
PT# (if Δ):	602 354	

Datalogger / Station Notes:

m=1.410862, b=-0.070684



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar on RH bank nr mast	0.408	306.476	0.397	306.476	-
Bench Mark 2:	Nail in tree w/orange flag	1.661	305.225	1.648	305.225	-
Top of Ice:						
Water Level:		3.447	303.437	3.436	303.437	303.437
Transducer Reading:		0.976	302.461	0.976	302.461	302.461
Other:						

General Notes:

Field Personnel:	SG, DB	Trip Date:	26-Apr-11
Data Entry Personnel:	CM	Date:	3-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S22 - Muskeg Creek near the mouth

UTM Location: 481036 E, 6348856 N

Site Visit Date: June 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TR	0.10	0.00	0.00	0.000	0.000	0.000	1.0	0.10	0.25	0.15	0.01	0.038	0.038	0.00	0.000	0%
1	0.40	0.02		0.152			1.0	0.25	0.46	0.21	0.02	0.152	0.152	0.00	0.001	1%
2	0.52	0.04		0.063			1.0	0.46	0.58	0.12	0.04	0.063	0.063	0.00	0.000	0%
3	0.64	0.06		0.303			1.0	0.58	0.70	0.12	0.06	0.303	0.303	0.01	0.002	2%
4	0.76	0.07		0.296			1.0	0.70	0.82	0.12	0.07	0.296	0.296	0.01	0.002	2%
5	0.88	0.11		0.377			1.0	0.82	0.94	0.12	0.11	0.377	0.377	0.01	0.005	4%
6	1.00	0.12		0.382			1.0	0.94	1.06	0.12	0.12	0.382	0.382	0.01	0.006	5%
7	1.12	0.16		0.430			1.0	1.06	1.18	0.12	0.16	0.430	0.430	0.02	0.008	7%
8	1.24	0.16		0.681			1.0	1.18	1.30	0.12	0.16	0.681	0.681	0.02	0.013	11%
9	1.36	0.16		0.565			1.0	1.30	1.42	0.12	0.16	0.565	0.565	0.02	0.011	9%
10	1.48	0.18		0.727			1.0	1.42	1.54	0.12	0.18	0.727	0.727	0.02	0.016	13%
11	1.60	0.20		0.788			1.0	1.54	1.66	0.12	0.20	0.788	0.788	0.02	0.019	16%
12	1.72	0.20		0.805			1.0	1.66	1.78	0.12	0.20	0.805	0.805	0.02	0.019	16%
13	1.84	0.20		0.632			1.0	1.78	1.90	0.12	0.20	0.632	0.632	0.02	0.015	12%
14	1.96	0.16		0.225			1.0	1.90	2.02	0.12	0.16	0.225	0.225	0.02	0.004	4%
15	2.08	0.14		0.002			1.0	2.02	2.14	0.12	0.14	0.002	0.002	0.02	0.000	0%
16	2.20	0.08		0.003			1.0	2.14	2.39	0.25	0.08	0.003	0.003	0.02	0.000	0%
TL	2.57	0.00	0.00	0.000	0.000	0.000	1.0	2.39	2.57	0.19	0.02	0.001	0.001	0.00	0.000	0%
Total Flow															0.122	

Measurement Details:

Start Time (MST):	14:00
End Time (MST):	14:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Rain, 18 deg C

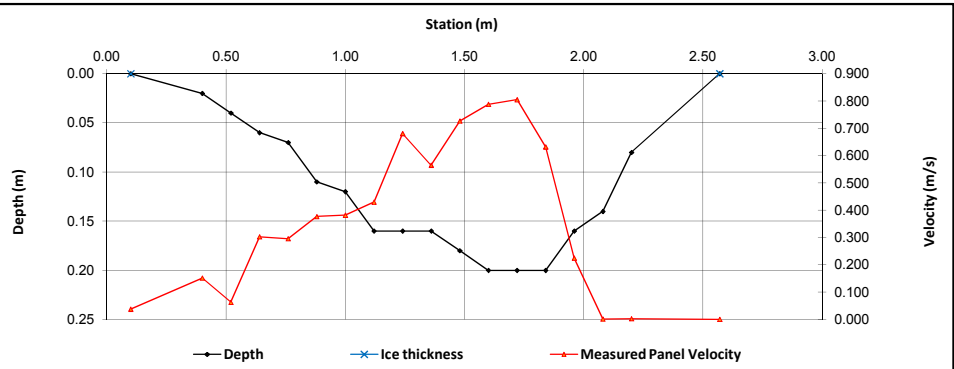
Flow characteristics:

Total Flow:	0.122	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.26	(m ²)
Wetted Width:	2.47	(m)
Hydraulic Depth:	0.107	(m)
Mean Velocity:	0.462	(m/s)
Froude Number:	0.452	

Datalogger Details:

	Before	After
Transducer Reading:		0.775
Battery (Main):	14.11	
Battery (Aux):	5.44	
Datalogger Clock:	12:56	
Laptop Clock:	13:00	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	2%	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar on RH bank nr mast	0.468	306.476	0.464	306.476	-
Bench Mark 2:	Nail in tree w/orange flag	1.732	305.225	1.725	305.225	-
Top of Ice:						
Water Level:		3.685	303.259	3.682	303.258	303.259
Transducer Reading:		0.775	302.484	0.775	302.483	302.484
Other:						

General Notes:

Note: significant edge effects close to the TL bank - 3 sets of measurements were removed due to poor velocity measurements

Field Personnel:	JO, SM	Trip Date:	17-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S22 - Muskeg Creek near the mouth

UTM Location: 481036 E, 6348856 N

Site Visit Date: August 10, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.40	0.00	0.00	0.000	0.000	0.000	1.0	0.40	0.50	0.10	0.01	0.123	0.123	0.00	0.000	0%
1	0.60	0.04		0.491			1.0	0.50	0.65	0.15	0.04	0.491	0.491	0.01	0.003	5%
2	0.70	0.05		0.246			1.0	0.65	0.75	0.10	0.05	0.246	0.246	0.01	0.001	2%
3	0.80	0.06		0.349			1.0	0.75	0.85	0.10	0.06	0.349	0.349	0.01	0.002	4%
4	0.90	0.08		0.453			1.0	0.85	0.95	0.10	0.08	0.453	0.453	0.01	0.004	6%
5	1.00	0.10		0.395			1.0	0.95	1.05	0.10	0.10	0.395	0.395	0.01	0.004	7%
6	1.10	0.09		0.345			1.0	1.05	1.15	0.10	0.09	0.345	0.345	0.01	0.003	5%
7	1.20	0.08		0.364			1.0	1.15	1.25	0.10	0.08	0.364	0.364	0.01	0.003	5%
8	1.30	0.09		0.492			1.0	1.25	1.33	0.08	0.09	0.492	0.492	0.01	0.003	6%
9	1.35	0.10		0.551			1.0	1.33	1.38	0.05	0.10	0.551	0.551	0.00	0.003	5%
10	1.40	0.10		0.562			1.0	1.38	1.43	0.05	0.10	0.562	0.562	0.00	0.003	5%
11	1.45	0.11		0.656			1.0	1.43	1.48	0.05	0.11	0.656	0.656	0.01	0.004	6%
12	1.50	0.14		0.743			1.0	1.48	1.53	0.05	0.14	0.743	0.743	0.01	0.005	9%
13	1.55	0.12		0.726			1.0	1.53	1.58	0.05	0.12	0.726	0.726	0.01	0.004	7%
14	1.60	0.15		0.678			1.0	1.58	1.63	0.05	0.15	0.678	0.678	0.01	0.005	9%
15	1.65	0.13		0.493			1.0	1.63	1.68	0.05	0.13	0.493	0.493	0.01	0.003	5%
16	1.70	0.14		0.546			1.0	1.68	1.73	0.05	0.14	0.546	0.546	0.01	0.004	6%
17	1.75	0.14		0.243			1.0	1.73	1.78	0.05	0.14	0.243	0.243	0.01	0.002	3%
18	1.80	0.13		0.304			1.0	1.78	1.85	0.08	0.13	0.304	0.304	0.01	0.003	5%
19	1.90	0.09		0.071			1.0	1.85	1.95	0.10	0.09	0.071	0.071	0.01	0.001	1%
20	2.00	0.04		0.001			1.0	1.95	2.10	0.15	0.04	0.001	0.001	0.01	0.000	0%
LB	2.20	0.00	0.00	0.000	0.000	0.000	1.0	2.10	2.20	0.10	0.01	0.000	0.000	0.00	0.000	0%
Total Flow														0.059		

Measurement Details:

Start Time (MST):	10:15
End Time (MST):	10:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

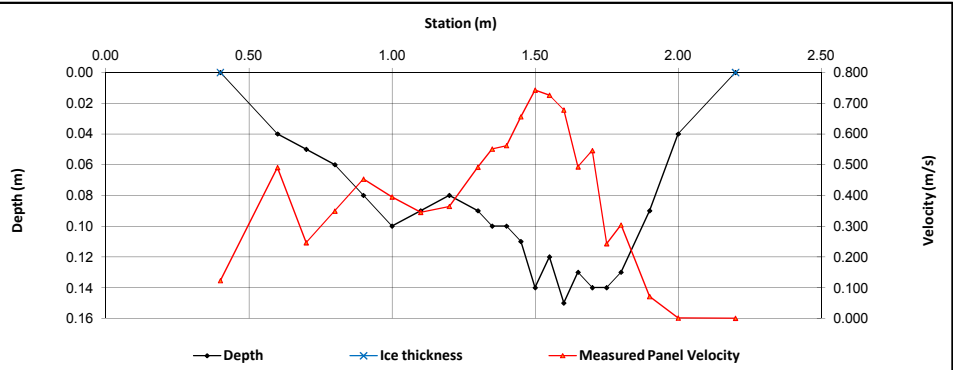
Flow characteristics:

Total Flow:	0.059	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.14	(m ²)
Wetted Width:	1.80	(m)
Hydraulic Depth:	0.079	(m)
Mean Velocity:	0.419	(m/s)
Froude Number:	0.476	

Datalogger Details:

	Before	After
Transducer Reading:		0.74
Battery (Main):	13.67	
Battery (Aux):	5.44	
Datalogger Clock:	10:08	
Laptop Clock:	10:18	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	4%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar on RH bank nr mast	0.320	306.476	0.301	306.476	-
Bench Mark 2:	Nail in tree w/orange flag	1.587	305.225	1.564	305.225	-
Top of Ice:						
Water Level:		3.601	303.195	3.581	303.196	303.196
Transducer Reading:		0.740	302.455	0.740	302.456	302.456
Other:						

General Notes:

Field Personnel:	SG, SM	Trip Date:	10-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S22 - Muskeg Creek near the mouth

UTM Location: 481036 E, 6348856 N

Site Visit Date: September 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.80	0.00	0.00	0.000	0.000	0.000	1.0	0.80	0.90	0.10	0.02	-0.001	-0.001	0.00	0.000	0%
1	1.00	0.06		-0.004			1.0	0.90	1.10	0.20	0.06	-0.004	-0.004	0.01	0.000	-1%
2	1.20	0.09		0.009			1.0	1.10	1.30	0.20	0.09	0.009	0.009	0.02	0.000	2%
3	1.40	0.09		0.010			1.0	1.30	1.50	0.20	0.09	0.010	0.010	0.02	0.000	3%
4	1.60	0.10		0.019			1.0	1.50	1.70	0.20	0.10	0.019	0.019	0.02	0.000	5%
5	1.80	0.12		0.007			1.0	1.70	1.90	0.20	0.12	0.007	0.007	0.02	0.000	2%
6	2.00	0.14		0.011			1.0	1.90	2.10	0.20	0.14	0.011	0.011	0.03	0.000	4%
7	2.20	0.14		0.011			1.0	2.10	2.30	0.20	0.14	0.011	0.011	0.03	0.000	4%
8	2.40	0.14		0.019			1.0	2.30	2.50	0.20	0.14	0.019	0.019	0.03	0.001	8%
9	2.60	0.13		0.014			1.0	2.50	2.70	0.20	0.13	0.014	0.014	0.03	0.000	5%
10	2.80	0.13		0.021			1.0	2.70	2.90	0.20	0.13	0.021	0.021	0.03	0.001	8%
11	3.00	0.13		0.016			1.0	2.90	3.10	0.20	0.13	0.016	0.016	0.03	0.000	6%
12	3.20	0.13		0.024			1.0	3.10	3.30	0.20	0.13	0.024	0.024	0.03	0.001	9%
13	3.40	0.13		0.013			1.0	3.30	3.50	0.20	0.13	0.013	0.013	0.03	0.000	5%
14	3.60	0.13		0.013			1.0	3.50	3.65	0.15	0.13	0.013	0.013	0.02	0.000	4%
15	3.70	0.13		0.016			1.0	3.65	3.75	0.10	0.13	0.016	0.016	0.01	0.000	3%
16	3.80	0.15		0.023			1.0	3.75	3.85	0.10	0.15	0.023	0.023	0.01	0.000	5%
17	3.90	0.18		0.026			1.0	3.85	3.95	0.10	0.18	0.026	0.026	0.02	0.000	7%
18	4.00	0.19		0.024			1.0	3.95	4.05	0.10	0.19	0.024	0.024	0.02	0.000	7%
19	4.10	0.18		0.027			1.0	4.05	4.15	0.10	0.18	0.027	0.027	0.02	0.000	7%
20	4.20	0.18		0.011			1.0	4.15	4.40	0.25	0.18	0.011	0.011	0.05	0.000	7%
21	4.40	0.14		-0.001			1.0	4.30	4.40	0.10	0.14	-0.001	-0.001	0.01	0.000	0%
LB	4.60	0.00	0.00	0.000	0.000	0.000	1.0	4.40	4.60	0.20	0.05	0.000	0.000	0.01	0.000	0%

Total Flow 0.007

Measurement Details:

Start Time (MST):	11:10
End Time (MST):	11:55
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 10°C

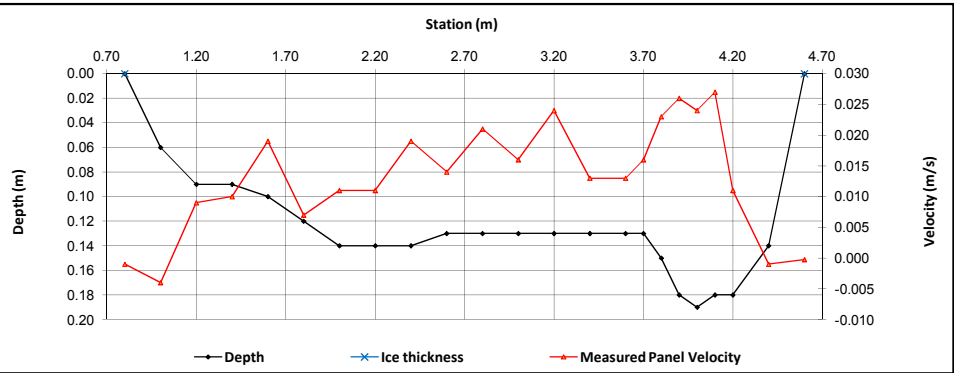
Flow characteristics:

Total Flow:	0.007	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.48	(m ²)
Wetted Width:	3.80	(m)
Hydraulic Depth:	0.126	(m)
Mean Velocity:	0.015	(m/s)
Froude Number:	0.013	

Datalogger Details:

Transducer Reading:	Before	After
		0.624
Battery (Main):	5.44	
Battery (Aux):	13.74	
Datalogger Clock:	10:58	
Laptop Clock:	11:11	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	5%	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-bar on RH bank nr mast	0.445	306.476	0.433	306.476	-
Bench Mark 2:	Nail in tree w/orange flag	1.714	305.225	1.700	305.225	-
Top of Ice:						
Water Level:		3.822	303.099	3.808	303.101	303.100
Transducer Reading:		0.624	302.475	0.624	302.477	302.476
Other:						

General Notes:

GPS at BM1

Field Personnel:	DB, SM	Trip Date:	14-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S22 - Muskeg Creek near the mouth

UTM Location: 481036 E, 6348856 N

Site Visit Date: November 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.55	0.05	0.02	0.027	0.027	0.00	0.000	0%
1	0.60	0.06		0.107			1.0	0.55	0.65	0.10	0.06	0.107	0.107	0.01	0.001	1%
2	0.70	0.06		0.176			1.0	0.65	0.75	0.10	0.06	0.176	0.176	0.01	0.001	2%
3	0.80	0.10		0.372			1.0	0.75	0.83	0.08	0.10	0.372	0.372	0.01	0.003	6%
4	0.85	0.11		0.296			1.0	0.83	0.88	0.05	0.11	0.296	0.296	0.01	0.002	3%
5	0.90	0.12		0.272			1.0	0.88	0.93	0.05	0.12	0.272	0.272	0.01	0.002	3%
6	0.95	0.12		0.464			1.0	0.93	0.98	0.05	0.12	0.464	0.464	0.01	0.003	6%
7	1.00	0.12		0.646			1.0	0.98	1.03	0.05	0.12	0.646	0.646	0.01	0.004	8%
8	1.05	0.12		0.201			1.0	1.03	1.08	0.05	0.12	0.201	0.201	0.01	0.001	3%
9	1.10	0.11		0.643			1.0	1.08	1.13	0.05	0.11	0.643	0.643	0.01	0.004	8%
10	1.15	0.12		0.633			1.0	1.13	1.18	0.05	0.12	0.633	0.633	0.01	0.004	8%
11	1.20	0.12		0.637			1.0	1.18	1.23	0.05	0.12	0.637	0.637	0.01	0.004	8%
12	1.25	0.11		0.593			1.0	1.23	1.28	0.05	0.11	0.593	0.593	0.01	0.003	7%
13	1.30	0.10		0.573			1.0	1.28	1.33	0.05	0.10	0.573	0.573	0.01	0.003	6%
14	1.35	0.08		0.459			1.0	1.33	1.38	0.05	0.08	0.459	0.459	0.00	0.002	4%
15	1.40	0.07		0.423			1.0	1.38	1.45	0.08	0.07	0.423	0.423	0.01	0.002	5%
16	1.50	0.07		0.372			1.0	1.45	1.55	0.10	0.07	0.372	0.372	0.01	0.003	6%
17	1.60	0.05		0.353			1.0	1.55	1.65	0.10	0.05	0.353	0.353	0.00	0.002	4%
18	1.70	0.05		0.289			1.0	1.65	1.75	0.10	0.05	0.289	0.289	0.01	0.001	3%
19	1.80	0.05		0.315			1.0	1.75	1.85	0.10	0.05	0.315	0.315	0.01	0.002	3%
20	1.90	0.04		0.364			1.0	1.85	2.00	0.15	0.04	0.364	0.364	0.01	0.002	5%
R	2.10	0.00	0.00	0.000	0.000	0.000	1.0	2.00	2.10	0.10	0.01	0.091	0.091	0.00	0.000	0%
Total Flow														0.047		

Measurement Details:

Start Time (MST):	8:35
End Time (MST):	9:25
Equipment:	ADV
Method:	Wading
River Condition:	low, open
Quality/Error (see reverse):	Excellent
Weather:	clear, -9°C

Flow characteristics:

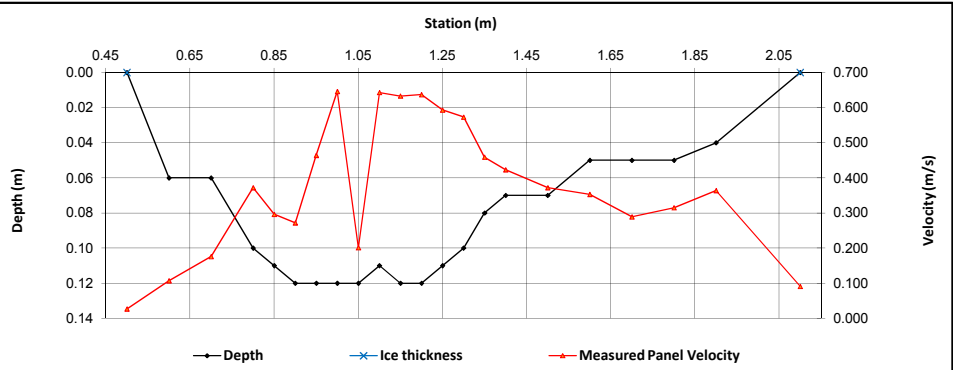
Total Flow:	0.047	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.12	(m ²)
Wetted Width:	1.60	(m)
Hydraulic Depth:	0.073	(m)
Mean Velocity:	0.402	(m/s)
Froude Number:	0.477	

Datalogger Details:

	Before	After
Transducer Reading:	0.732	
Battery (Main):	5.44	
Battery (Aux):	12.93	
Datalogger Clock:	8:25	
Laptop Clock:	8:42	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	7%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Removed DD-400, PT, Battery



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar on RH bank nr mast	0.345	306.476	0.330	306.476	-
Bench Mark 2:	Nail in tree w/orange flag	1.609	305.225	1.592	305.225	-
Top of Ice:						
Water Level:		3.610	303.211	3.593	303.213	303.212
Transducer Reading:		0.732	302.479	0.732	302.481	302.480
Other:						

General Notes:

- Creek is partially covered by ice
- TSS collected at centre
- PT weight disconnected

Field Personnel:	SM, GB	Trip Date:	5-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: January 18, 2011



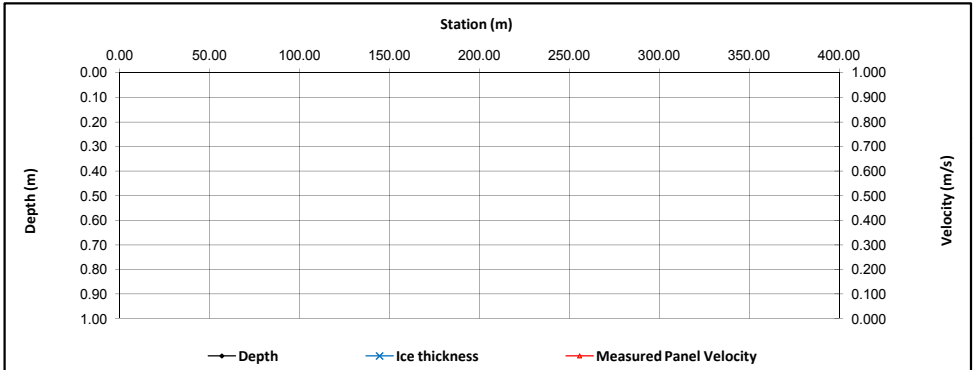
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	10:45
End Time (MST):	11:25
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear, -30°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		2.583
Battery (Main):	15.39	
Battery (Aux):	11:04	
Datalogger Clock:	11:03	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.70	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
Battery changed.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall		231.347		231.347	-
Bench Mark 2:	Nail in birch tree		231.096		231.096	-
Top of Ice:						
Water Level:						0.000
Transducer Reading:	14528	2.583	-2.583	2.583	-2.583	-2.583
Other:	WL PLS (m)	1.029				

General Notes:
Ice conditions considered unsafe for discharge and water level.

Field Personnel:	JO, DB	Trip Date:	18-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: February 13, 2011



Flow Measurement:

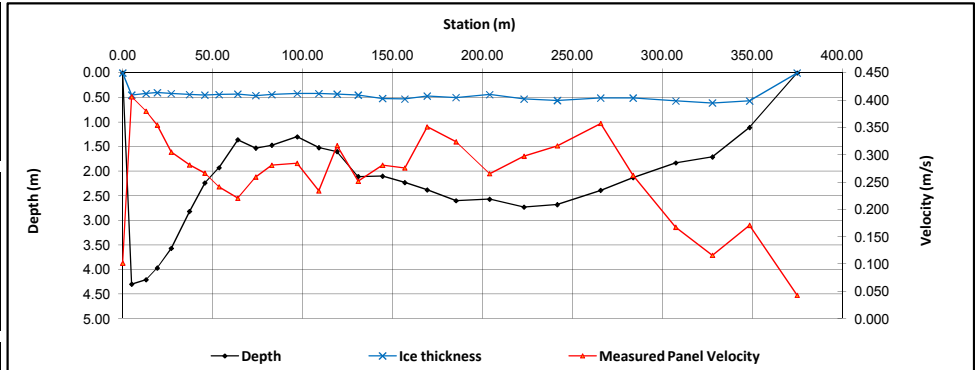
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	2.50	2.50	0.96	0.102	0.102	2.41	0.245	0%
1	5.00	4.30	0.45	0.415	0.398	0.398	1.0	2.50	9.00	6.50	3.85	0.407	0.407	25.03	10.173	6%
2	13.00	4.21	0.42	0.386	0.374	0.374	1.0	9.00	16.13	7.13	3.79	0.380	0.380	27.00	10.261	6%
3	19.25	3.97	0.40	0.361	0.348	0.348	1.0	16.13	23.13	7.00	3.57	0.355	0.355	24.99	8.859	5%
4	27.00	3.57	0.42	0.306	0.304	0.304	1.0	23.13	32.08	8.95	3.15	0.305	0.305	28.19	8.599	5%
5	37.15	2.82	0.44	0.255	0.308	0.308	1.0	32.08	41.43	9.35	2.38	0.282	0.282	22.25	6.264	4%
6	45.70	2.24	0.45	0.232	0.301	0.301	1.0	41.43	49.65	8.23	1.79	0.267	0.267	14.72	3.924	2%
7	53.60	1.93	0.44	0.257	0.226	0.226	1.0	49.65	58.80	9.15	1.49	0.242	0.242	13.63	3.292	2%
8	64.00	1.36	0.43	0.201	0.240	0.240	1.0	58.80	69.00	10.20	0.93	0.221	0.221	9.49	2.092	1%
9	74.00	1.53	0.46	0.232	0.287	0.287	1.0	69.00	78.45	9.45	1.07	0.260	0.260	10.11	2.624	1%
10	82.90	1.47	0.44	0.271	0.291	0.291	1.0	78.45	89.98	11.53	1.03	0.281	0.281	11.87	3.336	2%
11	97.05	1.30	0.42	0.326	0.243	0.243	1.0	89.98	103.05	13.08	0.88	0.285	0.285	11.51	3.273	2%
12	109.05	1.52	0.42	0.192	0.276	0.276	1.0	103.05	114.15	11.10	1.10	0.234	0.234	12.21	2.857	2%
13	119.25	1.60	0.43	0.304	0.330	0.330	1.0	114.15	125.10	10.95	1.17	0.317	0.317	12.81	4.061	2%
14	130.95	2.11	0.45	0.244	0.259	0.259	1.0	125.10	137.73	12.63	1.66	0.252	0.252	20.96	5.271	3%
15	144.50	2.10	0.52	0.237	0.325	0.325	1.0	137.73	150.68	12.95	1.58	0.281	0.281	20.46	5.750	3%
16	156.85	2.23	0.53	0.266	0.286	0.286	1.0	150.68	163.08	12.40	1.70	0.276	0.276	21.08	5.818	3%
17	169.30	2.38	0.47	0.354	0.349	0.349	1.0	163.08	177.33	14.25	1.91	0.351	0.351	27.22	9.560	5%
18	185.35	2.60	0.50	0.303	0.345	0.345	1.0	177.33	194.68	17.35	2.10	0.324	0.324	36.44	11.805	7%
19	204.00	2.57	0.44	0.218	0.313	0.313	1.0	194.68	213.58	18.90	2.13	0.266	0.266	40.26	10.688	6%
20	223.15	2.73	0.53	0.261	0.334	0.334	1.0	213.58	232.40	18.83	2.20	0.298	0.298	41.42	12.321	7%
21	241.65	2.68	0.56	0.316	0.317	0.317	1.0	232.40	253.70	21.30	2.12	0.317	0.317	45.16	14.292	8%
22	265.75	2.39	0.51	0.407	0.308	0.308	1.0	253.70	274.78	21.08	1.88	0.358	0.358	39.62	14.165	8%
23	283.80	2.13	0.51	0.256	0.269	0.269	1.0	274.78	295.65	20.88	1.62	0.263	0.263	33.82	8.877	5%
24	307.50	1.83	0.57	0.119	0.216	0.216	1.0	295.65	317.70	22.05	1.26	0.168	0.168	27.78	4.654	3%
25	327.90	1.71	0.61	0.070	0.162	0.162	1.0	317.70	338.23	20.53	1.10	0.116	0.116	22.58	2.619	1%
26	348.55	1.11	0.57	0.171	0.000	0.000	0.9	338.23	361.78	23.55	0.54	0.171	0.154	12.72	1.957	1%
Right	375.00	0.00	0.00	0.000	0.000	0.000	1.0	361.78	375.00	13.22	0.14	0.043	0.043	1.79	0.076	0%
Total Flow															177.712	

Measurement Details:	
Start Time (MST):	10:15
End Time (MST):	12:40
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast

Flow characteristics:	
Total Flow:	177.712 (m ³ /s)
Perceived Measurement Quality:	Good
Cross Section Area:	617.50 (m ²)
Wetted Width:	375.00 (m)
Hydraulic Depth:	1.647 (m)
Mean Velocity:	0.288 (m/s)
Froude Number:	0.072

Datalogger Details:		
	Before	After
Transducer Reading:	-	2.616
Battery (Main):	15.01	-
Battery (Aux):	-	-
Datalogger Clock:	12:20	-
Laptop Clock:	12:19	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	0.60	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-bar 1m tall	0.345	231.347	0.332	231.347	-
Bench Mark 2:	Nail in birch tree	0.612	231.096	0.600	231.096	-
Top of Ice:		5.581	226.111	5.568	226.111	226.111
Water Level:		5.607	226.101	5.595	226.101	226.101
Transducer Reading:	14528	2.616	223.485	2.616	223.485	223.485
Other:	PLS	1.061				

General Notes:

Field Personnel:	SG, BL	Trip Date:	13-Feb-11
Data Entry Personnel:	DB	Date:	22-Feb-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: March 8, 2011



Flow Measurement:

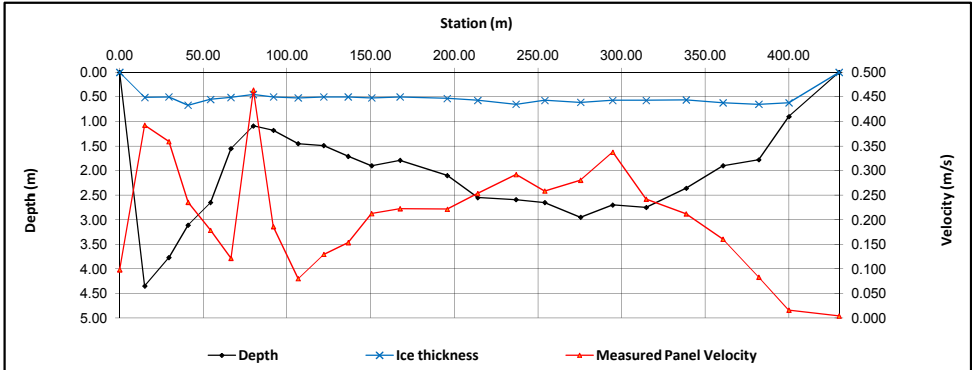
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	7.50	7.50	0.96	0.098	0.098	7.20	0.706	0%
1	15.00	4.35	0.51		0.380	0.405	1.0	7.50	22.20	14.70	3.84	0.393	0.393	56.45	22.156	13%
2	29.40	3.77	0.50		0.405	0.313	1.0	22.20	35.15	12.95	3.27	0.359	0.359	42.35	15.202	9%
3	40.90	3.11	0.67		0.234	0.237	1.0	35.15	47.60	12.45	2.44	0.236	0.236	30.38	7.154	4%
4	54.30	2.65	0.55		0.176	0.181	1.0	47.60	60.40	12.80	2.10	0.179	0.179	26.88	4.798	3%
5	66.50	1.55	0.51		0.194	0.049	1.0	60.40	73.20	12.80	1.04	0.122	0.122	13.31	1.617	1%
6	79.90	1.09	0.45	0.464			0.9	73.20	85.90	12.70	0.64	0.464	0.418	8.13	3.394	2%
7	91.90	1.18	0.50	0.186			0.9	85.90	99.30	13.40	0.68	0.186	0.167	9.11	1.525	1%
8	106.70	1.45	0.52		0.079	0.081	1.0	99.30	114.35	15.05	0.93	0.080	0.080	14.00	1.120	1%
9	122.00	1.49	0.50		0.109	0.150	1.0	114.35	129.30	14.95	0.99	0.130	0.130	14.80	1.917	1%
10	136.60	1.71	0.50		0.139	0.168	1.0	129.30	143.60	14.30	1.21	0.154	0.154	17.30	2.656	2%
11	150.60	1.90	0.52		0.171	0.254	1.0	143.60	159.10	15.50	1.38	0.213	0.213	21.39	4.545	3%
12	167.60	1.79	0.50		0.220	0.225	1.0	159.10	181.70	22.60	1.29	0.223	0.223	29.15	6.487	4%
13	195.80	2.10	0.53		0.208	0.235	1.0	181.70	204.90	23.20	1.57	0.222	0.222	36.42	8.068	5%
14	214.00	2.55	0.57		0.197	0.310	1.0	204.90	225.45	20.55	1.98	0.254	0.254	40.69	10.315	6%
15	236.90	2.59	0.65		0.289	0.295	1.0	225.45	245.50	20.05	1.94	0.292	0.292	38.90	11.358	7%
16	254.10	2.65	0.57		0.255	0.262	1.0	245.50	264.80	19.30	2.08	0.259	0.259	40.14	10.377	6%
17	275.50	2.95	0.61		0.342	0.219	1.0	264.80	285.10	20.30	2.34	0.281	0.281	47.50	13.324	8%
18	294.70	2.70	0.57		0.331	0.344	1.0	285.10	304.70	19.60	2.13	0.338	0.338	41.75	14.090	8%
19	314.70	2.75	0.57		0.227	0.257	1.0	304.70	326.65	21.95	2.18	0.242	0.242	47.85	11.580	7%
20	338.60	2.36	0.56		0.209	0.215	1.0	326.65	349.60	22.95	1.80	0.212	0.212	41.31	8.758	5%
21	360.60	1.90	0.62		0.162	0.159	1.0	349.60	371.30	21.70	1.28	0.161	0.161	27.78	4.458	3%
22	382.00	1.78	0.65		0.069	0.097	1.0	371.30	391.00	19.70	1.13	0.083	0.083	22.26	1.848	1%
23	400.00	0.90	0.62		0.032		1.0	391.00	415.00	24.00	0.28	0.016	0.016	6.72	0.108	0%
Right	430.00	0.00	0.00	0.000	0.000	0.000	1.0	415.00	430.00	15.00	0.07	0.004	0.004	1.05	0.004	0%
Total Flow															167.565	

Measurement Details:	
Start Time (MST):	10:15
End Time (MST):	11:15
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear, -16 °C

Flow characteristics:	
Total Flow:	167.565 (m ³ /s)
Perceived Measurement Quality:	Good
Cross Section Area:	682.82 (m ²)
Wetted Width:	430.00 (m)
Hydraulic Depth:	1.588 (m)
Mean Velocity:	0.245 (m/s)
Froude Number:	0.062

Datalogger Details:		Before	After
Transducer Reading:		2.553	
Battery (Main):		14.83	
Battery (Aux):		-	
Datalogger Clock:		12:30	
Laptop Clock:		12:29	
Air Temperature °C:		-	
Air Pressure:		-	
RH:		-	
Water °C:		0.60	
Memory Used:		-	
Dessicant:		Changed	
Logger# (if Δ):			
PT# (if Δ):			

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall	0.122	231.347	0.115	231.347	-
Bench Mark 2:	Nail in birch tree	0.392	231.096	0.392	231.096	-
Top of Ice:		5.432	226.037	5.425	226.037	226.037
Water Level:		5.432	226.056	5.430	226.058	226.057
Transducer Reading:		2.553	223.503	2.553	223.505	223.504
Other:	PLS	0.997				

General Notes:

Field Personnel:	JO, BL	Trip Date:	8-Mar-11
Data Entry Personnel:	CM	Date:	22-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: March 31, 2011



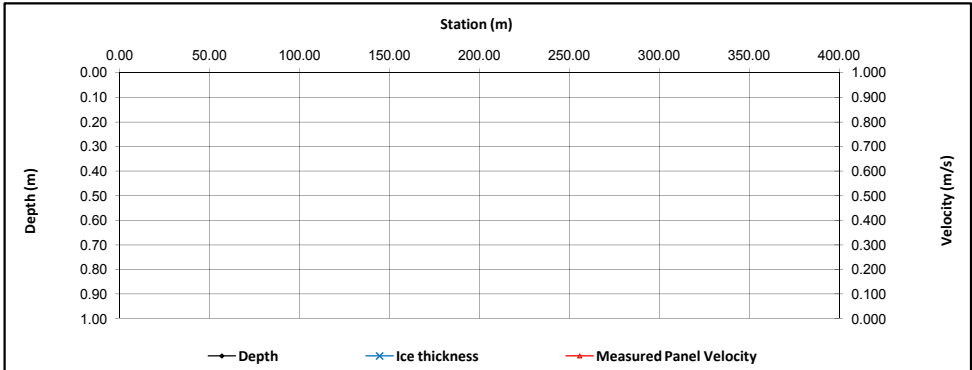
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	11:00
End Time (MST):	11:50
Equipment:	ADV
Method:	-
River Condition:	Ice/Open leads
Quality/Error (see reverse):	-
Weather:	Partly cloudy, 6°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	14.44	2.610
Battery (Aux):	-	
Datalogger Clock:	10:14	
Laptop Clock:	10:13	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.70	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-bar 1m tall	0.140	231.347	0.130	231.347	-
Bench Mark 2:	Nail in birch tree	0.402	231.096	0.392	231.096	-
Top of Ice:		5.399	226.088	5.385	226.092	226.090
Water Level:		5.390	226.108	5.380	226.108	226.108
Transducer Reading:		2.610	223.498	2.610	223.498	223.498
Other:	PLS	1.055				

General Notes:
Conditions deemed unsafe due to open water patches and dangerous looking ice (see photos).

Field Personnel:	JO, SG	Trip Date:	31-Mar-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: June 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	6.00	6.00	0.63	0.119	0.119	3.78	0.449	0%
1	12.00	2.52		0.42	0.53	0.43	1.0	6.00	14.00	8.00	2.52	0.475	0.475	20.16	9.576	1%
2	16.00	3.45		0.39	0.43	0.43	1.0	14.00	19.00	5.00	3.45	0.409	0.409	17.25	7.055	1%
3	22.00	3.78		0.36	0.52	0.52	1.0	19.00	30.50	11.50	3.78	0.440	0.440	43.47	19.127	2%
4	39.00	6.26		0.51	0.50	0.50	1.0	30.50	41.00	10.50	6.26	0.505	0.505	65.73	33.194	3%
5	43.00	5.93		0.42	0.52	0.52	1.0	41.00	47.00	6.00	5.93	0.470	0.470	35.58	16.723	2%
6	51.00	5.58		0.48	0.50	0.50	1.0	47.00	59.50	12.50	5.58	0.490	0.490	69.75	34.178	3%
7	68.00	4.72		0.42	0.54	0.54	1.0	59.50	76.50	17.00	4.72	0.480	0.480	80.24	38.515	4%
8	85.00	3.49		0.50	0.60	0.60	1.0	76.50	94.50	18.00	3.49	0.550	0.550	62.82	34.551	3%
9	104.00	2.81		0.45	0.59	0.59	1.0	94.50	114.50	20.00	2.81	0.520	0.520	56.20	29.224	3%
10	125.00	2.98		0.48	0.66	0.66	1.0	114.50	132.00	17.50	2.98	0.570	0.570	52.15	29.726	3%
11	139.00	3.31		0.51	0.70	0.70	1.0	132.00	150.00	18.00	3.31	0.605	0.605	59.58	36.046	4%
12	161.00	3.49		0.56	0.89	0.89	1.0	150.00	174.00	24.00	3.49	0.725	0.725	83.76	60.726	6%
13	187.00	3.34		0.73	0.97	0.97	1.0	174.00	201.50	27.50	3.34	0.850	0.850	91.85	78.073	8%
14	216.00	3.40		0.78	1.03	1.03	1.0	201.50	231.00	29.50	3.40	0.905	0.905	100.30	90.772	9%
15	246.00	3.68		0.79	1.04	1.04	1.0	231.00	262.50	31.50	3.68	0.915	0.915	115.92	106.067	11%
16	279.00	3.33		0.57	1.02	1.02	1.0	262.50	296.00	33.50	3.33	0.795	0.795	111.56	88.686	9%
17	313.00	3.13		0.43	0.62	0.62	1.0	296.00	331.50	35.50	3.13	0.525	0.525	111.12	58.335	6%
18	350.00	2.88		1.01	0.97	0.97	1.0	331.50	366.00	34.50	2.88	0.990	0.990	99.36	98.366	10%
19	382.00	2.18		0.78	0.92	0.92	1.0	366.00	401.00	35.00	2.18	0.850	0.850	76.30	64.855	6%
20	420.00	2.69		0.52	0.72	0.72	1.0	401.00	429.50	28.50	2.69	0.620	0.620	76.67	47.532	5%
21	439.00	2.65		0.36	0.59	0.59	1.0	429.50	444.50	15.00	2.65	0.475	0.475	39.75	18.881	2%
RB	450.00	0.00	0.00	0.000	0.000	0.000	1.0	444.50	450.00	5.50	0.66	0.119	0.119	3.64	0.433	0%
Total Flow															1001.1	

Measurement Details:

Start Time (MST):	8:30
End Time (MST):	12:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Showers, ~15C

Flow characteristics:

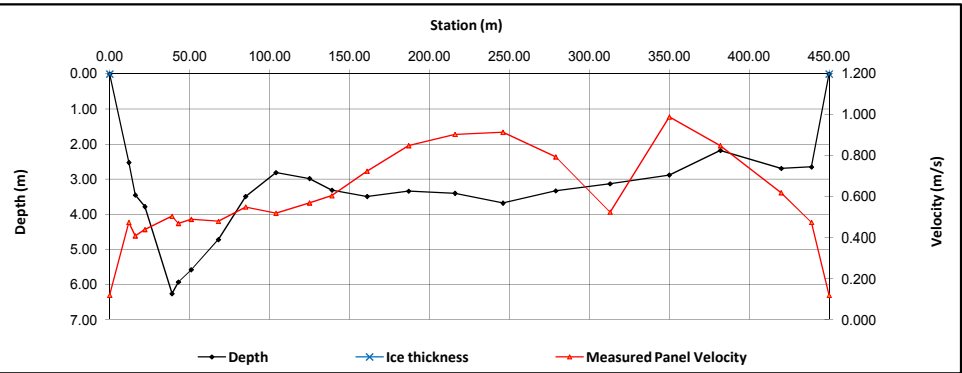
Total Flow:	1001.088	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1476.93	(m ²)
Wetted Width:	450.00	(m)
Hydraulic Depth:	3.282	(m)
Mean Velocity:	0.678	(m/s)
Froude Number:	0.120	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	10:26	
Laptop Clock:	10:26	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Intermittent logger response. PTs not working. 15m PLS installed, needs burying at lower water.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall	0.192	231.347	0.188	231.347	-
Bench Mark 2:	Nail in birch tree	0.457	231.096	0.453	231.096	-
Top of Ice:						
Water Level:		3.940	227.613	3.938	227.611	227.612
Transducer Reading:						
Other:	PLS					

General Notes:

Note: some slight drift downstream on some measurements due to anchor not being able to grab onto sandy bottom and therefore not perfectly stabilising boat for velocity measurement.

Field Personnel:	DB SM	Trip Date:	18-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: August 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	490	0.00	0.00	0.000	0.000	0.000	1.0	490.00	481.50	8.50	0.94	0.115	0.115	7.97	0.916	0%
1	473	3.75		0.39	0.53		1.0	481.50	465.50	16.00	3.75	0.460	0.460	60.00	27.600	3%
2	458	3.35		0.52	0.53		1.0	465.50	448.00	17.50	3.35	0.525	0.525	58.63	30.778	4%
3	438	6.36		0.38	0.60		1.0	448.00	432.00	16.00	6.36	0.490	0.490	101.76	49.862	6%
4	426	5.02		0.46	0.60		1.0	432.00	410.00	22.00	5.02	0.530	0.530	110.44	58.533	7%
5	394	1.45		0.62	0.75		1.0	410.00	378.50	31.50	1.45	0.685	0.685	45.68	31.287	4%
6	363	1.73		0.67	0.78		1.0	378.50	349.00	29.50	1.73	0.725	0.725	51.04	37.000	4%
7	335	1.91		0.78	0.81		1.0	349.00	320.50	28.50	1.91	0.795	0.795	54.44	43.276	5%
8	306	2.47		0.66	0.81		1.0	320.50	300.00	20.50	2.47	0.735	0.735	50.64	37.217	4%
9	294	2.77		0.57	0.91		1.0	300.00	280.50	19.50	2.77	0.740	0.740	54.02	39.971	5%
10	267	2.95		0.81	0.94		1.0	280.50	259.50	21.00	2.95	0.875	0.875	61.95	54.206	6%
11	252	3.25		0.45	0.69		1.0	259.50	242.00	17.50	3.25	0.570	0.570	56.88	32.419	4%
12	232	3.45		0.72	0.86		1.0	242.00	224.00	18.00	3.45	0.790	0.790	62.10	49.059	6%
13	216	3.38		0.73	0.87		1.0	224.00	201.50	22.50	3.38	0.800	0.800	76.05	60.840	7%
14	187	3.62		0.51	0.39		1.0	201.50	165.00	36.50	3.62	0.450	0.450	132.13	59.459	7%
15	143	3.73		0.61	0.70		1.0	165.00	125.00	40.00	3.73	0.655	0.655	149.20	97.726	11%
16	107	3.48		0.59	0.67		1.0	125.00	86.50	38.50	3.48	0.630	0.630	133.98	84.407	10%
17	66	3.61		0.32	0.28		1.0	86.50	45.50	41.00	3.61	0.300	0.300	148.01	44.403	5%
18	25	2.25		0.23	0.30		1.0	45.50	12.51	33.00	2.25	0.265	0.265	74.24	19.673	2%
LB	0	0.00	0.00	0.000	0.000	0.000	1.0	12.51	0.01	12.50	0.56	0.066	0.066	7.03	0.466	0%
Total Flow															859.1	

Measurement Details:

Start Time (MST):	9:00
End Time (MST):	12:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Partly Cloudy, ~20C

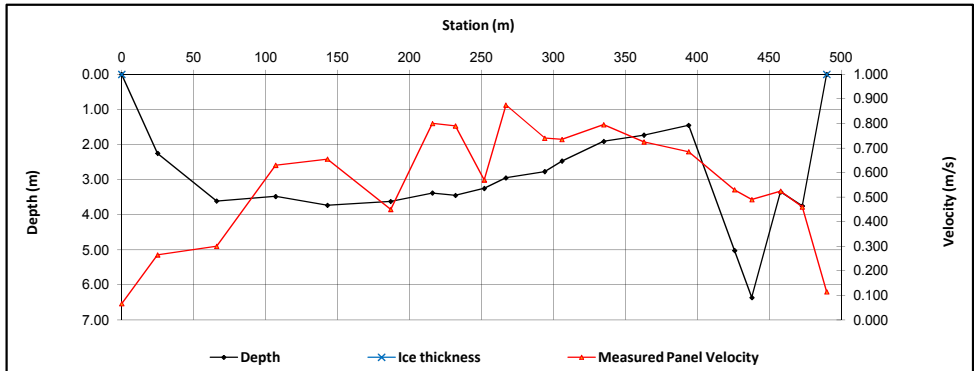
Flow characteristics:

Total Flow:	859.099	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1496.15	(m ²)
Wetted Width:	469.00	(m)
Hydraulic Depth:	3.190	(m)
Mean Velocity:	0.574	(m/s)
Froude Number:	0.103	

Datalogger Details:

	Before	After
Transducer Reading:	0.534	2.921
Battery (Main):	14.06	13.96
Battery (Aux):	-	-
Datalogger Clock:	10:54	12:06
Laptop Clock:	10:56	12:06
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	19.4	19.5
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall	0.185	231.347	0.178	231.347	-
Bench Mark 2:	Nail in birch tree	0.451	231.096	0.445	231.096	-
Top of Ice:						
Water Level:		4.226	227.321	4.218	227.323	227.322
Transducer Reading:		2.921	224.400	2.921	224.402	224.401
Other:						

General Notes:

30m transducer installed and launched from boat several meters from current shoreline, under ~3m of water and complete with 20lbs of weight plus chain. Could only get real-time output from 15m PLS while running both simultaneously, need a program to run 2xPLS successfully.

Note: some slight drift downstream on some measurements due to anchor not being able to grab onto sandy bottom and therefore not perfectly stabilising boat for velocity measurement.

Field Personnel:	DB SM	Trip Date:	17-Aug-11
Data Entry Personnel:	DB	Date:	25-Aug-11
Data Check Personnel:	JP	Date:	26-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: September 20, 2011



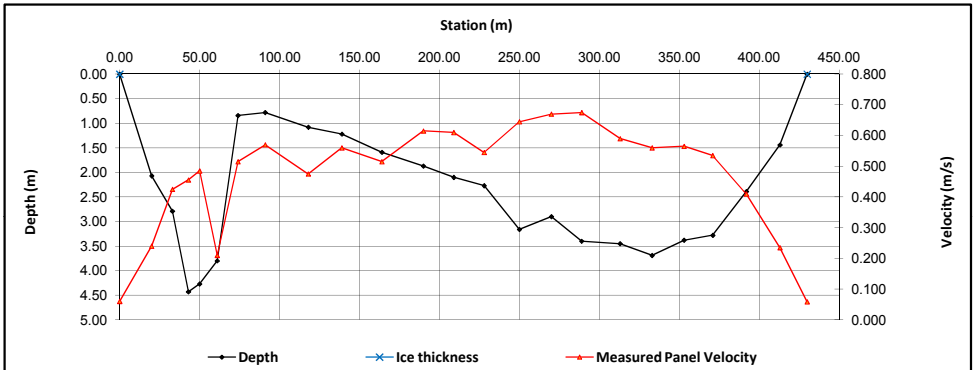
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	10.00	10.00	0.52	0.060	0.060	5.17	0.310	0%
1	20.00	2.07		0.260	0.220		1.0	10.00	26.50	16.50	2.07	0.240	0.240	34.15	8.197	2%
2	33.00	2.79		0.410	0.440		1.0	26.50	38.00	11.50	2.79	0.425	0.425	32.09	13.636	3%
3	43.00	4.43		0.450	0.461		1.0	38.00	46.50	8.50	4.43	0.456	0.456	37.66	17.152	3%
4	50.00	4.27		0.490	0.480		1.0	46.50	55.50	9.00	4.27	0.485	0.485	38.43	18.639	4%
5	61.00	3.80			0.300	0.120	1.0	55.50	67.50	12.00	3.80	0.210	0.210	45.60	9.576	2%
6	74.00	0.84		0.430	0.600		1.0	67.50	82.50	15.00	0.84	0.515	0.515	12.60	6.489	1%
7	91.00	0.78		0.460	0.680		1.0	82.50	104.50	22.00	0.78	0.570	0.570	17.16	9.781	2%
8	118.00	1.08		0.420	0.530		1.0	104.50	128.50	24.00	1.08	0.475	0.475	25.92	12.312	2%
9	139.00	1.22		0.480	0.640		1.0	128.50	151.50	23.00	1.22	0.560	0.560	28.06	15.714	3%
10	164.00	1.59		0.430	0.600		1.0	151.50	177.00	25.50	1.59	0.515	0.515	40.55	20.881	4%
11	190.00	1.87		0.520	0.710		1.0	177.00	199.50	22.50	1.87	0.615	0.615	42.08	25.876	5%
12	209.00	2.10		0.620	0.600		1.0	199.50	218.50	19.00	2.10	0.610	0.610	39.90	24.339	5%
13	228.00	2.27		0.480	0.610		1.0	218.50	239.00	20.50	2.27	0.545	0.545	46.54	25.362	5%
14	250.00	3.16		0.600	0.690		1.0	239.00	260.00	21.00	3.16	0.645	0.645	66.36	42.802	8%
15	270.00	2.90		0.660	0.680		1.0	260.00	279.50	19.50	2.90	0.670	0.670	56.55	37.889	7%
16	289.00	3.40		0.630	0.720		1.0	279.50	301.00	21.50	3.40	0.675	0.675	73.10	49.343	9%
17	313.00	3.45		0.560	0.620		1.0	301.00	323.00	22.00	3.45	0.590	0.590	75.90	44.781	9%
18	333.00	3.69		0.490	0.630		1.0	323.00	343.00	20.00	3.69	0.560	0.560	73.80	41.328	8%
19	353.00	3.38		0.470	0.660		1.0	343.00	362.00	19.00	3.38	0.565	0.565	64.22	36.284	7%
20	371.00	3.28		0.400	0.670		1.0	362.00	381.50	19.50	3.28	0.535	0.535	63.96	34.219	7%
21	392.00	2.39		0.370	0.450		1.0	381.50	402.50	21.00	2.39	0.410	0.410	50.19	20.578	4%
22	413.00	1.44		0.230	0.240		1.0	402.50	421.50	19.00	1.44	0.235	0.235	27.36	6.430	1%
RB	430.00	0.00	0.00	0.000	0.000	0.000	1.0	421.50	430.00	8.50	0.36	0.059	0.059	3.06	0.180	1%
Total Flow															522.096	

Measurement Details:	
Start Time (MST):	14:00
End Time (MST):	15:40
Equipment:	ADC
Method:	Boat
River Condition:	Clear, light chop
Quality/Error (see reverse):	Excellent
Weather:	sunny

Flow characteristics:		
Total Flow:	522.096	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1000.39	(m ²)
Wetted Width:	430.00	(m)
Hydraulic Depth:	2.327	(m)
Mean Velocity:	0.522	(m/s)
Froude Number:	0.109	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	12.73	
Battery (Aux):	-	
Datalogger Clock:	15:05	
Laptop Clock:	15:05	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	13.90	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:	



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall	0.413	231.347	0.394	231.347	-
Bench Mark 2:	Nail in birch tree	0.677	231.096	0.658	231.096	-
Top of Ice:						
Water Level:		5.375	226.398	5.355	226.399	226.399
Transducer Reading:		1.981	224.417	1.981	224.418	224.418
Other:						

General Notes:
 Reconnected PLS ground wire and solar panel wires. Secured cables.
 Removed 15 m PLS which was dry.

Field Personnel:	SM, GB	Trip Date:	20-Sep-11
Data Entry Personnel:	tk	Date:	28-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: October 25, 2011



Flow Measurement:

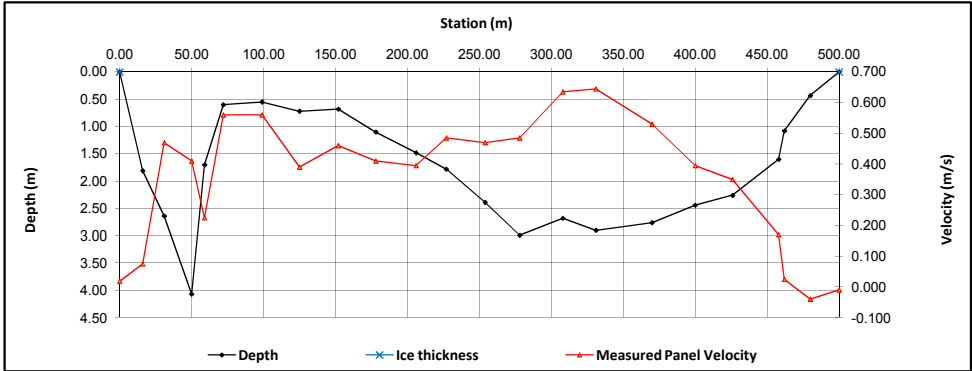
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	8.00	8.00	0.45	0.019	0.019	3.62	0.068	0%
1	16.00	1.81			0.080	0.070	1.0	8.00	23.50	15.50	1.81	0.075	0.075	28.05	2.104	1%
2	31.00	2.64			0.450	0.490	1.0	23.50	40.50	17.00	2.64	0.470	0.470	44.88	21.094	5%
3	50.00	4.07			0.410	0.410	1.0	40.50	54.50	14.00	4.07	0.410	0.410	56.98	23.362	6%
4	59.00	1.70				0.280	1.0	54.50	65.50	11.00	1.70	0.225	0.225	18.70	4.208	1%
5	72.00	0.60		0.560			1.0	65.50	85.50	20.00	0.60	0.560	0.560	12.00	6.720	2%
6	99.00	0.55		0.560			1.0	85.50	112.00	26.50	0.55	0.560	0.560	14.58	8.162	2%
7	125.00	0.72		0.390			1.0	112.00	138.50	26.50	0.72	0.390	0.390	19.08	7.441	2%
8	152.00	0.68		0.460			1.0	138.50	165.00	26.50	0.68	0.460	0.460	18.02	8.289	2%
9	178.00	1.10			0.350	0.470	1.0	165.00	192.00	27.00	1.10	0.410	0.410	29.70	12.177	3%
10	206.00	1.48			0.330	0.460	1.0	192.00	216.50	24.50	1.48	0.395	0.395	36.26	14.323	4%
11	227.00	1.78			0.430	0.540	1.0	216.50	240.50	24.00	1.78	0.485	0.485	42.72	20.719	5%
12	254.00	2.39			0.390	0.550	1.0	240.50	266.00	25.50	2.39	0.470	0.470	60.95	28.644	7%
13	278.00	2.99			0.360	0.610	1.0	266.00	293.00	27.00	2.99	0.485	0.485	80.73	39.154	10%
14	308.00	2.68			0.580	0.690	1.0	293.00	319.50	26.50	2.68	0.635	0.635	71.02	45.098	11%
15	331.00	2.90			0.560	0.730	1.0	319.50	350.50	31.00	2.90	0.645	0.645	89.90	57.986	14%
16	370.00	2.76			0.470	0.590	1.0	350.50	385.00	34.50	2.76	0.530	0.530	95.22	50.467	12%
17	400.00	2.44			0.360	0.430	1.0	385.00	413.00	28.00	2.44	0.395	0.395	68.32	26.986	7%
18	426.00	2.26			0.350	0.350	1.0	413.00	442.00	29.00	2.26	0.350	0.350	65.54	22.939	6%
19	458.00	1.60			0.140	0.200	1.0	442.00	460.00	18.00	1.60	0.170	0.170	28.80	4.896	1%
20	462.00	1.08			0.040	0.010	1.0	460.00	471.00	11.00	1.08	0.025	0.025	11.88	0.297	0%
21	480.00	0.43		-0.040			1.0	471.00	490.00	19.00	0.43	-0.040	-0.040	8.17	-0.327	0%
RB	500.00	0.00	0.00	0.000	0.000	0.000	1.0	490.00	500.00	10.00	0.11	-0.010	-0.010	1.08	-0.011	0%
Total Flow															404.795	

Measurement Details:	
Start Time (MST):	10:30
End Time (MST):	12:13
Equipment:	ADC
Method:	Boat
River Condition:	low flow, open
Quality/Error (see reverse):	Good
Weather:	mainly sunny

Flow characteristics:	
Total Flow:	404.795 (m ³ /s)
Perceived Measurement Quality:	Good
Cross Section Area:	906.19 (m ²)
Wetted Width:	500.00 (m)
Hydraulic Depth:	1.812 (m)
Mean Velocity:	0.447 (m/s)
Froude Number:	0.106

Datalogger Details:		
	Before	After
Transducer Reading:		1.676
Battery (Main):	14.52	
Battery (Aux):	-	
Datalogger Clock:	11:40	
Laptop Clock:	11:40	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	4.40	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall	0.183	231.347	0.171	231.347	-
Bench Mark 2:	Nail in birch tree	0.450	231.096	0.437	231.096	-
Top of Ice:						
Water Level:		5.457	226.089	5.440	226.093	226.091
Transducer Reading:		1.676	224.413	1.676	224.417	224.415
Other:						

General Notes:

- flow distances measured with range finder
- BM2: 109 cm

Field Personnel:	DW, SM	Trip Date:	25-Oct-11
Data Entry Personnel:	DW	Date:	7-Nov-11
Data Check Personnel:	VS	Date:	24-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S24 - Athabasca River below Eymundson Creek

UTM Location: 466313 E, 6372760 N

Site Visit Date: December 4, 2011



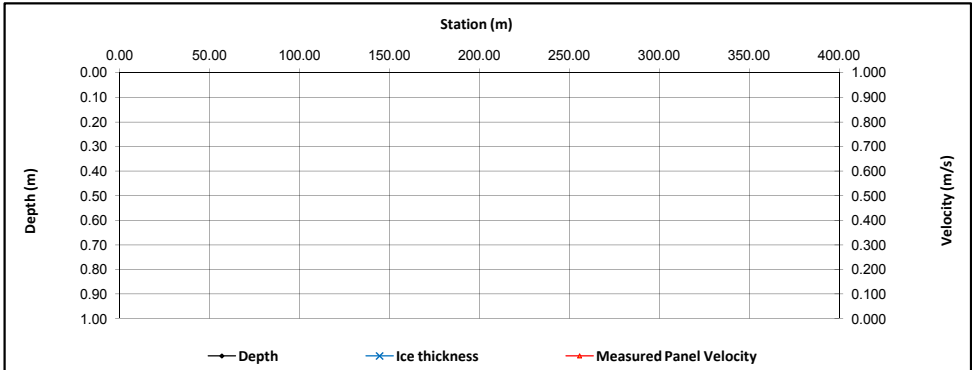
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	10:30
End Time (MST):	11:00
Equipment:	-
Method:	-
River Condition:	Partly Open
Quality/Error (see reverse):	-
Weather:	Overcast, -9C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-bar 1m tall		231.347		231.347	-
Bench Mark 2:	Nail in birch tree		231.096		231.096	-
Top of Ice:			231.347		231.347	231.347
Water Level:			231.096		231.096	231.096
Transducer Reading:						
Other:						

General Notes:

- River was unsafe to take flow measurement
- Open sections of water

Field Personnel:	SG, SM	Trip Date:	4-Dec-11
Data Entry Personnel:	DW	Date:	18-Jan-12
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S25 - Susan Lake Outlet

UTM Location: 464513 E, 6368477 N

Site Visit Date: June 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.50	0.00	0.00	0.000	0.000	0.000	1.0	0.50	0.55	0.05	0.02	0.042	0.042	0.00	0.000	0%
1	0.60	0.08		0.168			1.0	0.55	0.65	0.10	0.08	0.168	0.168	0.01	0.001	4%
2	0.70	0.09		0.195			1.0	0.65	0.75	0.10	0.09	0.195	0.195	0.01	0.002	5%
3	0.80	0.17		0.086			1.0	0.75	0.85	0.10	0.17	0.086	0.086	0.02	0.001	5%
4	0.90	0.17		0.101			1.0	0.85	0.95	0.10	0.17	0.101	0.101	0.02	0.002	5%
5	1.00	0.18		0.077			1.0	0.95	1.05	0.10	0.18	0.077	0.077	0.02	0.001	4%
6	1.10	0.17		0.135			1.0	1.05	1.15	0.10	0.17	0.135	0.135	0.02	0.002	7%
7	1.20	0.17		0.195			1.0	1.15	1.23	0.08	0.17	0.195	0.195	0.01	0.002	8%
8	1.25	0.16		0.088			1.0	1.23	1.28	0.05	0.16	0.088	0.088	0.01	0.001	2%
9	1.30	0.16		0.112			1.0	1.28	1.33	0.05	0.16	0.112	0.112	0.01	0.001	3%
10	1.35	0.17		0.095			1.0	1.33	1.38	0.05	0.17	0.095	0.095	0.01	0.001	3%
11	1.40	0.16		0.157			1.0	1.38	1.43	0.05	0.16	0.157	0.157	0.01	0.001	4%
12	1.45	0.16		0.260			1.0	1.43	1.48	0.05	0.16	0.260	0.260	0.01	0.002	6%
13	1.50	0.16		0.175			1.0	1.48	1.53	0.05	0.16	0.175	0.175	0.01	0.001	4%
14	1.55	0.16		0.475			1.0	1.53	1.58	0.05	0.16	0.475	0.475	0.01	0.004	12%
15	1.60	0.16		0.417			1.0	1.58	1.63	0.05	0.16	0.417	0.417	0.01	0.003	10%
16	1.65	0.17		0.297			1.0	1.63	1.68	0.05	0.17	0.297	0.297	0.01	0.003	8%
17	1.70	0.18		0.316			1.0	1.68	1.73	0.05	0.18	0.316	0.316	0.01	0.003	9%
18	1.75	0.18		0.007			1.0	1.73	1.78	0.05	0.18	0.007	0.007	0.01	0.000	0%
19	1.80	0.18		0.005			1.0	1.78	1.83	0.05	0.18	0.005	0.005	0.01	0.000	0%
RB	1.85	0.00	0.00	0.000	0.000	0.000	1.0	1.83	1.85	0.02	0.05	0.001	0.001	0.00	0.000	0%
Total Flow														0.032		

Measurement Details:

Start Time (MST):	14:00
End Time (MST):	14:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Rain ~ 15oC

Flow characteristics:

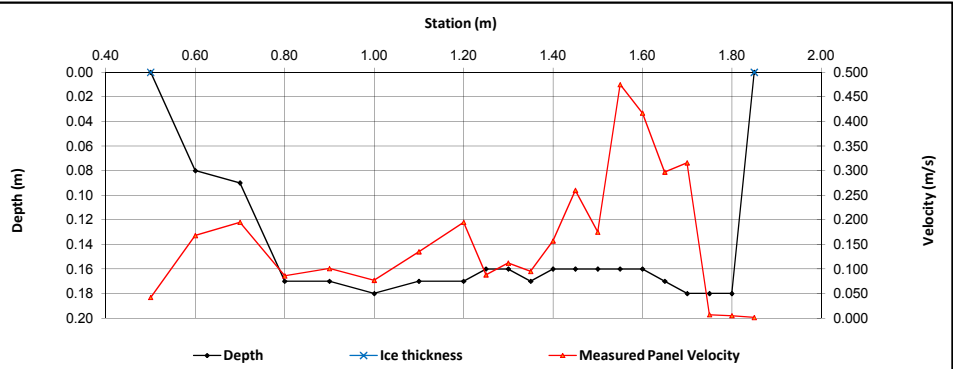
Total Flow:	0.032	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.20	(m ²)
Wetted Width:	1.35	(m)
Hydraulic Depth:	0.149	(m)
Mean Velocity:	0.161	(m/s)
Froude Number:	0.133	

Datalogger Details:

	Before	After
Transducer Reading:		0.185
Battery (Main):	5.47	
Battery (Aux):	18.70	
Datalogger Clock:	14:21	
Laptop Clock:	14:21	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	0%, cleared	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Unreliable battery data reporting



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Tbar in PVC	1.150	100.000	1.141	100.000	-
Bench Mark 2:	Nail in stump to W of logger	1.169	99.977	1.162	99.977	-
Top of Ice:						
Water Level:		2.267	98.883	2.255	98.886	98.885
Transducer Reading:		0.185	98.698	0.185	98.701	98.700
Other:						

General Notes:

Field Personnel:	DB SM	Trip Date:	18-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S25 - Susan Lake Outlet

UTM Location: 464513 E, 6368477 N

Site Visit Date: August 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.30	0.00	0.00	0.000	0.000	0.000	1.0	0.30	0.40	0.10	0.03	0.031	0.031	0.00	0.000	0%
1	0.50	0.12		0.125			1.0	0.40	0.53	0.13	0.12	0.125	0.125	0.02	0.002	10%
2	0.55	0.12		0.111			1.0	0.53	0.58	0.05	0.12	0.111	0.111	0.01	0.001	3%
3	0.60	0.12		0.067			1.0	0.58	0.63	0.05	0.12	0.067	0.067	0.01	0.000	2%
4	0.65	0.14		0.037			1.0	0.63	0.68	0.05	0.14	0.037	0.037	0.01	0.000	1%
5	0.70	0.14		0.006			1.0	0.68	0.73	0.05	0.14	0.006	0.006	0.01	0.000	0%
6	0.75	0.14		-0.006			1.0	0.73	0.78	0.05	0.14	-0.006	-0.006	0.01	0.000	0%
7	0.80	0.14		0.005			1.0	0.78	0.83	0.05	0.14	0.005	0.005	0.01	0.000	0%
8	0.85	0.13		0.009			1.0	0.83	0.88	0.05	0.13	0.009	0.009	0.01	0.000	0%
9	0.90	0.12		0.091			1.0	0.88	0.93	0.05	0.12	0.091	0.091	0.01	0.001	3%
10	0.95	0.12		0.100			1.0	0.93	0.98	0.05	0.12	0.100	0.100	0.01	0.001	3%
11	1.00	0.14		0.102			1.0	0.98	1.03	0.05	0.14	0.102	0.102	0.01	0.001	4%
12	1.05	0.13		0.139			1.0	1.03	1.08	0.05	0.13	0.139	0.139	0.01	0.001	5%
13	1.10	0.11		0.197			1.0	1.08	1.13	0.05	0.11	0.197	0.197	0.01	0.001	6%
14	1.15	0.11		0.182			1.0	1.13	1.18	0.05	0.11	0.182	0.182	0.01	0.001	5%
15	1.20	0.11		0.190			1.0	1.18	1.23	0.05	0.11	0.190	0.190	0.01	0.001	5%
16	1.25	0.11		0.240			1.0	1.23	1.28	0.05	0.11	0.240	0.240	0.01	0.001	7%
17	1.30	0.11		0.213			1.0	1.28	1.33	0.05	0.11	0.213	0.213	0.01	0.001	6%
18	1.35	0.11		0.392			1.0	1.33	1.38	0.05	0.11	0.392	0.392	0.01	0.002	11%
19	1.40	0.11		0.346			1.0	1.38	1.43	0.05	0.11	0.346	0.346	0.01	0.002	10%
20	1.45	0.10		0.347			1.0	1.43	1.48	0.05	0.10	0.347	0.347	0.01	0.002	9%
21	1.50	0.10		0.304			1.0	1.48	1.53	0.05	0.10	0.304	0.304	0.00	0.002	8%
22	1.55	0.09		0.002			1.0	1.53	1.58	0.05	0.09	0.002	0.002	0.00	0.000	0%
LB	1.60	0.00	0.00	0.000	0.000	0.000	1.0	1.58	1.60	0.02	0.02	0.001	0.001	0.00	0.000	0%
Total Flow															0.019	

Measurement Details:

Start Time (MST):	15:15
End Time (MST):	16:05
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Sunny

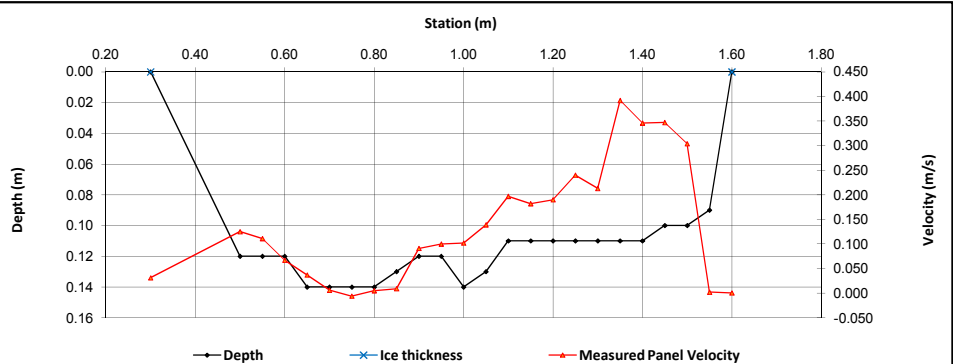
Flow characteristics:

Total Flow:	0.019	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.14	(m ²)
Wetted Width:	1.30	(m)
Hydraulic Depth:	0.110	(m)
Mean Velocity:	0.133	(m/s)
Froude Number:	0.128	

Datalogger Details:

	Before	After
Transducer Reading:	0.120	0.139
Battery (Main):	1.84	1.84
Battery (Aux):	14.06	14.12
Datalogger Clock:	15:07	16:00
Laptop Clock:	15:13	16:05
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	2%	2%
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Tbar in PVC	1.049	100.000	1.045	100.000	-
Bench Mark 2:	Nail in stump to W of logger	1.073	99.977	1.068	99.977	-
Top of Ice:						
Water Level:		2.227	98.822	2.223	98.822	98.822
Transducer Reading:		0.120	98.702	0.120	98.702	98.702
Other:						

General Notes:

Beaver dam controls outlet at lake as seen from helicopter. TSS taken @ 1m.

Field Personnel:	DB, KW	Trip Date:	17-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S25 - Susan Lake Outlet

UTM Location: 464513 E, 6368477 N

Site Visit Date: October 25, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.10	0.00	0.00	0.000	0.000	0.000	1.0	0.10	0.15	0.05	0.03	0.051	0.051	0.00	0.000	0%
1	0.20	0.11		0.202			1.0	0.15	0.23	0.08	0.11	0.202	0.202	0.01	0.002	5%
2	0.25	0.14		0.037			1.0	0.23	0.28	0.05	0.14	0.037	0.037	0.01	0.000	1%
3	0.30	0.15		0.052			1.0	0.28	0.33	0.05	0.15	0.052	0.052	0.01	0.000	1%
4	0.35	0.15		0.055			1.0	0.33	0.38	0.05	0.15	0.055	0.055	0.01	0.000	1%
5	0.40	0.15		0.082			1.0	0.38	0.43	0.05	0.15	0.082	0.082	0.01	0.001	2%
6	0.45	0.15		0.064			1.0	0.43	0.48	0.05	0.15	0.064	0.064	0.01	0.000	1%
7	0.50	0.14		0.081			1.0	0.48	0.53	0.05	0.14	0.081	0.081	0.01	0.001	2%
8	0.55	0.14		0.114			1.0	0.53	0.58	0.05	0.14	0.114	0.114	0.01	0.001	2%
9	0.60	0.15		0.219			1.0	0.58	0.63	0.05	0.15	0.219	0.219	0.01	0.002	5%
10	0.65	0.15		0.212			1.0	0.63	0.68	0.05	0.15	0.212	0.212	0.01	0.002	5%
11	0.70	0.16		0.380			1.0	0.68	0.73	0.05	0.16	0.380	0.380	0.01	0.003	9%
12	0.75	0.16		0.177			1.0	0.73	0.78	0.05	0.16	0.177	0.177	0.01	0.001	4%
13	0.80	0.14		0.228			1.0	0.78	0.83	0.05	0.14	0.228	0.228	0.01	0.002	5%
14	0.85	0.15		0.263			1.0	0.83	0.88	0.05	0.15	0.263	0.263	0.01	0.002	6%
15	0.90	0.16		0.220			1.0	0.88	0.93	0.05	0.16	0.220	0.220	0.01	0.002	5%
16	0.95	0.18		0.184			1.0	0.93	0.98	0.05	0.18	0.184	0.184	0.01	0.002	5%
17	1.00	0.18		0.213			1.0	0.98	1.03	0.05	0.18	0.213	0.213	0.01	0.002	6%
18	1.05	0.18		0.253			1.0	1.03	1.08	0.05	0.18	0.253	0.253	0.01	0.002	7%
19	1.10	0.17		0.294			1.0	1.08	1.13	0.05	0.17	0.294	0.294	0.01	0.002	8%
20	1.15	0.17		0.247			1.0	1.13	1.18	0.05	0.17	0.247	0.247	0.01	0.002	7%
21	1.20	0.12		0.216			1.0	1.18	1.23	0.05	0.12	0.216	0.216	0.01	0.001	4%
22	1.25	0.12		0.337			1.0	1.23	1.28	0.05	0.12	0.337	0.337	0.01	0.002	6%
23	1.30	0.09		0.004			1.0	1.28	1.35	0.08	0.09	0.004	0.004	0.01	0.000	0%
LB	1.40	0.00	0.00	0.000	0.000	0.000	1.0	1.35	1.40	0.05	0.02	0.001	0.001	0.00	0.000	0%
Total Flow															0.032	

Measurement Details:

Start Time (MST):	13:25
End Time (MST):	14:25
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Mainly Sunny

Flow characteristics:

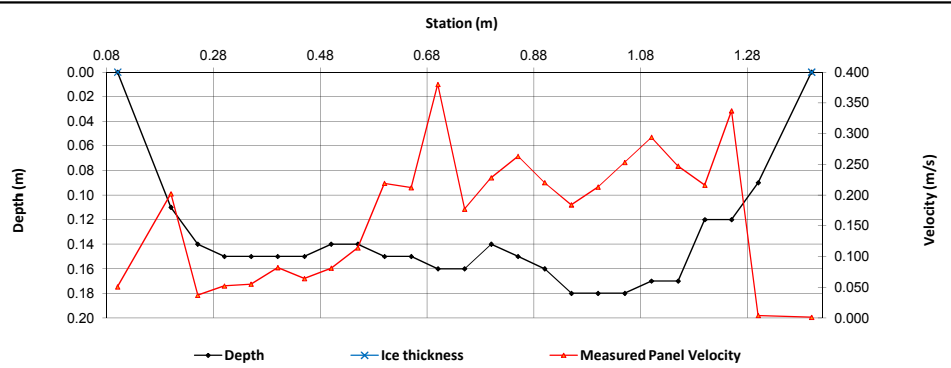
Total Flow:	0.032	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.18	(m ²)
Wetted Width:	1.30	(m)
Hydraulic Depth:	0.137	(m)
Mean Velocity:	0.180	(m/s)
Froude Number:	0.156	

Datalogger Details:

	Before	After
Transducer Reading:		0.184
Battery (Main):	5.10	
Battery (Aux):	13.49	
Datalogger Clock:	12:32	
Laptop Clock:	12:32	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	4%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

removed logger, PLS, weight and battery



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Tbar in PVC	0.848	100.000	0.790	100.000	-
Bench Mark 2:	Nail in stump to W of logger	0.874	99.977	0.816	99.977	-
Top of Ice:						
Water Level:		1.987	98.861	1.931	98.859	98.860
Transducer Reading:		0.184	98.677	0.184	98.675	98.676
Other:						

General Notes:

Field Personnel:	SM, DW	Trip Date:	25-Oct-11
Data Entry Personnel:	DW	Date:	7-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S26 - MacKay River near Fort MacKay

UTM Location: 458031 E, 6341078 N

Site Visit Date: January 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:

Start Time (MST):	-
End Time (MST):	-
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	-

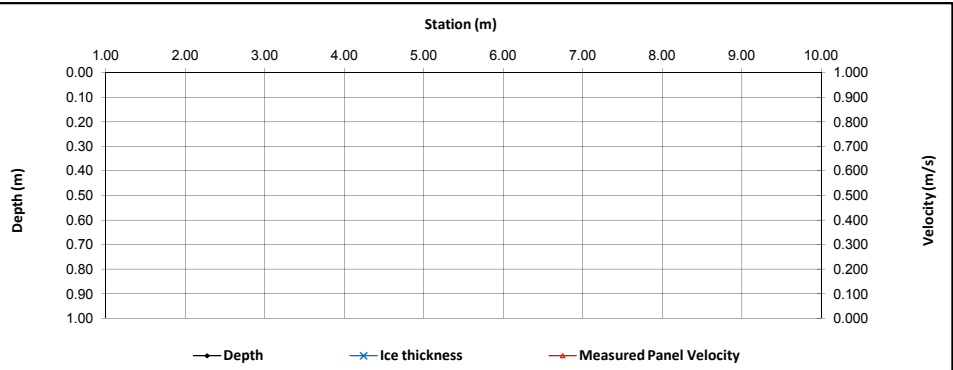
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rock under flagged bush		100.000		100.000	-
Bench Mark 2:	No BM2				0.000	-
Top of Ice:			100.000		100.000	100.000
Water Level:			100.000		100.000	100.000
Transducer Reading:						
Other:						

General Notes:

Site abandoned due to thin ice. Unsafe conditions.

Field Personnel:	DB JO	Trip Date:	22-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S26 - MacKay River near Fort MacKay
 UTM Location: 458031 E, 6341078 N

Site Visit Date: February 11, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	2.00	0.00	0.00	0.000	0.000	0.000	0.9	2.00	2.53	0.53	0.01	0.001	0.000	0.01	0.000	0%
1	3.05	0.55	0.50	0.002			0.9	2.53	3.43	0.90	0.05	0.002	0.002	0.05	0.000	0%
2	3.80	0.50	0.50	0.085			0.9	3.43	4.08	0.65	0.00	0.085	0.077	0.00	0.000	0%
3	4.35	0.50	0.50	0.161			0.9	4.08	4.43	0.35	0.00	0.161	0.145	0.00	0.000	0%
4	4.50	0.50	0.50	0.168			0.9	4.43	4.68	0.25	0.00	0.168	0.151	0.00	0.000	0%
5	4.85	0.60	0.45	0.120			0.9	4.68	4.95	0.27	0.15	0.120	0.108	0.04	0.004	1%
6	5.05	0.60	0.45	0.066			0.9	4.95	5.18	0.23	0.15	0.066	0.059	0.03	0.002	0%
7	5.30	0.60	0.45	0.122			0.9	5.18	5.38	0.20	0.15	0.122	0.110	0.03	0.003	1%
8	5.45	0.55	0.45	0.237			0.9	5.38	5.38	0.00	0.10	0.237	0.213	0.00	0.000	0%
9	5.30	0.55	0.45	0.204			0.9	5.38	5.38	0.00	0.10	0.204	0.184	0.00	0.000	0%
10	5.45	0.55	0.45	0.256			0.9	5.38	5.55	0.18	0.10	0.256	0.230	0.02	0.004	1%
11	5.65	0.55	0.50	0.292			0.9	5.55	5.75	0.20	0.05	0.292	0.263	0.01	0.003	1%
12	5.85	0.58	0.50	0.356			0.9	5.75	5.95	0.20	0.08	0.356	0.320	0.02	0.005	1%
13	6.05	0.60	0.40	0.280			0.9	5.95	6.13	0.18	0.20	0.280	0.252	0.04	0.009	2%
14	6.20	0.60	0.40	0.266			0.9	6.13	6.30	0.18	0.20	0.266	0.239	0.04	0.008	2%
15	6.40	0.60	0.40	0.421			0.9	6.30	6.50	0.20	0.20	0.421	0.379	0.04	0.015	4%
16	6.60	0.61	0.40	0.398			0.9	6.50	6.75	0.25	0.21	0.398	0.358	0.05	0.019	4%
17	6.90	0.65	0.38	0.474			0.9	6.75	7.00	0.25	0.27	0.474	0.427	0.07	0.029	7%
18	7.10	0.65	0.40	0.424			0.9	7.00	7.30	0.30	0.25	0.424	0.382	0.08	0.029	7%
19	7.50	0.60	0.40	0.438			0.9	7.30	7.80	0.50	0.20	0.438	0.394	0.10	0.039	9%
20	8.10	0.60	0.40	0.370			0.9	7.80	8.50	0.70	0.20	0.370	0.333	0.14	0.047	11%
21	8.90	0.62	0.40	0.355			0.9	8.50	9.18	0.68	0.22	0.355	0.320	0.15	0.047	11%
22	9.45	0.65	0.50	0.366			0.9	9.18	9.78	0.60	0.15	0.366	0.329	0.09	0.030	7%
23	10.10	0.60	0.45	0.348			0.9	9.78	10.48	0.70	0.15	0.348	0.313	0.11	0.033	8%
24	10.85	0.58	0.50	0.306			0.9	10.48	11.28	0.80	0.08	0.306	0.275	0.06	0.018	4%
25	11.70	0.60	0.40	0.323			0.9	11.28	12.20	0.93	0.20	0.323	0.291	0.19	0.054	13%
26	12.70	0.51	0.45	0.219			0.9	12.20	13.20	1.00	0.06	0.219	0.197	0.06	0.012	3%
27	13.70	0.50	0.45	0.207			0.9	13.20	14.20	1.00	0.05	0.207	0.186	0.05	0.009	2%
28	14.70	0.42	0.40	0.169			0.9	14.20	15.85	1.65	0.02	0.169	0.152	0.03	0.005	1%
RB	17.00	0.00	0.00	0.000	0.000	0.000	1.0	15.85	17.00	1.15	0.00	0.042	0.042	0.01	0.000	0%
Total Flow															0.424	

Measurement Details:

Start Time (MST):	10:46
End Time (MST):	12:02
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, -10°C

Flow characteristics:

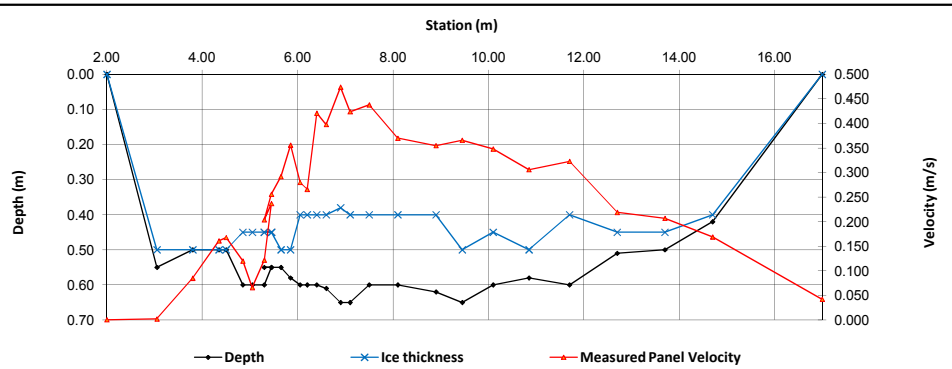
Total Flow:	0.424	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.49	(m ²)
Wetted Width:	15.00	(m)
Hydraulic Depth:	0.099	(m)
Mean Velocity:	0.285	(m/s)
Froude Number:	0.290	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rock under flagged bush	2.571	100.000	2.558	100.000	-
Bench Mark 2:	No BM2				0.000	-
Top of Ice:		5.194	97.377	5.176	97.382	97.380
Water Level:		5.198	97.373	5.170	97.388	97.381
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	BL, GB	Trip Date:	11-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S26 - MacKay River near Fort MacKay
 UTM Location: 458031 E, 6341078 N

Site Visit Date: November 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	17.00	0.00	0.00	0.000	0.000	0.000	1.0	17.00	17.50	0.50	0.02	0.000	0.000	0.01	0.000	0%
1	18.00	0.32	0.23	0.000			1.0	17.50	18.50	1.00	0.09	0.000	0.000	0.09	0.000	0%
2	19.00	0.38	0.23	-0.080			0.9	18.50	19.50	1.00	0.15	-0.080	-0.072	0.15	-0.011	-1%
3	20.00	0.41	0.21	0.080			0.9	19.50	20.50	1.00	0.20	0.080	0.072	0.20	0.014	2%
4	21.00	0.44	0.23	0.160			0.9	20.50	21.45	0.95	0.21	0.160	0.144	0.20	0.029	3%
5	21.90	0.51	0.23	0.250			0.9	21.45	22.40	0.95	0.28	0.250	0.225	0.27	0.060	7%
6	22.90	0.60	0.21	0.300			0.9	22.40	23.45	1.05	0.39	0.300	0.270	0.41	0.111	12%
7	24.00	0.58	0.21	0.080			0.9	23.45	24.25	0.80	0.37	0.080	0.072	0.30	0.021	2%
8	24.50	0.60	0.21	0.410			0.9	24.25	24.75	0.50	0.39	0.410	0.369	0.20	0.072	8%
9	25.00	0.53	0.21	0.380			0.9	24.75	25.25	0.50	0.32	0.380	0.342	0.16	0.055	6%
10	25.50	0.55	0.22	0.450			0.9	25.25	25.70	0.45	0.33	0.450	0.405	0.15	0.060	7%
11	25.90	0.55	0.22	0.460			0.9	25.70	26.20	0.50	0.33	0.460	0.414	0.17	0.068	8%
12	26.50	0.58	0.22	0.330			0.9	26.20	26.70	0.50	0.36	0.330	0.297	0.18	0.053	6%
13	26.90	0.58	0.23	0.450			0.9	26.70	27.20	0.50	0.35	0.450	0.405	0.18	0.071	8%
14	27.50	0.51	0.23	0.420			0.9	27.20	27.75	0.55	0.28	0.420	0.378	0.15	0.058	6%
15	28.00	0.50	0.23	0.430			0.9	27.75	28.25	0.50	0.27	0.430	0.387	0.14	0.052	6%
16	28.50	0.51	0.22	0.330			0.9	28.25	28.75	0.50	0.29	0.330	0.297	0.15	0.043	5%
17	29.00	0.43	0.22	0.290			0.9	28.75	29.50	0.75	0.21	0.290	0.261	0.16	0.041	5%
18	30.00	0.42	0.15	0.290			0.9	29.50	30.45	0.95	0.27	0.290	0.261	0.26	0.067	7%
19	30.90	0.40	0.23	0.180			0.9	30.45	31.40	0.95	0.17	0.180	0.162	0.16	0.026	3%
20	31.90	0.35	0.25	0.060			0.9	31.40	33.45	2.05	0.10	0.060	0.054	0.21	0.011	1%
L	35.00	0.00	0.00	0.000	0.000	0.000	1.0	33.45	35.00	1.55	0.03	0.015	0.015	0.04	0.001	0%
Total Flow														0.903		

Measurement Details:

Start Time (MST):	13:30
End Time (MST):	15:10
Equipment:	MARSH
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, light breeze, -5

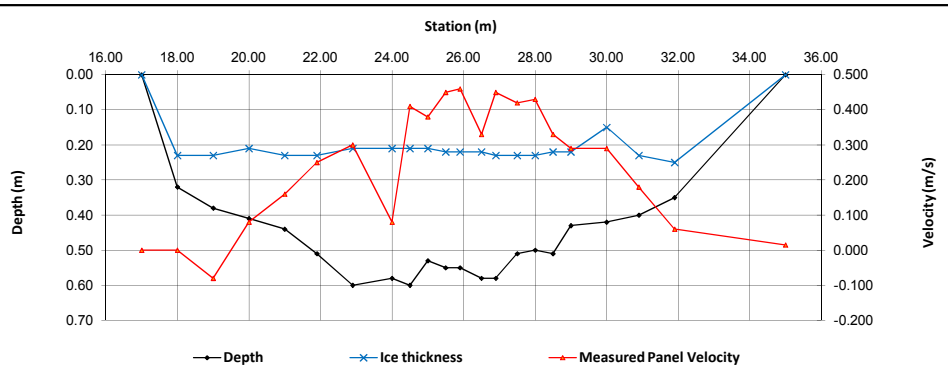
Flow characteristics:

Total Flow:	0.903	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.90	(m ²)
Wetted Width:	18.00	(m)
Hydraulic Depth:	0.217	(m)
Mean Velocity:	0.232	(m/s)
Froude Number:	0.159	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rock under flagged bush	1.248	100.000	1.236	100.000	-
Bench Mark 2:	No BM2	-	-	-	0.000	-
Top of Ice:		7.222	94.026	7.210	94.026	94.026
Water Level:		7.260	93.988	7.248	93.988	93.988
Transducer Reading:						
Other:						

General Notes:

BM1 rebar stake 4m SW of shack marked with 2 wood stakes and pink flagging.

Field Personnel:	SM, DB	Trip Date:	29-Nov-11
Data Entry Personnel:	DW	Date:	30-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S27 - Firebag River WSC

UTM Location: 488685 E, 6388706 N

Site Visit Date: January 16, 2011



Flow Measurement:

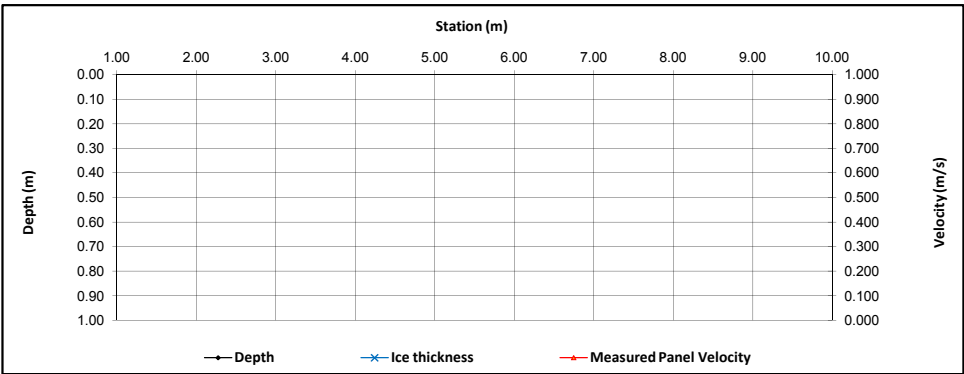
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	9:00
End Time (MST):	10:00
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	Clear, -40°C

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		1.097
Battery (Main):	12.52	
Battery (Aux):	4.62	
Datalogger Clock:	9:07	
Laptop Clock:	9:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	23%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
M: 0.8622496, B: -0.104788



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar in PVC 1m from lggr		100.000		100.000	-
Bench Mark 2:	No BM 2					
Top of Ice:						
Water Level:			100.000		100.000	100.000
Transducer Reading:		1.097	98.903	1.097	98.903	98.903
Other:						

General Notes:
Conditions considered unsafe for flow measurement.

Field Personnel:	DB, JO	Trip Date:	16-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S27 - Firebag River WSC

UTM Location: 488685 E, 6388706 N

Site Visit Date: February 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	1.50	0.00	0.00	0.000	0.000	0.000	0.9	1.50	2.05	0.55	0.17	0.133	0.120	0.09	0.011	0%
1	2.60	1.21	0.55	0.533			0.9	2.05	3.35	1.30	0.66	0.533	0.480	0.86	0.412	3%
2	4.10	1.15	0.56	0.665			0.9	3.35	4.75	1.40	0.59	0.665	0.599	0.83	0.494	4%
3	5.40	1.17	0.64	0.476			0.9	4.75	6.25	1.50	0.53	0.476	0.428	0.80	0.341	3%
4	7.10	1.10	0.47	0.580			0.9	6.25	8.00	1.75	0.63	0.580	0.522	1.10	0.576	5%
5	8.90	1.18	0.56	0.552			0.9	8.00	9.85	1.85	0.62	0.552	0.497	1.15	0.570	5%
6	10.80	1.25	0.51	0.569			0.9	9.85	11.90	2.05	0.74	0.569	0.512	1.52	0.777	6%
7	13.00	1.27	0.55	0.471			0.9	11.90	14.20	2.30	0.72	0.471	0.424	1.66	0.702	6%
8	15.40	1.18	0.53	0.443			0.9	14.20	16.65	2.45	0.65	0.443	0.399	1.59	0.635	5%
9	17.90	1.09	0.49	0.451			0.9	16.65	19.15	2.50	0.60	0.451	0.406	1.50	0.609	5%
10	20.40	1.06	0.52	0.337			0.9	19.15	21.45	2.30	0.54	0.337	0.303	1.24	0.377	3%
11	22.50	1.05	0.54	0.342			0.9	21.45	23.70	2.25	0.51	0.342	0.308	1.15	0.353	3%
12	24.90	0.92	0.52	0.242			0.9	23.70	26.10	2.40	0.40	0.242	0.218	0.96	0.209	2%
13	27.30	0.83	0.45	0.317			0.9	26.10	28.90	2.80	0.38	0.317	0.285	1.06	0.304	2%
14	30.50	0.87	0.35	0.304			0.9	28.90	31.75	2.85	0.52	0.304	0.274	1.48	0.405	3%
15	33.00	0.77	0.37	0.350			0.9	31.75	34.00	2.25	0.40	0.350	0.315	0.90	0.284	2%
16	35.00	0.75	0.45	0.240			0.9	34.00	36.05	2.05	0.30	0.240	0.216	0.61	0.133	1%
17	37.10	0.68	0.52	0.249			0.9	36.05	38.40	2.35	0.16	0.249	0.224	0.38	0.084	1%
18	39.70	0.75	0.56	0.194			0.9	38.40	40.85	2.45	0.19	0.194	0.175	0.47	0.081	1%
19	42.00	0.68	0.55	0.153			0.9	40.85	43.10	2.25	0.13	0.153	0.138	0.29	0.040	0%
20	44.20	0.99	0.55	0.266			0.9	43.10	45.35	2.25	0.44	0.266	0.239	0.99	0.237	2%
21	46.50	1.00	0.57	0.300			0.9	45.35	47.70	2.35	0.43	0.300	0.270	1.01	0.273	2%
22	48.90	1.11	0.56	0.321			0.9	47.70	50.10	2.40	0.55	0.321	0.289	1.32	0.381	3%
23	51.30	1.16	0.64	0.182			0.9	50.10	52.50	2.40	0.52	0.182	0.164	1.25	0.204	2%
24	53.70	1.05	0.58	0.498			0.9	52.50	54.80	2.30	0.47	0.498	0.448	1.08	0.485	4%
25	55.90	1.12	0.60	0.548			0.9	54.80	57.10	2.30	0.52	0.548	0.493	1.20	0.590	5%
26	58.30	1.05	0.56	0.383			0.9	57.10	60.90	3.80	0.49	0.383	0.345	1.86	0.642	5%
27	63.50	0.91	0.43	0.860			0.9	60.90	67.00	6.10	0.48	0.860	0.774	2.93	2.266	18%
Left	70.50	0.00	0.00	0.000	0.000	0.000	1.0	67.00	70.50	3.50	0.12	0.215	0.215	0.42	0.090	1%
Total Flow														12.564		

Measurement Details:

Start Time (MST):	11:30
End Time (MST):	12:30
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Clear

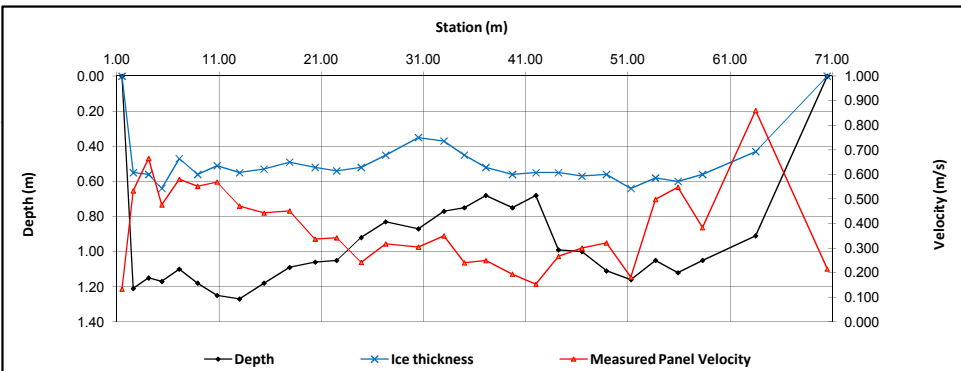
Flow characteristics:

Total Flow:	12.564	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	31.68	(m ²)
Wetted Width:	69.00	(m)
Hydraulic Depth:	0.459	(m)
Mean Velocity:	0.397	(m/s)
Froude Number:	0.187	

Datalogger Details:

	Before	After
Transducer Reading:	1.245	
Battery (Main):	12.58	
Battery (Aux):	4.75	
Datalogger Clock:	11:29	
Laptop Clock:	11:38	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	24%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC 1m from lggr	1.457	100.000	1.436	100.000	-
Bench Mark 2:	No BM 2					
Top of Ice:		3.463	97.994	3.439	97.997	97.996
Water Level:		3.442	98.015	3.419	98.017	98.016
Transducer Reading:		1.245	96.770	1.245	96.772	96.771
Other:						

General Notes:

Field Personnel:	SG, BL	Trip Date:	14-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S27 - Firebag River WSC

UTM Location: 488685 E, 6388706 N

Site Visit Date: December 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
R	2.00	0.00	0.00	0.000	0.000	0.000	1.0	2.00	3.10	1.10	0.18	0.120	0.120	0.19	0.023	0%
1	4.20	0.85	0.15	0.480			1.0	3.10	5.60	2.50	0.70	0.480	0.480	1.75	0.840	6%
2	7.00	0.80	0.15	0.430			1.0	5.60	8.30	2.70	0.65	0.430	0.430	1.76	0.755	5%
3	9.60	0.81	0.15	0.470			1.0	8.30	10.90	2.60	0.66	0.470	0.470	1.72	0.807	6%
4	12.20	0.94	0.16	0.500			1.0	10.90	13.40	2.50	0.78	0.500	0.500	1.95	0.975	7%
5	14.60	0.95	0.15	0.460			1.0	13.40	15.75	2.35	0.80	0.460	0.460	1.88	0.865	6%
6	16.90	0.87	0.15	0.450			1.0	15.75	18.25	2.50	0.72	0.450	0.450	1.80	0.810	6%
7	19.60	0.80	0.16	0.440			1.0	18.25	20.55	2.30	0.64	0.440	0.440	1.47	0.648	5%
8	21.50	0.70	0.15	0.390			1.0	20.55	23.10	2.55	0.55	0.390	0.390	1.40	0.547	4%
9	24.70	0.61	0.15	0.230			1.0	23.10	26.90	3.80	0.46	0.230	0.230	1.75	0.402	3%
10	29.10	0.55	0.15	0.290			1.0	26.90	31.80	4.90	0.40	0.290	0.290	1.96	0.568	4%
11	34.50	0.55	0.15	0.260			1.0	31.80	36.75	4.95	0.40	0.260	0.260	1.98	0.515	4%
12	39.00	0.35	0.16	0.260			1.0	36.75	41.15	4.40	0.19	0.260	0.260	0.84	0.217	2%
13	43.30	0.52	0.16	0.230			1.0	41.15	45.35	4.20	0.36	0.230	0.230	1.51	0.348	3%
14	47.40	0.64	0.16	0.440			1.0	45.35	48.65	3.30	0.48	0.440	0.440	1.58	0.697	5%
15	49.90	0.76	0.18	0.520			1.0	48.65	51.15	2.50	0.58	0.520	0.520	1.45	0.754	5%
16	52.40	0.74	0.15	0.490			1.0	51.15	53.60	2.35	0.59	0.490	0.490	1.39	0.679	5%
17	54.60	0.74	0.16	0.330			1.0	53.60	56.00	2.50	0.58	0.330	0.330	1.45	0.479	3%
18	57.40	0.85	0.15	0.440			1.0	56.00	58.65	2.65	0.70	0.440	0.440	1.86	0.816	6%
19	59.90	0.87	0.16	0.510			1.0	58.65	61.05	2.40	0.71	0.510	0.510	1.70	0.869	6%
20	62.20	0.72	0.12	0.490			1.0	61.05	63.35	2.30	0.60	0.490	0.490	1.38	0.676	5%
	64.50	0.50	0.15	0.510			1.0	63.35	65.55	2.20	0.35	0.510	0.510	0.77	0.393	3%
L	66.60	0.00	0.00	0.000	0.000	0.000	1.0	63.25	66.60	3.35	0.18	0.128	0.128	0.59	0.076	1%

Total Flow 13.758

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	11:45
Equipment:	MARSH
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Sunny, -3

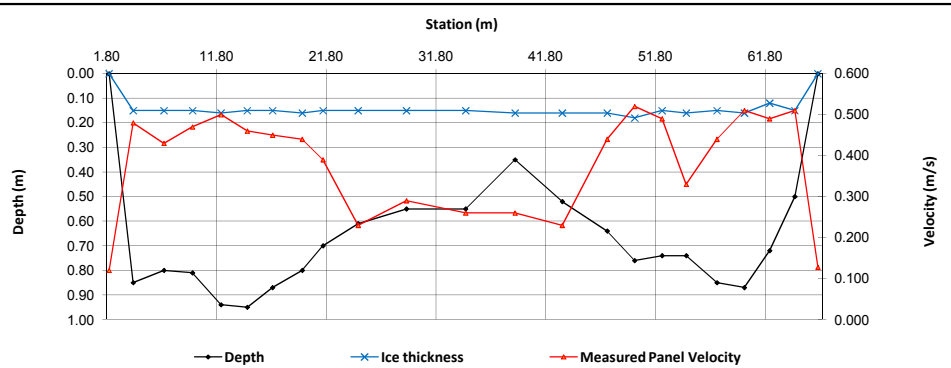
Flow characteristics:

Total Flow:	13.758	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	34.13	(m ²)
Wetted Width:	64.60	(m)
Hydraulic Depth:	0.528	(m)
Mean Velocity:	0.403	(m/s)
Froude Number:	0.177	

Datalogger Details:

	Before	After
Transducer Reading:	-	-
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar in PVC 1m from lggr		100.000		100.000	-
Bench Mark 2:	No BM 2					
Top of Ice:			100.000		100.000	100.000
Water Level:			100.000		100.000	100.000
Transducer Reading:		#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
Other:						

General Notes:

Field Personnel:	SM,SG	Trip Date:	3-Dec-11
Data Entry Personnel:	DW	Date:	5-Dec-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S29 - Christina River near Chard
 UTM Location: 508183 E, 6187926 N

Site Visit Date: January 11, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	30.00	0.00	0.00	0.000	0.000	0.000	0.9	30.00	29.10	0.90	0.10	0.067	0.060	0.09	0.005	0%
1	28.20	0.78	0.40	0.268			0.9	29.10	27.85	1.25	0.38	0.268	0.241	0.48	0.115	4%
2	27.50	1.10	0.40	0.378			0.9	27.85	27.20	0.65	0.70	0.378	0.340	0.46	0.155	5%
3	26.90	1.22	0.40		0.403	0.338	1.0	27.20	26.50	0.70	0.82	0.371	0.371	0.57	0.213	7%
4	26.10	1.32	0.40		0.320	0.270	1.0	26.50	25.65	0.85	0.92	0.295	0.295	0.78	0.231	7%
5	25.20	1.30	0.40		0.257	0.182	1.0	25.65	24.65	1.00	0.90	0.220	0.220	0.90	0.198	6%
6	24.10	1.09	0.45	0.499			0.9	24.65	23.55	1.10	0.64	0.499	0.449	0.70	0.316	10%
7	23.00	1.02	0.42	0.556			0.9	23.55	22.25	1.30	0.60	0.556	0.500	0.78	0.390	12%
8	21.50	0.91	0.42	0.383			0.9	22.25	21.10	1.15	0.49	0.383	0.345	0.56	0.194	6%
9	20.70	0.88	0.40	0.536			0.9	21.10	20.35	0.75	0.48	0.536	0.482	0.36	0.174	5%
10	20.00	0.84	0.38	0.418			0.9	20.35	19.60	0.75	0.46	0.418	0.376	0.35	0.130	4%
11	19.20	0.75	0.35	0.189			0.9	19.60	18.85	0.75	0.40	0.189	0.170	0.30	0.051	2%
12	18.50	0.70	0.32	0.748			0.9	18.85	18.15	0.70	0.38	0.748	0.673	0.27	0.179	6%
13	17.80	0.70	0.35	0.604			0.9	18.15	17.40	0.75	0.35	0.604	0.544	0.26	0.143	4%
14	17.00	0.65	0.35	0.607			0.9	17.40	16.80	0.60	0.30	0.607	0.546	0.18	0.098	3%
15	16.60	0.65	0.35	0.564			0.9	16.80	16.30	0.50	0.30	0.564	0.508	0.15	0.076	2%
16	16.00	0.65	0.32	0.816			0.9	16.30	15.65	0.65	0.33	0.816	0.734	0.21	0.158	5%
17	15.30	0.60	0.32	0.638			0.9	15.65	14.90	0.75	0.28	0.638	0.574	0.21	0.121	4%
18	14.50	0.60	0.32	0.853			0.9	14.90	14.15	0.75	0.28	0.853	0.768	0.21	0.161	5%
19	13.80	0.58	0.32	0.579			0.9	14.15	13.40	0.75	0.26	0.579	0.521	0.20	0.102	3%
20	13.00	0.51	0.32	0.403			0.9	13.40	11.85	1.55	0.19	0.403	0.363	0.29	0.107	3%
21	10.70	0.50	0.40	-0.165			0.9	11.85	9.70	2.15	0.10	-0.165	-0.149	0.22	-0.032	-1%
22	8.70	0.45	0.38	-0.495			0.9	9.70	6.35	3.35	0.07	-0.495	-0.446	0.23	-0.104	-3%
Right	4.00	0.00	0.00	0.000	0.000	0.000	1.0	6.35	4.00	2.35	0.02	-0.124	-0.124	0.04	-0.005	0%
Total Flow															3.173	

Measurement Details:

Start Time (MST):	13:35
End Time (MST):	16:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast

Flow characteristics:

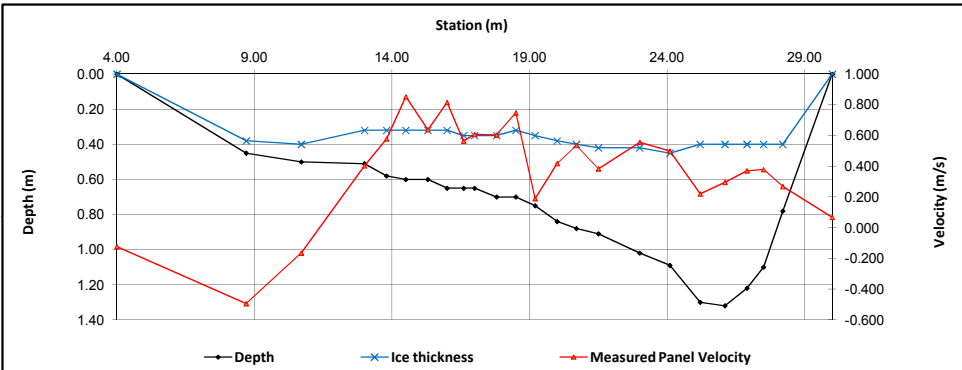
Total Flow:	3.173	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	8.80	(m ²)
Wetted Width:	22.75	(m)
Hydraulic Depth:	0.387	(m)
Mean Velocity:	0.361	(m/s)
Froude Number:	0.185	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site, no measurements taken.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	87-1: Bolt w/orange 'BM'	4.385	6.963	4.390	6.963	-
Bench Mark 2:			9.838		9.838	-
Top of Ice:		5.985	5.363	5.983	5.370	5.367
Water Level:		5.926	5.422	5.930	5.423	5.423
Transducer Reading:						
Other:	Rebar closest to WSC shack	1.183		1.178		
	Pipe 10m from WSC shack	0.738		0.733		

General Notes:

Benchmark 2 - Couldn't locate therefore use alternate location. (Water level based on 87-1 anyway)

Field Personnel:	DB, JO	Trip Date:	11-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S29 - Christina River near Chard
 UTM Location: 508183 E, 6187926 N

Site Visit Date: February 10, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.50	0.50	0.01	-0.013	-0.013	0.01	0.000	0%
1	4.00	0.45	0.40	-0.053			1.0	3.50	4.55	1.05	0.05	-0.053	-0.053	0.05	-0.003	0%
2	5.10	0.40	0.40	0.068			0.9	4.55	5.68	1.13	0.00	0.068	0.068	0.00	0.000	0%
3	6.25	0.75	0.50	0.017			0.9	5.68	6.78	1.10	0.25	0.017	0.015	0.28	0.004	0%
4	7.30	0.75	0.50	0.793			0.9	6.78	7.95	1.18	0.25	0.793	0.714	0.29	0.210	15%
5	8.60	0.75	0.50	0.775			0.9	7.95	9.25	1.30	0.25	0.775	0.698	0.33	0.227	16%
6	9.90	0.70	0.50	0.793			0.9	9.25	10.50	1.25	0.20	0.793	0.714	0.25	0.178	13%
7	11.10	0.70	0.50	0.732			0.9	10.50	11.70	1.20	0.20	0.732	0.659	0.24	0.158	11%
8	12.30	0.75	0.60	0.553			0.9	11.70	12.90	1.20	0.15	0.553	0.498	0.18	0.090	6%
9	13.50	0.70	0.50	0.476			0.9	12.90	14.30	1.40	0.20	0.476	0.428	0.28	0.120	9%
10	15.10	0.70	0.55	0.346			0.9	14.30	15.75	1.45	0.15	0.346	0.311	0.22	0.068	5%
11	16.40	0.70	0.50	0.157			0.9	15.75	16.98	1.23	0.20	0.157	0.141	0.25	0.035	2%
12	17.55	0.60	0.55	0.002			0.9	16.98	18.18	1.20	0.05	0.002	0.002	0.06	0.000	0%
13	18.80			0.000			1.0	18.18	19.30	1.13	0.01	0.000	0.000	0.01	0.000	0%
14	19.80	0.55	0.50	-0.052			0.9	19.30	20.40	1.10	0.05	-0.052	-0.047	0.05	-0.003	0%
15	21.00	0.65	0.60	0.052			0.9	20.40	21.60	1.20	0.05	0.052	0.047	0.06	0.003	0%
16	22.20			0.000			1.0	21.60	23.20	1.60	0.01	0.000	0.000	0.02	0.000	0%
17	24.20			0.000			1.0	23.20	24.65	1.45	0.00	0.000	0.000	0.00	0.000	0%
18	25.10	0.70	0.65	-0.002			0.9	24.65	25.55	0.90	0.05	-0.002	-0.002	0.05	0.000	0%
19	26.00	0.80	0.70	0.128			0.9	25.55	26.35	0.80	0.10	0.128	0.115	0.08	0.009	1%
20	26.70	0.80	0.70	0.222			0.9	26.35	27.20	0.85	0.10	0.222	0.200	0.08	0.017	1%
21	27.70	0.90	0.70	0.237			0.9	27.20	28.20	1.00	0.20	0.237	0.213	0.20	0.043	3%
22	28.70	0.90	0.70	0.161			0.9	28.20	29.15	0.95	0.20	0.161	0.145	0.19	0.028	2%
23	29.60	0.90	0.70	0.259			0.9	29.15	30.10	0.95	0.20	0.259	0.233	0.19	0.044	3%
24	30.60	0.95	0.65	0.255			0.9	30.10	31.05	0.95	0.30	0.255	0.230	0.29	0.065	5%
25	31.50	1.00	0.95	0.216			0.9	31.05	31.95	0.90	0.05	0.216	0.194	0.05	0.009	1%
26	32.40	1.00	0.70	0.113			0.9	31.95	32.80	0.85	0.30	0.113	0.102	0.25	0.026	2%
27	33.20	1.00	0.70	0.415			0.9	32.80	33.35	0.55	0.30	0.415	0.374	0.17	0.062	4%
28	33.50	0.95	0.90	0.337			0.9	33.35	33.70	0.35	0.05	0.337	0.303	0.02	0.005	0%
Right	33.90	0.00	0.00	0.000	0.000	0.000	1.0	33.70	33.90	0.20	0.01	0.084	0.084	0.00	0.000	0%
Total Flow															1.394	

Measurement Details:

Start Time (MST):	9:45
End Time (MST):	11:26
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Overcast (-9 °C)

Flow characteristics:

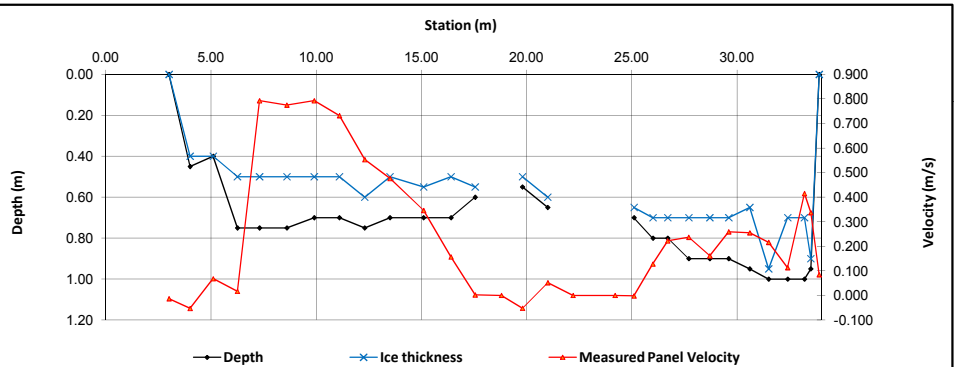
Total Flow:	1.394	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	4.13	(m ²)
Wetted Width:	30.90	(m)
Hydraulic Depth:	0.134	(m)
Mean Velocity:	0.337	(m/s)
Froude Number:	0.295	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	87-1: Bolt w/orange 'BM'	4.721	6.963	4.708	6.963	-
Bench Mark 2:	1" pipe with flagging	1.104	9.838	1.090	9.838	-
Top of Ice:		6.149	5.535	6.134	5.537	5.536
Water Level:		6.195	5.489	6.181	5.490	5.490
Transducer Reading:						
Other:						

General Notes:

Benchmark 2 - Couldn't locate brass cap therefore used 1" pipe with flagging.

Field Personnel:	BL, GE	Trip Date:	10-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S29 - Christina River near Chard
 UTM Location: 508183 E, 6187926 N

Site Visit Date: December 1, 2011



Flow Measurement:

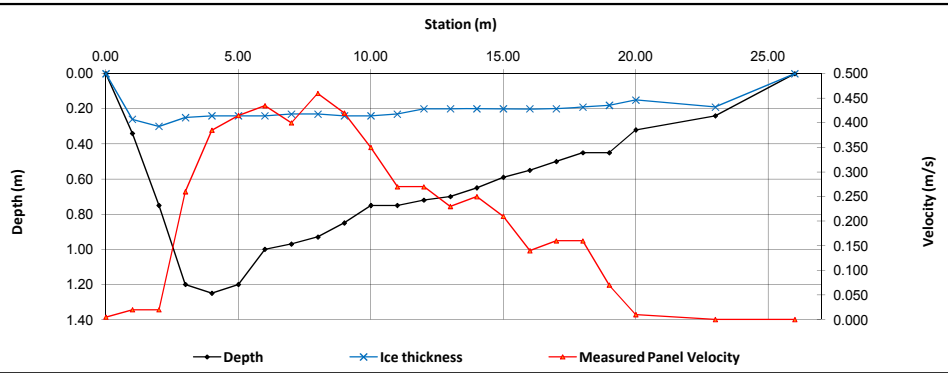
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	0.00	0.00	0.00	0.000	0.000	0.000	0.9	0.00	0.50	0.50	0.02	0.005	0.005	0.01	0.000	0%
1	1.00	0.34	0.26	0.020			0.9	0.50	1.50	1.00	0.08	0.020	0.018	0.08	0.001	0%
2	2.00	0.75	0.30	0.020			0.9	1.50	2.50	1.00	0.45	0.020	0.018	0.45	0.008	0%
3	3.00	1.20	0.25		0.270	0.250	1.0	2.50	3.50	1.00	0.95	0.260	0.260	0.95	0.247	8%
4	4.00	1.25	0.24		0.290	0.480	1.0	3.50	4.50	1.00	1.01	0.385	0.385	1.01	0.389	13%
5	5.00	1.20	0.24		0.360	0.470	1.0	4.50	5.50	1.00	0.96	0.415	0.415	0.96	0.398	13%
6	6.00	1.00	0.24		0.420	0.450	1.0	5.50	6.50	1.00	0.76	0.435	0.435	0.76	0.331	11%
7	7.00	0.97	0.23	0.400			0.9	6.50	7.50	1.00	0.74	0.400	0.360	0.74	0.266	9%
8	8.00	0.93	0.23	0.460			0.9	7.50	8.50	1.00	0.70	0.460	0.414	0.70	0.290	10%
9	9.00	0.85	0.24	0.420			0.9	8.50	9.50	1.00	0.61	0.420	0.378	0.61	0.231	8%
10	10.00	0.75	0.24	0.350			0.9	9.50	10.50	1.00	0.51	0.350	0.315	0.51	0.161	5%
11	11.00	0.75	0.23	0.270			0.9	10.50	11.50	1.00	0.52	0.270	0.243	0.52	0.126	4%
12	12.00	0.72	0.20	0.270			0.9	11.50	12.50	1.00	0.52	0.270	0.243	0.52	0.126	4%
13	13.00	0.70	0.20	0.230			0.9	12.50	13.50	1.00	0.50	0.230	0.207	0.50	0.104	3%
14	14.00	0.65	0.20	0.250			0.9	13.50	14.50	1.00	0.45	0.250	0.225	0.45	0.101	3%
15	15.00	0.59	0.20	0.210			0.9	14.50	15.50	1.00	0.39	0.210	0.189	0.39	0.074	2%
16	16.00	0.55	0.20	0.140			0.9	15.50	16.50	1.00	0.35	0.140	0.126	0.35	0.044	1%
17	17.00	0.50	0.20	0.160			0.9	16.50	17.50	1.00	0.30	0.160	0.144	0.30	0.043	1%
18	18.00	0.45	0.19	0.160			0.9	17.50	18.50	1.00	0.26	0.160	0.144	0.26	0.037	1%
19	19.00	0.45	0.18	0.070			0.9	18.50	19.50	1.00	0.27	0.070	0.063	0.27	0.017	1%
20	20.00	0.32	0.15	0.010			0.9	19.50	21.50	2.00	0.17	0.010	0.009	0.34	0.003	0%
21	23.00	0.24	0.19	0.000			1.0	21.50	24.50	3.00	0.05	0.000	0.000	0.15	0.000	0%
R	26.00	0.00	0.00	0.000	0.000	0.000	1.0	24.50	26.00	1.50	0.01	0.000	0.000	0.02	0.000	0%
Total Flow															2.998	

Measurement Details:	
Start Time (MST):	8:30
End Time (MST):	9:45
Equipment:	MARSH
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	good
Weather:	Clear, -8

Flow characteristics:	
Total Flow:	2.998 (m ³ /s)
Perceived Measurement Quality:	good
Cross Section Area:	10.85 (m ²)
Wetted Width:	26.00 (m)
Hydraulic Depth:	0.417 (m)
Mean Velocity:	0.276 (m/s)
Froude Number:	0.137

Datalogger Details:		
	Before	After
Transducer Reading:		
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	87-1: Bolt w/orange 'BM'	4.350	6.963	4.340	6.963	-
Bench Mark 2:	94-1: Brass cap by blue stk	1.711	9.838	1.703	9.838	-
Top of Ice:		6.040	5.273	6.035	5.268	5.271
Water Level:		6.065	5.248	6.060	5.243	5.246
Transducer Reading:	Brass Cap	1.462		1.455		
Other:						

General Notes:

Field Personnel:	SM, DB	Trip Date:	1-Dec-11
Data Entry Personnel:	DW	Date:	6-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S31 - Hangingstone Creek at North Star Road
 UTM Location: 476969 E, 6236095 N

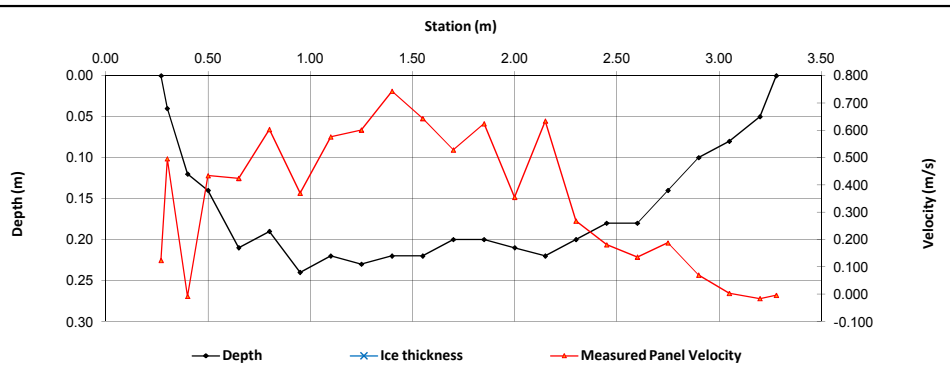
Site Visit Date: April 19, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	0.27	0.00		0.000	0.000	0.000	1.0	0.27	0.29	0.02	0.01	0.124	0.124	0.00	0.000	0%
1	0.30	0.04		0.496			1.0	0.29	0.35	0.06	0.04	0.496	0.496	0.00	0.001	1%
2	0.40	0.12		-0.008			1.0	0.35	0.45	0.10	0.12	-0.008	-0.008	0.01	0.000	0%
3	0.50	0.14		0.434			1.0	0.45	0.58	0.13	0.14	0.434	0.434	0.02	0.008	3%
4	0.65	0.21		0.424			1.0	0.58	0.73	0.15	0.21	0.424	0.424	0.03	0.013	6%
5	0.80	0.19		0.603			1.0	0.73	0.88	0.15	0.19	0.603	0.603	0.03	0.017	8%
6	0.95	0.24		0.370			1.0	0.88	1.03	0.15	0.24	0.370	0.370	0.04	0.013	6%
7	1.10	0.22		0.576			1.0	1.03	1.18	0.15	0.22	0.576	0.576	0.03	0.019	8%
8	1.25	0.23		0.601			1.0	1.18	1.33	0.15	0.23	0.601	0.601	0.03	0.021	9%
9	1.40	0.22		0.743			1.0	1.33	1.48	0.15	0.22	0.743	0.743	0.03	0.025	11%
10	1.55	0.22		0.643			1.0	1.48	1.63	0.15	0.22	0.643	0.643	0.03	0.021	9%
11	1.70	0.20		0.528			1.0	1.63	1.78	0.15	0.20	0.528	0.528	0.03	0.016	7%
12	1.85	0.20		0.624			1.0	1.78	1.93	0.15	0.20	0.624	0.624	0.03	0.019	8%
13	2.00	0.21		0.355			1.0	1.93	2.08	0.15	0.21	0.355	0.355	0.03	0.011	5%
14	2.15	0.22		0.634			1.0	2.08	2.23	0.15	0.22	0.634	0.634	0.03	0.021	9%
15	2.30	0.20		0.268			1.0	2.23	2.38	0.15	0.20	0.268	0.268	0.03	0.008	4%
16	2.45	0.18		0.181			1.0	2.38	2.53	0.15	0.18	0.181	0.181	0.03	0.005	2%
17	2.60	0.18		0.136			1.0	2.53	2.68	0.15	0.18	0.136	0.136	0.03	0.004	2%
18	2.75	0.14		0.188			1.0	2.68	2.83	0.15	0.14	0.188	0.188	0.02	0.004	2%
19	2.90	0.10		0.070			1.0	2.83	2.98	0.15	0.10	0.070	0.070	0.01	0.001	0%
20	3.05	0.08		0.003			1.0	2.98	3.13	0.15	0.08	0.003	0.003	0.01	0.000	0%
21	3.20	0.05		-0.016			1.0	3.13	3.24	0.12	0.05	-0.016	-0.016	0.01	0.000	0%
Left	3.28	0.00		0.000	0.000	0.000	1.0	3.24	3.28	0.04	0.01	-0.004	-0.004	0.00	0.000	0%
Total Flow															0.226	

Measurement Details:	
Start Time (MST):	14:00
End Time (MST):	15:15
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Mix of sun/cloud, 1°C



Flow characteristics:		
Total Flow:	0.226	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.52	(m ²)
Wetted Width:	3.01	(m)
Hydraulic Depth:	0.174	(m)
Mean Velocity:	0.432	(m/s)
Froude Number:	0.330	

Datalogger Details:		
	Before	After
Transducer Reading:		0.55
Battery (Main):	12.4	
Battery (Aux):	5.4	
Datalogger Clock:	13:15	
Laptop Clock:	13:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	7%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 Logger started at 1410hrs using original settings. Note 0.9 mm of rain recorded as a test. Calibration values NOT added to this location.

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	T-post right of trail	0.689	100.128	0.682	100.128	-
Bench Mark 2:	Nail in tree 3m west of lggr	1.371	99.418	1.368	99.418	-
Top of Ice:						
Water Level:		2.568	98.249	2.562	98.248	98.249
Transducer Reading:		0.550	97.699	0.550	97.698	97.699
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	19-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S31 - Hangingstone Creek at North Star Road

UTM Location: 476969 E, 6236095 N

Site Visit Date: June 20, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	2.80	0.00		0.000	0.000	0.000	1.0	2.80	2.98	0.18	0.02	0.001	0.001	0.00	0.000	0%
1	3.15	0.08		0.004			1.0	2.98	3.33	0.35	0.08	0.004	0.004	0.03	0.000	0%
2	3.50	0.18		0.109			1.0	3.33	3.65	0.33	0.18	0.109	0.109	0.06	0.006	2%
3	3.80	0.28		0.062			1.0	3.65	3.95	0.30	0.28	0.062	0.062	0.08	0.005	2%
4	4.10	0.34		0.083			1.0	3.95	4.25	0.30	0.34	0.083	0.083	0.10	0.008	3%
5	4.40	0.40		0.131			1.0	4.25	4.55	0.30	0.40	0.131	0.131	0.12	0.016	6%
6	4.70	0.45		0.100			1.0	4.55	4.85	0.30	0.45	0.100	0.100	0.14	0.014	5%
7	5.00	0.45		0.157			1.0	4.85	5.15	0.30	0.45	0.157	0.157	0.14	0.021	8%
8	5.30	0.44		0.194			1.0	5.15	5.45	0.30	0.44	0.194	0.194	0.13	0.026	9%
9	5.60	0.43		0.189			1.0	5.45	5.75	0.30	0.43	0.189	0.189	0.13	0.024	9%
10	5.90	0.43		0.185			1.0	5.75	6.05	0.30	0.43	0.185	0.185	0.13	0.024	9%
11	6.20	0.42		0.228			1.0	6.05	6.35	0.30	0.42	0.228	0.228	0.13	0.029	11%
12	6.50	0.38		0.161			1.0	6.35	6.65	0.30	0.38	0.161	0.161	0.11	0.018	7%
13	6.80	0.32		0.180			1.0	6.65	6.95	0.30	0.32	0.180	0.180	0.10	0.017	6%
14	7.10	0.28		0.196			1.0	6.95	7.25	0.30	0.28	0.196	0.196	0.08	0.016	6%
15	7.40	0.24		0.176			1.0	7.25	7.55	0.30	0.24	0.176	0.176	0.07	0.013	5%
16	7.70	0.20		0.176			1.0	7.55	7.85	0.30	0.20	0.176	0.176	0.06	0.011	4%
17	8.00	0.18		0.179			1.0	7.85	8.15	0.30	0.18	0.179	0.179	0.05	0.010	4%
18	8.30	0.17		0.144			1.0	8.15	8.45	0.30	0.17	0.144	0.144	0.05	0.007	3%
19	8.60	0.13		0.117			1.0	8.45	8.75	0.30	0.13	0.117	0.117	0.04	0.005	2%
20	8.90	0.10		0.058			1.0	8.75	9.05	0.30	0.10	0.058	0.058	0.03	0.002	1%
Right	9.20	0.00		0.000	0.000	0.000	1.0	9.05	9.20	0.15	0.03	0.015	0.015	0.00	0.000	0%
Total Flow														0.272		

Measurement Details:

Start Time (MST):	9:00
End Time (MST):	12:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast, 15°C

Flow characteristics:

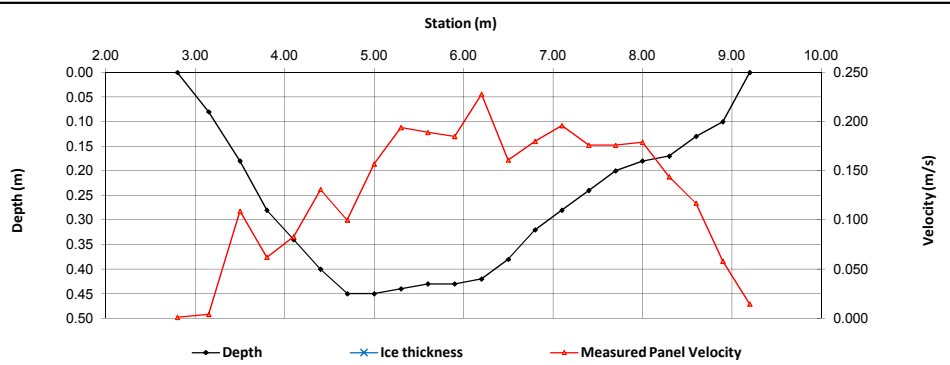
Total Flow:	0.272	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	1.79	(m ²)
Wetted Width:	6.40	(m)
Hydraulic Depth:	0.279	(m)
Mean Velocity:	0.152	(m/s)
Froude Number:	0.092	

Datalogger Details:

	Before	After
Transducer Reading:	0.448	0.354
Battery (Main):	5.4	5.44
Battery (Aux):	14.4	14.39
Datalogger Clock:	-	10:58
Laptop Clock:	-	11:04
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	10%	10%
Dessicant:	-	Changed
Logger# (if Δ):		
PT# (if Δ):		603609

Datalogger / Station Notes:

Collected PT data looks bad, possibly due to faulty sensor or logger. PT changed and checked water depth manually (was OK).
 Precipitation (before) = 1.414708, (after) = -0.083335



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post right of trail	0.429	100.128	0.423	100.128	-
Bench Mark 2:	Nail in tree 3m west of lggr	1.143	99.418	1.135	99.418	-
Top of Ice:						
Water Level:		2.258	98.299	2.251	98.300	98.300
Transducer Reading:		0.354	97.945	0.354	97.946	97.946
Other:						

General Notes:

Field Personnel:	DB SM	Trip Date:	20-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S31 - Hangingstone Creek at North Star Road

UTM Location: 476969 E, 6236095 N

Site Visit Date: August 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.40	0.00	0.00	0.000	0.000	0.000	1.0	3.40	3.55	0.15	0.09	0.048	0.048	0.01	0.001	0%
1	3.70	0.36		0.193			1.0	3.55	3.85	0.30	0.36	0.193	0.193	0.11	0.021	2%
2	4.00	0.28		0.299			1.0	3.85	4.15	0.30	0.28	0.299	0.299	0.08	0.025	2%
3	4.30	0.48		0.400			1.0	4.15	4.45	0.30	0.48	0.400	0.400	0.14	0.058	5%
4	4.60	0.50		0.401			1.0	4.45	4.75	0.30	0.50	0.401	0.401	0.15	0.060	6%
5	4.90	0.54		0.368			1.0	4.75	5.05	0.30	0.54	0.368	0.368	0.16	0.060	6%
6	5.20	0.55		0.399			1.0	5.05	5.35	0.30	0.55	0.399	0.399	0.16	0.066	6%
7	5.50	0.58		0.412			1.0	5.35	5.65	0.30	0.58	0.412	0.412	0.17	0.072	7%
8	5.80	0.58		0.371			1.0	5.65	5.95	0.30	0.58	0.371	0.371	0.17	0.065	6%
9	6.10	0.60		0.423			1.0	5.95	6.25	0.30	0.60	0.423	0.423	0.18	0.076	7%
10	6.40	0.59		0.357			1.0	6.25	6.55	0.30	0.59	0.357	0.357	0.18	0.063	6%
11	6.70	0.60		0.377			1.0	6.55	6.85	0.30	0.60	0.377	0.377	0.18	0.068	6%
12	7.00	0.60		0.334			1.0	6.85	7.15	0.30	0.60	0.334	0.334	0.18	0.060	6%
13	7.30	0.60		0.331			1.0	7.15	7.45	0.30	0.60	0.331	0.331	0.18	0.060	6%
14	7.60	0.58		0.355			1.0	7.45	7.75	0.30	0.58	0.355	0.355	0.17	0.062	6%
15	7.90	0.59		0.258			1.0	7.75	8.05	0.30	0.59	0.258	0.258	0.18	0.046	4%
16	8.20	0.59		0.230			1.0	8.05	8.35	0.30	0.59	0.230	0.230	0.18	0.041	4%
17	8.50	0.49		0.275			1.0	8.35	8.65	0.30	0.49	0.275	0.275	0.15	0.040	4%
18	8.80	0.50		0.167			1.0	8.65	8.95	0.30	0.50	0.167	0.167	0.15	0.025	2%
19	9.10	0.49		0.215			1.0	8.95	9.25	0.30	0.49	0.215	0.215	0.15	0.032	3%
20	9.40	0.42		0.211			1.0	9.25	9.55	0.30	0.42	0.211	0.211	0.13	0.027	3%
21	9.70	0.38		0.190			1.0	9.55	9.85	0.30	0.38	0.190	0.190	0.11	0.022	2%
22	10.00	0.26		0.139			1.0	9.85	10.20	0.35	0.26	0.139	0.139	0.09	0.013	1%
LB	10.40	0.00	0.00	0.000	0.000	0.000	1.0	10.20	10.40	0.20	0.07	0.035	0.035	0.01	0.000	0%
Total Flow															1.060	

Measurement Details:

Start Time (MST):	6:45
End Time (MST):	8:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast

Flow Characteristics:

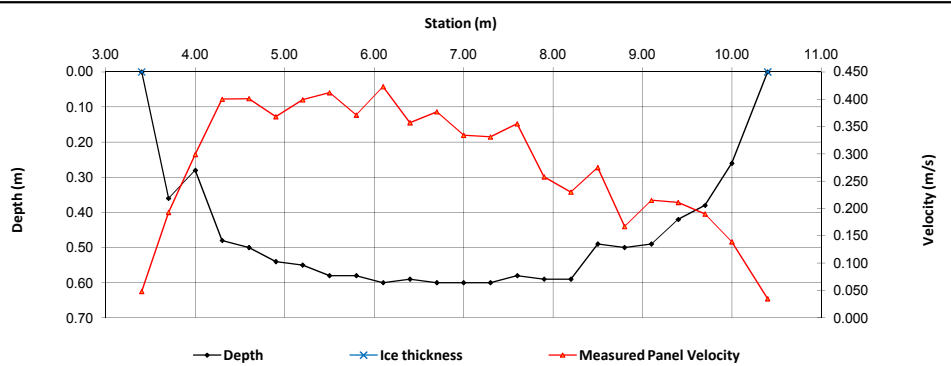
Total Flow:	1.060	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	3.39	(m ²)
Wetted Width:	7.00	(m)
Hydraulic Depth:	0.484	(m)
Mean Velocity:	0.313	(m/s)
Froude Number:	0.144	

Datalogger Details:

	Before	After
Transducer Reading:	0.545	0.546
Battery (Main):	5.4	4.50
Battery (Aux):	13.4	13.69
Datalogger Clock:	6:35	8:49
Laptop Clock:	6:47	8:49
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	12%	0%
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Rain Gauge Levelled. Rain started 8:50 MST. Ignore prior data.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post right of trail	0.569	100.128	0.561	100.128	-
Bench Mark 2:	Nail in tree 3m west of lggr	1.285	99.418	1.277	99.418	-
Top of Ice:						
Water Level:		2.194	98.503	2.185	98.504	98.504
Transducer Reading:		0.545	97.958	0.545	97.959	97.959
Other:	3/4" post nr logger	0.978	100.000	0.970	100.000	

General Notes:

Field Personnel:	DB, KW	Trip Date:	18-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S31 - Hangingstone Creek at North Star Road
 UTM Location: 476969 E, 6236095 N

Site Visit Date: September 13, 2011



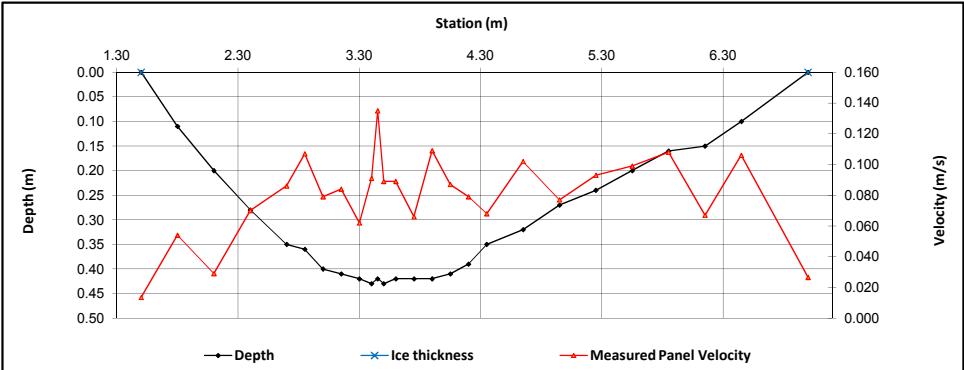
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	1.50	0.00	0.00	0.000	0.000	0.000	1.0	1.50	1.65	0.15	0.03	0.014	0.014	0.00	0.000	0%
1	1.80	0.11		0.054			1.0	1.65	1.95	0.30	0.11	0.054	0.054	0.03	0.002	2%
2	2.10	0.20		0.029			1.0	1.95	2.25	0.30	0.20	0.029	0.029	0.06	0.002	1%
3	2.40	0.28		0.070			1.0	2.25	2.55	0.30	0.28	0.070	0.070	0.08	0.006	5%
4	2.70	0.35		0.086			1.0	2.55	2.78	0.23	0.35	0.086	0.086	0.08	0.007	6%
5	2.85	0.36		0.107			1.0	2.78	2.93	0.15	0.36	0.107	0.107	0.05	0.006	5%
6	3.00	0.40		0.079			1.0	2.93	3.08	0.15	0.40	0.079	0.079	0.06	0.005	4%
7	3.15	0.41		0.084			1.0	3.08	3.23	0.15	0.41	0.084	0.084	0.06	0.005	4%
8	3.30	0.42		0.062			1.0	3.23	3.35	0.13	0.42	0.062	0.062	0.05	0.003	3%
9	3.40	0.43		0.091			1.0	3.35	3.43	0.08	0.43	0.091	0.091	0.03	0.003	3%
10	3.45	0.42		0.135			1.0	3.43	3.48	0.05	0.42	0.135	0.135	0.02	0.003	2%
11	3.50	0.43		0.089			1.0	3.48	3.55	0.07	0.43	0.089	0.089	0.03	0.003	2%
12	3.60	0.43		0.089			1.0	3.55	3.68	0.13	0.42	0.089	0.089	0.05	0.005	4%
13	3.75	0.42		0.066			1.0	3.68	3.83	0.15	0.42	0.066	0.066	0.06	0.004	4%
14	3.90	0.42		0.109			1.0	3.83	3.98	0.15	0.42	0.109	0.109	0.06	0.007	6%
15	4.05	0.41		0.087			1.0	3.98	4.13	0.15	0.41	0.087	0.087	0.06	0.005	5%
16	4.20	0.39		0.079			1.0	4.13	4.28	0.15	0.39	0.079	0.079	0.06	0.005	4%
17	4.35	0.35		0.068			1.0	4.28	4.50	0.23	0.35	0.068	0.068	0.08	0.005	5%
18	4.65	0.32		0.102			1.0	4.50	4.80	0.30	0.32	0.102	0.102	0.10	0.010	8%
19	4.95	0.27		0.077			1.0	4.80	5.10	0.30	0.27	0.077	0.077	0.08	0.006	5%
20	5.25	0.24		0.093			1.0	5.10	5.40	0.30	0.24	0.093	0.093	0.07	0.007	6%
21	5.55	0.20		0.099			1.0	5.40	5.70	0.30	0.20	0.099	0.099	0.06	0.006	5%
22	5.85	0.16		0.108			1.0	5.70	6.00	0.30	0.16	0.108	0.108	0.05	0.005	4%
23	6.15	0.15		0.067			1.0	6.00	6.30	0.30	0.15	0.067	0.067	0.05	0.003	3%
24	6.45	0.10		0.106			1.0	6.30	6.73	0.42	0.10	0.106	0.106	0.04	0.005	4%
RB	7.00	0.00	0.00	0.000	0.000	0.000	1.0	6.73	7.00	0.28	0.03	0.027	0.027	0.01	0.000	0%
Total Flow															0.116	

Measurement Details:	
Start Time (MST):	7:00
End Time (MST):	8:05
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, frost, -5°C

Flow characteristics:		
Total Flow:	0.116	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.40	(m ²)
Wetted Width:	5.50	(m)
Hydraulic Depth:	0.255	(m)
Mean Velocity:	0.083	(m/s)
Froude Number:	0.053	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	4.5	
Battery (Aux):	12.8	
Rainfall Before (mm)	15.40	
Datalogger Clock:	7:14	
Laptop Clock:	7:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	1%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 checked precipitation gauge levelled. 22mm at 7.33m.
 Ignore data at 8:am



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post right of trail	0.597	100.128	0.588	100.128	-
Bench Mark 2:	Nail in tree 3m west of lggr	1.314	99.418	1.306	99.418	-
Top of Ice:						
Water Level:		2.492	98.233	2.483	98.233	98.233
Transducer Reading:			98.233		98.233	98.233
Other:	3/4" post nr logger	1.006	100.000	0.998	100.000	

General Notes:
 BM3: pipe in ground 1.5m West of logger box

Field Personnel:	DB, SM	Trip Date:	13-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S31 - Hangingstone Creek at North Star Road

UTM Location: 476969 E, 6236095 N

Site Visit Date: November 2, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	3.16	0.00	0.00	0.000	0.000	0.000	1.0	3.16	3.33	0.17	0.04	-0.002	-0.002	0.01	0.000	0%
1	3.50	0.14		-0.008			1.0	3.33	3.65	0.32	0.14	-0.008	-0.008	0.04	0.000	0%
2	3.80	0.22		0.036			1.0	3.65	3.95	0.30	0.22	0.036	0.036	0.07	0.002	2%
3	4.10	0.24		0.090			1.0	3.95	4.25	0.30	0.24	0.090	0.090	0.07	0.006	6%
4	4.40	0.37		0.064			1.0	4.25	4.55	0.30	0.37	0.064	0.064	0.11	0.007	6%
5	4.70	0.42		0.073			1.0	4.55	4.78	0.23	0.42	0.073	0.073	0.09	0.007	6%
6	4.85	0.47		0.060			1.0	4.78	4.93	0.15	0.47	0.060	0.060	0.07	0.004	4%
7	5.00	0.44		0.037			1.0	4.93	5.08	0.15	0.44	0.037	0.037	0.07	0.002	2%
8	5.15	0.44		0.071			1.0	5.08	5.23	0.15	0.44	0.071	0.071	0.07	0.005	4%
9	5.30	0.44		0.102			1.0	5.23	5.38	0.15	0.44	0.102	0.102	0.07	0.007	6%
10	5.45	0.42		0.110			1.0	5.38	5.53	0.15	0.42	0.110	0.110	0.06	0.007	6%
11	5.60	0.43		0.122			1.0	5.53	5.68	0.15	0.43	0.122	0.122	0.06	0.008	7%
12	5.75	0.40		0.104			1.0	5.68	5.83	0.15	0.40	0.104	0.104	0.06	0.006	6%
13	5.90	0.40		0.082			1.0	5.83	6.05	0.23	0.40	0.082	0.082	0.09	0.007	7%
14	6.20	0.37		0.067			1.0	6.05	6.35	0.30	0.37	0.067	0.067	0.11	0.007	7%
15	6.50	0.32		0.072			1.0	6.35	6.65	0.30	0.32	0.072	0.072	0.10	0.007	6%
16	6.80	0.28		0.034			1.0	6.65	6.95	0.30	0.28	0.034	0.034	0.08	0.003	3%
17	7.10	0.26		0.092			1.0	6.95	7.25	0.30	0.26	0.092	0.092	0.08	0.007	7%
18	7.40	0.22		0.095			1.0	7.25	7.55	0.30	0.22	0.095	0.095	0.07	0.006	6%
19	7.70	0.16		0.098			1.0	7.55	7.85	0.30	0.16	0.098	0.098	0.05	0.005	4%
20	8.00	0.14		0.067			1.0	7.85	8.15	0.30	0.14	0.067	0.067	0.04	0.003	3%
21	8.30	0.10		0.076			1.0	8.15	8.55	0.40	0.10	0.076	0.076	0.04	0.003	3%
R	8.80	0.00	0.00	0.000	0.000	0.000	1.0	8.55	8.80	0.25	0.03	0.019	0.019	0.01	0.000	0%
Total Flow															0.110	

Measurement Details:

Start Time (MST):	8:15
End Time (MST):	9:05
Equipment:	ADV
Method:	Wading
River Condition:	Low
Quality/Error (see reverse):	Excellent
Weather:	Clear, -2°C

Flow characteristics:

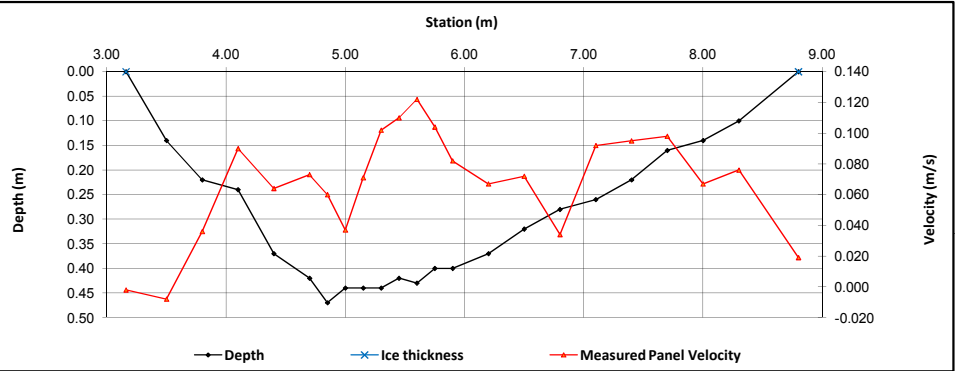
Total Flow:	0.110	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.51	(m ²)
Wetted Width:	5.64	(m)
Hydraulic Depth:	0.268	(m)
Mean Velocity:	0.073	(m/s)
Froude Number:	0.045	

Datalogger Details:

Transducer Reading:	Before	After
		0.274
Battery (Main):	4.5	
Battery (Aux):	12.9	
Rainfall Before (mm)	53	
Rainfall After (mm)	53	
Datalogger Clock:	8:14	
Laptop Clock:	8:19	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	4%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station

Removed DD-44, PT, Battery



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	T-post right of trail	0.459	100.128	0.476	100.128	-
Bench Mark 2:	Nail in tree 3m west of lggr	1.200	99.418	1.192	99.418	-
Top of Ice:						
Water Level:		2.387	98.200	2.369	98.235	98.218
Transducer Reading:			98.200		98.235	98.218
Other:	3/4" post nr logger	0.903	100.000	0.885	100.000	

General Notes:

BM1: 0.98m
 BM3: 0.48m
 PT Weight placed next to base of logger box tree

Field Personnel:	SM, GB	Trip Date:	2-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S32 - Surmont Creek at Highway 881

UTM Location: 490252 E, 6254511 N

Site Visit Date: April 25, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	2.80	0.00	0.00	0.000	0.000	0.000	0.9	2.80	3.05	0.25	0.11	-0.009	-0.008	0.03	0.000	0%
1	3.30	0.42		-0.036			0.9	3.05	3.40	0.35	0.42	-0.036	-0.032	0.15	-0.005	-1%
2	3.50	0.78			-0.038	0.043	1.0	3.40	3.65	0.25	0.78	0.003	0.003	0.20	0.000	0%
3	3.80	0.78			0.043	0.104	1.0	3.65	3.95	0.30	0.78	0.074	0.074	0.23	0.017	5%
4	4.10	0.74		0.198			0.9	3.95	4.25	0.30	0.74	0.198	0.178	0.22	0.040	12%
5	4.40	0.71		0.206			0.9	4.25	4.55	0.30	0.71	0.206	0.185	0.21	0.039	12%
6	4.70	0.68		0.169			0.9	4.55	4.85	0.30	0.68	0.169	0.152	0.20	0.031	10%
7	5.00	0.71		0.193			0.9	4.85	5.15	0.30	0.71	0.193	0.174	0.21	0.037	11%
8	5.30	0.74		0.200			0.9	5.15	5.45	0.30	0.74	0.200	0.180	0.22	0.040	12%
9	5.60	0.80			0.105	0.226	1.0	5.45	5.75	0.30	0.80	0.166	0.166	0.24	0.040	12%
10	5.90	0.76			0.161	0.225	1.0	5.75	6.05	0.30	0.76	0.193	0.193	0.23	0.044	13%
11	6.20	0.74		0.137			0.9	6.05	6.35	0.30	0.74	0.137	0.123	0.22	0.027	8%
12	6.50	0.44		0.122			0.9	6.35	6.70	0.35	0.44	0.122	0.110	0.15	0.017	5%
13	6.90	0.41		0.073			0.9	6.70	7.10	0.40	0.41	0.073	0.066	0.16	0.011	3%
14	7.30	0.38		0.015			0.9	7.10	7.50	0.40	0.38	0.015	0.014	0.15	0.002	1%
15	7.70	0.31		-0.035			0.9	7.50	7.90	0.40	0.31	-0.035	-0.032	0.12	-0.004	-1%
16	8.10	0.14		-0.144			0.9	7.90	8.30	0.40	0.14	-0.144	-0.130	0.06	-0.007	-2%
17	8.50	0.09		-0.059			0.9	8.30	8.70	0.40	0.09	-0.059	-0.053	0.04	-0.002	-1%
18	8.90	0.10		-0.049			0.9	8.70	9.00	0.30	0.10	-0.049	-0.044	0.03	-0.001	0%
Right	9.10	0.00	0.00	0.000	0.000	0.000	1.0	9.00	9.10	0.10	0.03	-0.012	-0.012	0.00	0.000	0%
Total Flow															0.326	

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	15:40
Equipment:	ADV
Method:	
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Sunny, 15°C

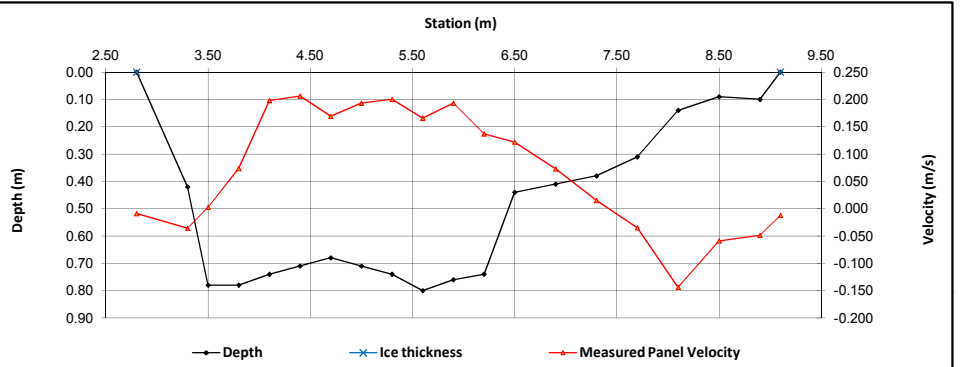
Flow characteristics:

Total Flow:	0.326	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.08	(m ²)
Wetted Width:	6.30	(m)
Hydraulic Depth:	0.490	(m)
Mean Velocity:	0.106	(m/s)
Froude Number:	0.048	

Datalogger Details:

	Before	After
Transducer Reading:		0.72
Battery (Main):	11.3	
Battery (Aux):	12.3	
Datalogger Clock:	15:20	
Laptop Clock:	15:20	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.30	
Memory Used:	0%	
Dessicant:	New	
Logger# (if Δ):	-	
PT# (if Δ):	-	

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail on bridge	2.058	97.942	2.027	97.942	-
Bench Mark 2:	Rebar with flagging	1.008	98.981	0.984	98.981	-
Top of Ice:						
Water Level:		2.433	97.567	2.910	97.059	97.313
Transducer Reading:		0.720	96.847	0.720	96.339	96.593
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	25-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S32 - Surmont Creek at Highway 881

UTM Location: 490252 E, 6254511 N

Site Visit Date: June 20, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.50	3.75	0.25	0.09	-0.018	-0.018	0.02	0.000	0%
1	4.00	0.36		-0.072			1.0	3.75	4.20	0.45	0.36	-0.072	-0.072	0.16	-0.012	-1%
2	4.40	0.52		0.032			1.0	4.20	4.60	0.40	0.52	0.032	0.032	0.21	0.007	1%
3	4.80	0.53		0.090			1.0	4.60	5.00	0.40	0.53	0.090	0.090	0.21	0.019	2%
4	5.20	0.72		0.205			1.0	5.00	5.33	0.33	0.72	0.205	0.205	0.23	0.048	4%
5	5.45	0.85			0.252	0.394	1.0	5.33	5.58	0.25	0.85	0.323	0.323	0.21	0.069	6%
6	5.70	0.94			0.367	0.483	1.0	5.58	5.83	0.25	0.94	0.425	0.425	0.24	0.100	8%
7	5.95	1.00			0.408	0.551	1.0	5.83	6.08	0.25	1.00	0.480	0.480	0.25	0.120	10%
8	6.20	1.00			0.323	0.540	1.0	6.08	6.33	0.25	1.00	0.432	0.432	0.25	0.108	9%
9	6.45	0.94			0.382	0.593	1.0	6.33	6.58	0.25	0.94	0.488	0.488	0.24	0.115	9%
10	6.70	0.88			0.318	0.557	1.0	6.58	6.83	0.25	0.88	0.438	0.438	0.22	0.096	8%
11	6.95	0.87			0.431	0.466	1.0	6.83	7.08	0.25	0.87	0.449	0.449	0.22	0.098	8%
12	7.20	0.83			0.223	0.279	1.0	7.08	7.30	0.23	0.83	0.251	0.251	0.19	0.047	4%
13	7.40	0.81			0.358	0.431	1.0	7.30	7.50	0.20	0.81	0.395	0.395	0.16	0.064	5%
14	7.60	0.84			0.426	0.369	1.0	7.50	7.80	0.30	0.84	0.398	0.398	0.25	0.100	8%
15	8.00	0.83			0.325	0.202	1.0	7.80	8.20	0.40	0.83	0.264	0.264	0.33	0.087	7%
16	8.40	0.75			0.212	0.198	1.0	8.20	8.60	0.40	0.75	0.205	0.205	0.30	0.062	5%
17	8.80	0.62		0.090			1.0	8.60	9.00	0.40	0.62	0.090	0.090	0.25	0.022	2%
18	9.20	0.66		-0.023			1.0	9.00	9.45	0.45	0.66	-0.023	-0.023	0.30	-0.007	-1%
19	9.70	0.67		0.072			1.0	9.45	9.95	0.50	0.67	0.072	0.072	0.34	0.024	2%
20	10.20	0.67		0.112			1.0	9.95	10.45	0.50	0.67	0.112	0.112	0.34	0.038	3%
21	10.70	0.55		0.185			1.0	10.45	10.95	0.50	0.55	0.185	0.185	0.28	0.051	4%
22	11.20	0.3		-0.040			1.0	10.95	11.55	0.60	0.30	-0.040	-0.040	0.18	-0.007	-1%
Left	11.90	0.00	0.00	0.000	0.000	0.000	1.0	11.55	11.90	0.35	0.08	-0.010	-0.010	0.03	0.000	0%
Total Flow															1.247	

Measurement Details:

Start Time (MST):	15:20
End Time (MST):	16:10
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Rain 15oC

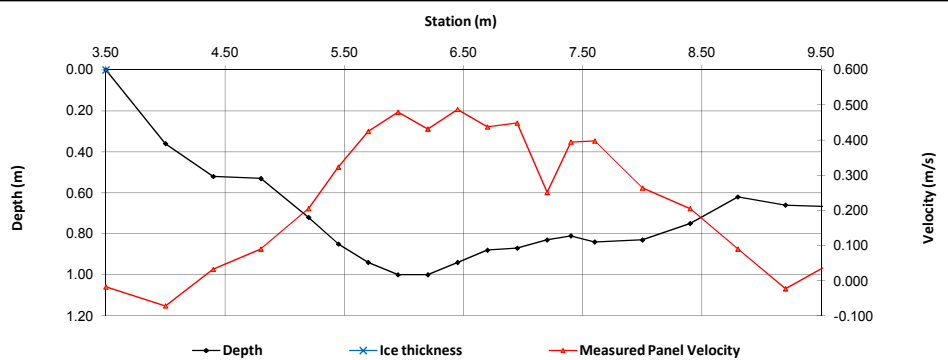
Flow characteristics:

Total Flow:	1.247	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	5.39	(m ²)
Wetted Width:	8.40	(m)
Hydraulic Depth:	0.641	(m)
Mean Velocity:	0.231	(m/s)
Froude Number:	0.092	

Datalogger Details:

	Before	After
Transducer Reading:		1.199
Battery (Main):	100%	
Battery (Aux):	11.92	12.29
Datalogger Clock:	15:21	
Laptop Clock:	15:22	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	9.86	
Memory Used:	40%	
Dessicant:	Changed	
Logger# (if Δ):	-	
PT# (if Δ):	-	

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail on bridge	1.724	97.942	1.690	97.942	-
Bench Mark 2:	Rebar with flagging	0.685	98.981	0.650	98.981	-
Top of Ice:						
Water Level:		2.555	97.111	2.520	97.112	97.112
Transducer Reading:		1.199	95.912	1.199	95.913	95.912
Other:						

General Notes:

Field Personnel:	DB SM	Trip Date:	20-Jun-11
Data Entry Personnel:	DB	Date:	30-Jun-11
Data Check Personnel:	CM	Date:	29-Jul-11

Hydrometric Measurement / Site Visit Record

Site: S32 - Surmont Creek at Highway 881

UTM Location: 490252 E, 6254511 N

Site Visit Date: August 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	3.20	0.00	0.00	0.000	0.000	0.000	1.0	3.20	3.40	0.20	0.07	0.019	0.019	0.01	0.000	0%
1	3.60	0.26		0.077			1.0	3.40	3.80	0.40	0.26	0.077	0.077	0.10	0.008	1%
2	4.00	0.36		0.058			1.0	3.80	4.20	0.40	0.36	0.058	0.058	0.14	0.008	1%
3	4.40	0.43		0.166			1.0	4.20	4.55	0.35	0.43	0.166	0.166	0.15	0.025	3%
4	4.70	0.49		0.238			1.0	4.55	4.85	0.30	0.49	0.238	0.238	0.15	0.035	4%
5	5.00	0.50		0.261			1.0	4.85	5.15	0.30	0.50	0.261	0.261	0.15	0.039	5%
6	5.30	0.59		0.312			1.0	5.15	5.45	0.30	0.59	0.312	0.312	0.18	0.055	7%
7	5.60	0.60		0.381			1.0	5.45	5.75	0.30	0.60	0.381	0.381	0.18	0.069	8%
8	5.90	0.61		0.381			1.0	5.75	6.05	0.30	0.61	0.381	0.381	0.18	0.070	8%
9	6.20	0.58		0.305			1.0	6.05	6.35	0.30	0.58	0.305	0.305	0.17	0.053	6%
10	6.50	0.56		0.328			1.0	6.35	6.65	0.30	0.56	0.328	0.328	0.17	0.055	7%
11	6.80	0.57		0.334			1.0	6.65	6.95	0.30	0.57	0.334	0.334	0.17	0.057	7%
12	7.10	0.55		0.347			1.0	6.95	7.25	0.30	0.55	0.347	0.347	0.17	0.057	7%
13	7.40	0.54		0.424			1.0	7.25	7.55	0.30	0.54	0.424	0.424	0.16	0.069	8%
14	7.70	0.54		0.397			1.0	7.55	7.85	0.30	0.54	0.397	0.397	0.16	0.064	8%
15	8.00	0.54		0.379			1.0	7.85	8.15	0.30	0.54	0.379	0.379	0.16	0.061	7%
16	8.30	0.54		0.294			1.0	8.15	8.45	0.30	0.54	0.294	0.294	0.16	0.048	6%
17	8.60	0.50		0.170			1.0	8.45	8.75	0.30	0.50	0.170	0.170	0.15	0.026	3%
18	8.90	0.40		0.178			1.0	8.75	9.05	0.30	0.40	0.178	0.178	0.12	0.021	3%
19	9.20	0.32		0.091			1.0	9.05	9.35	0.30	0.32	0.091	0.091	0.10	0.009	1%
20	9.50	0.24		0.083			1.0	9.35	9.75	0.40	0.24	0.083	0.083	0.10	0.008	1%
21	10.00	0.18		0.016			1.0	9.75	10.25	0.50	0.18	0.016	0.016	0.09	0.001	0%
RB	10.50	0.00	0.00	0.000	0.000	0.000	1.0	10.25	10.50	0.25	0.05	0.004	0.004	0.01	0.000	0%
Total Flow															0.839	

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	14:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Partly Cloudy

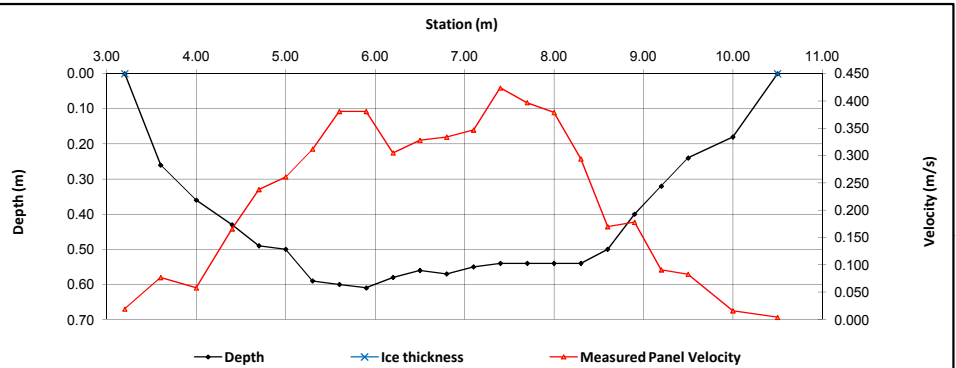
Flow characteristics:

Total Flow:	0.839	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	3.14	(m ²)
Wetted Width:	7.30	(m)
Hydraulic Depth:	0.430	(m)
Mean Velocity:	0.267	(m/s)
Froude Number:	0.130	

Datalogger Details:

	Before	After
Transducer Reading:		1.221
Battery (Main):	100%	
Battery (Aux):	77%	
Datalogger Clock:	13:04	
Laptop Clock:	13:08	
Air Temperature °C:	15	
Air Pressure:	-	
RH:	-	
Water °C:	12.6	
Memory Used:	65%	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail on bridge	1.913	97.942	1.855	97.942	-
Bench Mark 2:	Rebar with flagging	0.871	98.981	0.816	98.981	-
Top of Ice:						
Water Level:		2.895	96.960	2.838	96.959	96.960
Transducer Reading:		1.221	95.739	1.221	95.738	95.739
Other:						

General Notes:

Field Personnel:	DB, KW	Trip Date:	18-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S32 - Surmont Creek at Highway 881

UTM Location: 490252 E, 6254511 N

Site Visit Date: September 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.50	3.75	0.25	0.04	0.004	0.004	0.01	0.000	0%
1	4.00	0.15		0.017			1.0	3.75	4.13	0.38	0.15	0.017	0.017	0.06	0.001	1%
2	4.25	0.26		0.023			1.0	4.13	4.38	0.25	0.26	0.023	0.023	0.07	0.001	1%
3	4.50	0.36		0.043			1.0	4.38	4.63	0.25	0.36	0.043	0.043	0.09	0.004	4%
4	4.75	0.40		0.046			1.0	4.63	4.88	0.25	0.40	0.046	0.046	0.10	0.005	4%
5	5.00	0.44		0.063			1.0	4.88	5.13	0.25	0.44	0.063	0.063	0.11	0.007	6%
6	5.25	0.49		0.058			1.0	5.13	5.38	0.25	0.49	0.058	0.058	0.12	0.007	7%
7	5.50	0.48		0.065			1.0	5.38	5.63	0.25	0.48	0.065	0.065	0.12	0.008	7%
8	5.75	0.49		0.049			1.0	5.63	5.88	0.25	0.49	0.049	0.049	0.12	0.006	5%
9	6.00	0.49		0.036			1.0	5.88	6.13	0.25	0.49	0.036	0.036	0.12	0.004	4%
10	6.25	0.47		0.045			1.0	6.13	6.38	0.25	0.47	0.045	0.045	0.12	0.005	5%
11	6.50	0.44		0.051			1.0	6.38	6.63	0.25	0.44	0.051	0.051	0.11	0.006	5%
12	6.75	0.41		0.059			1.0	6.63	6.88	0.25	0.41	0.059	0.059	0.10	0.006	6%
13	7.00	0.38		0.046			1.0	6.88	7.13	0.25	0.38	0.046	0.046	0.10	0.004	4%
14	7.25	0.38		0.078			1.0	7.13	7.38	0.25	0.38	0.078	0.078	0.10	0.007	7%
15	7.50	0.36		0.077			1.0	7.38	7.63	0.25	0.36	0.077	0.077	0.09	0.007	6%
16	7.75	0.37		0.062			1.0	7.63	7.88	0.25	0.37	0.062	0.062	0.09	0.006	5%
17	8.00	0.35		0.078			1.0	7.88	8.13	0.25	0.35	0.078	0.078	0.09	0.007	6%
18	8.25	0.33		0.057			1.0	8.13	8.38	0.25	0.33	0.057	0.057	0.08	0.005	4%
19	8.50	0.33		0.049			1.0	8.38	8.63	0.25	0.33	0.049	0.049	0.08	0.004	4%
20	8.75	0.30		0.045			1.0	8.63	8.88	0.25	0.30	0.045	0.045	0.08	0.003	3%
21	9.00	0.24		0.038			1.0	8.88	9.15	0.28	0.24	0.038	0.038	0.07	0.003	2%
22	9.30	0.20		0.039			1.0	9.15	9.55	0.40	0.20	0.039	0.039	0.08	0.003	3%
LB	9.80	0.00	0.00	0.000	0.000	0.000	1.0	9.55	9.80	0.25	0.05	0.010	0.010	0.01	0.000	0%
Total Flow															0.109	

Measurement Details:

Start Time (MST):	11:25
End Time (MST):	12:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 15°C

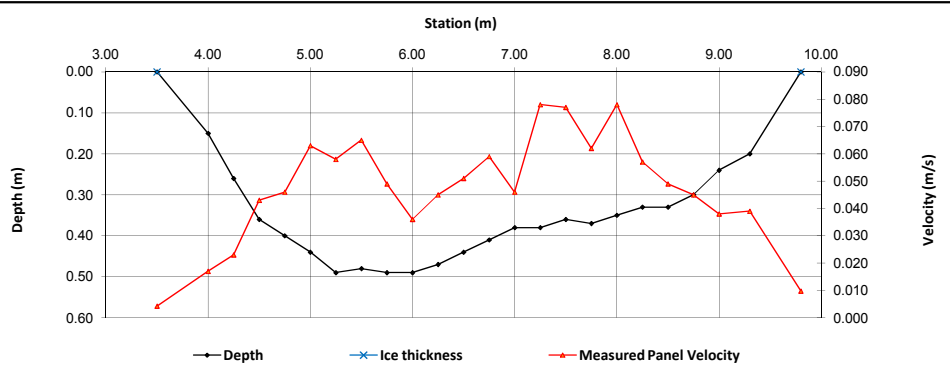
Flow characteristics:

Total Flow:	0.109	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	2.11	(m ²)
Wetted Width:	6.30	(m)
Hydraulic Depth:	0.334	(m)
Mean Velocity:	0.052	(m/s)
Froude Number:	0.029	

Datalogger Details:

	Before	After
Transducer Reading:		1.128
Battery (Main):	76% fair	
Battery (Aux):	100.00%	
Datalogger Clock:	11:26	
Laptop Clock:	11:29	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	12.40	
Memory Used:	80%	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Nail on bridge	1.907	97.942	1.900	97.942	-
Bench Mark 2:	Rebar with flagging	0.869	98.981	0.863	98.981	-
Top of Ice:						
Water Level:		2.997	96.852	2.988	96.854	96.853
Transducer Reading:		1.128	95.724	1.128	95.726	95.725
Other:						

General Notes:

GPS next to rebar with flagging

Field Personnel:	DB, SM	Trip Date:	13-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S32 - Surmont Creek at Highway 881
 UTM Location: 490252 E, 6254511 N

Site Visit Date: November 2, 2011



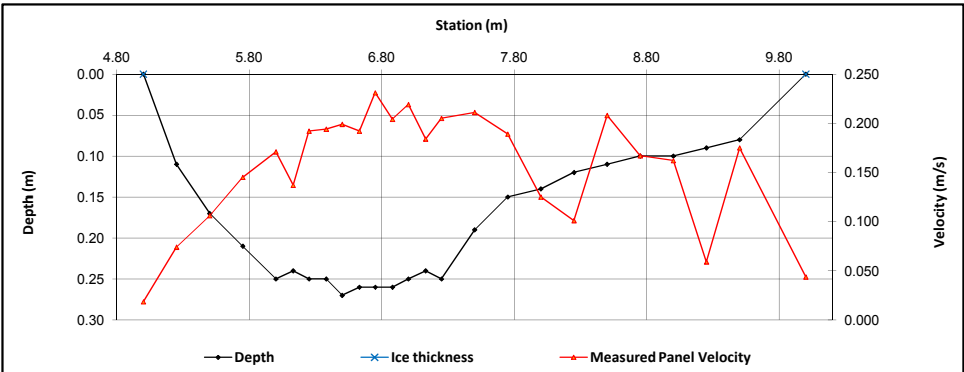
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1	5.00	0.00	0.00	0.000	0.000	0.000	1.0	5.00	5.13	0.13	0.03	0.019	0.019	0.00	0.000	0%
2	5.25	0.11		0.074			1.0	5.13	5.38	0.25	0.11	0.074	0.074	0.03	0.002	2%
3	5.50	0.17		0.106			1.0	5.38	5.63	0.25	0.17	0.106	0.106	0.04	0.005	3%
4	5.75	0.21		0.145			1.0	5.63	5.88	0.25	0.21	0.145	0.145	0.05	0.008	6%
5	6.00	0.25		0.171			1.0	5.88	6.07	0.19	0.25	0.171	0.171	0.05	0.008	6%
6	6.13	0.24		0.137			1.0	6.07	6.19	0.13	0.24	0.137	0.137	0.03	0.004	3%
7	6.25	0.25		0.192			1.0	6.19	6.32	0.13	0.25	0.192	0.192	0.03	0.006	5%
8	6.38	0.25		0.194			1.0	6.32	6.44	0.13	0.25	0.194	0.194	0.03	0.006	5%
9	6.50	0.27		0.199			1.0	6.44	6.57	0.13	0.27	0.199	0.199	0.03	0.007	5%
10	6.63	0.26		0.192			1.0	6.57	6.69	0.13	0.26	0.192	0.192	0.03	0.006	5%
11	6.75	0.26		0.231			1.0	6.69	6.82	0.13	0.26	0.231	0.231	0.03	0.008	6%
12	6.88	0.26		0.204			1.0	6.82	6.94	0.13	0.26	0.204	0.204	0.03	0.007	5%
13	7.00	0.25		0.219			1.0	6.94	7.07	0.13	0.25	0.219	0.219	0.03	0.007	5%
14	7.13	0.24		0.184			1.0	7.07	7.19	0.13	0.24	0.184	0.184	0.03	0.006	4%
15	7.25	0.25		0.205			1.0	7.19	7.38	0.19	0.25	0.205	0.205	0.05	0.009	7%
16	7.50	0.19		0.211			1.0	7.38	7.63	0.25	0.19	0.211	0.211	0.05	0.010	8%
17	7.75	0.15		0.189			1.0	7.63	7.88	0.25	0.15	0.189	0.189	0.04	0.007	5%
18	8.00	0.14		0.125			1.0	7.88	8.13	0.25	0.14	0.125	0.125	0.04	0.004	3%
19	8.25	0.12		0.101			1.0	8.13	8.38	0.25	0.12	0.101	0.101	0.03	0.003	2%
20	8.50	0.11		0.208			1.0	8.38	8.63	0.25	0.11	0.208	0.208	0.03	0.006	4%
21	8.75	0.10		0.167			1.0	8.63	8.88	0.25	0.10	0.167	0.167	0.03	0.004	3%
22	9.00	0.10		0.162			1.0	8.88	9.13	0.25	0.10	0.162	0.162	0.03	0.004	3%
23	9.25	0.09		0.059			1.0	9.13	9.38	0.25	0.09	0.059	0.059	0.02	0.001	1%
23	9.50	0.08		0.175			1.0	9.38	9.75	0.38	0.08	0.175	0.175	0.03	0.005	4%
10.00	0.00	0.00	0.000	0.000	0.000		1.0	9.75	10.00	0.25	0.02	0.044	0.044	0.01	0.000	0%
Total Flow															0.133	

Measurement Details:	
Start Time (MST):	10:05
End Time (MST):	11:30
Equipment:	ADV
Method:	Wading
River Condition:	Low, Open
Quality/Error (see reverse):	excellent
Weather:	Overcast, 5°C

Flow characteristics:		
Total Flow:	0.133	(m ³ /s)
Perceived Measurement Quality:	excellent	
Cross Section Area:	0.79	(m ²)
Wetted Width:	5.00	(m)
Hydraulic Depth:	0.158	(m)
Mean Velocity:	0.168	(m/s)
Froude Number:	0.135	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	100%	0.908
Battery (Aux):	75%	
Datalogger Clock:	10:05	
Laptop Clock:	10:05	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	3.87	
Memory Used:	30%	
Dessicant:	not replaced	
Logger# (if Δ):	removed	
PT# (if Δ):		

Datalogger / Station Notes:
 Removed lakewood logger



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail on bridge	1.681	97.942	1.700	97.942	-
Bench Mark 2:	Rebar with flagging	1.641	98.981	0.660	98.981	-
Top of Ice:						
Water Level:		2.996	96.627	3.017	96.625	96.626
Transducer Reading:		0.908	95.719	0.908	95.717	95.718
Other:						

General Notes:
 BM2: 0.69m
 TSS sampled at centre of flow
 PT stuck in .9 m of water/ mud and not recovered
 PT anchored to trr @ logger box
 see photos

Field Personnel:	GB, SM	Trip Date:	2-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: January 17, 2011



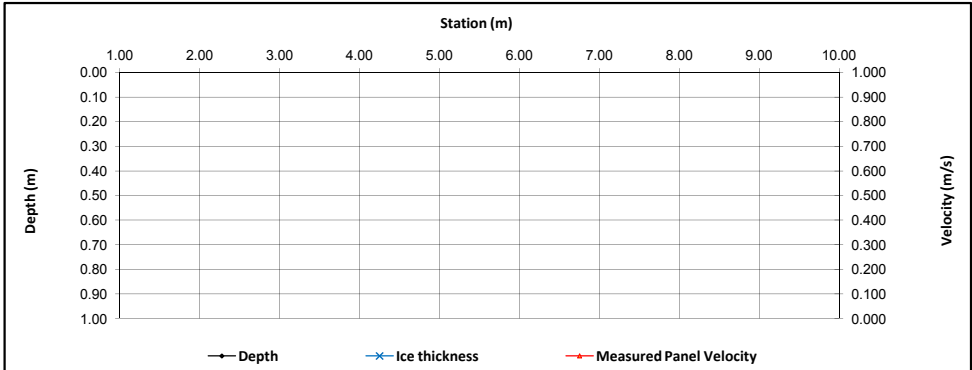
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
														Total Flow	0.000	

Measurement Details:	
Start Time (MST):	14:30
End Time (MST):	14:50
Equipment:	ADV
Method:	Ice
River Condition:	Unknown
Quality/Error (see reverse):	-
Weather:	Overcast, -30°C

Flow characteristics:	
Total Flow:	- (m ³ /s)
Perceived Measuremt Quality:	-
Cross Section Area:	0.00 (m ²)
Wetted Width:	0.00 (m)
Hydraulic Depth:	- (m)
Mean Velocity:	- (m/s)
Froude Number:	-

Datalogger Details:		
	Before	After
Transducer Reading:		1.106
Battery (Main):	13.9	
Battery (Aux):	-	
Datalogger Clock:	14:43	
Laptop Clock:	14:41	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe		281.740		281.740	-
Bench Mark 2:	Pipe with flagging		281.550		281.550	-
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:
 Unsafe ice conditions, no flow measurements or water level taken.

Field Personnel:	DB, JO	Trip Date:	17-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: February 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	2.00	0.00	0.00	0.000	0.000	0.000	0.9	2.00	2.18	0.18	0.25	0.005	0.005	0.04	0.000	0%
1	2.35	1.18	0.18	0.020			0.9	2.18	2.63	0.45	1.00	0.020	0.018	0.45	0.008	4%
2	2.90	1.29	0.22	0.020			0.9	2.63	3.13	0.50	1.07	0.020	0.018	0.54	0.010	5%
3	3.35	1.30	0.22	0.059			0.9	3.13	3.63	0.50	1.08	0.059	0.053	0.54	0.029	15%
4	3.90	1.45	0.25	0.014			0.9	3.63	4.08	0.45	1.20	0.014	0.013	0.54	0.007	3%
5	4.25	1.43	0.22	0.035			0.9	4.08	4.50	0.43	1.21	0.035	0.032	0.51	0.016	8%
6	4.75	1.37	0.34	0.025			0.9	4.50	4.98	0.48	1.03	0.025	0.023	0.49	0.011	6%
7	5.20	1.38	0.34	0.011			0.9	4.98	5.43	0.45	1.04	0.011	0.010	0.47	0.005	2%
8	5.65	1.40	0.30	0.046			0.9	5.43	5.93	0.50	1.10	0.046	0.041	0.55	0.023	12%
9	6.20	1.40	0.31	0.032			0.9	5.93	6.43	0.50	1.09	0.032	0.029	0.55	0.016	8%
10	6.65	1.34	0.29	0.084			0.9	6.43	6.88	0.45	1.05	0.084	0.076	0.47	0.036	18%
11	7.10	1.34	0.27	0.024			0.9	6.88	7.40	0.53	1.07	0.024	0.022	0.56	0.012	6%
12	7.70	1.21	0.25	0.031			0.9	7.40	7.93	0.53	0.96	0.031	0.028	0.50	0.014	7%
13	8.15	1.10	0.24	0.014			0.9	7.93	8.30	0.38	0.86	0.014	0.013	0.32	0.004	2%
14	8.45	1.02	0.24	0.019			0.9	8.30	8.73	0.42	0.78	0.019	0.017	0.33	0.006	3%
15	9.00	0.70	0.26	0.001			0.9	8.73	9.20	0.48	0.44	0.001	0.001	0.21	0.000	0%
Left	9.40	0.00	0.00	0.000	0.000	0.000	1.0	9.20	9.40	0.20	0.11	0.000	0.000	0.02	0.000	0%
Total Flow															0.196	

Measurement Details:

Start Time (MST):	11:20
End Time (MST):	12:15
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	-22 °C, light snow

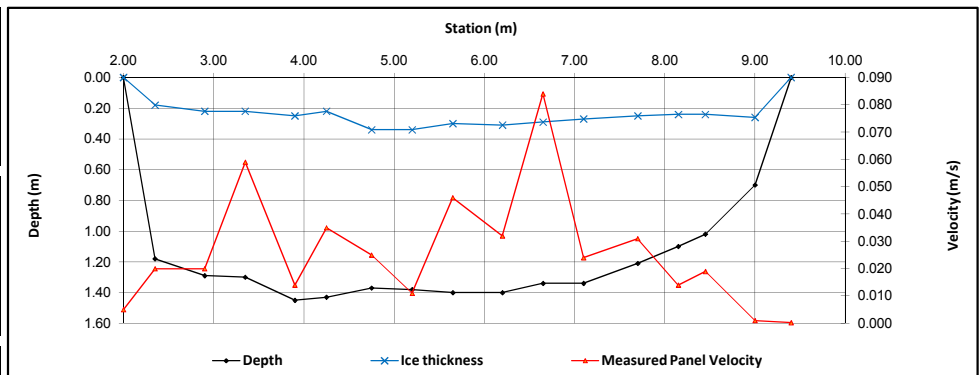
Flow characteristics:

Total Flow:	0.196	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	7.10	(m ²)
Wetted Width:	7.40	(m)
Hydraulic Depth:	0.959	(m)
Mean Velocity:	0.028	(m/s)
Froude Number:	0.009	

Datalogger Details:

	Before	After
Transducer Reading:		1.12
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.920	281.740	0.913	281.740	-
Bench Mark 2:	Pipe with flagging	1.193	281.550	1.187	281.550	-
Top of Ice:		2.907	279.753	2.896	279.757	279.755
Water Level:		2.956	279.704	2.946	279.707	279.706
Transducer Reading:		1.120	278.584	1.120	278.587	278.586
Other:						

General Notes:

Low SNR, poor velocity measurements

Field Personnel:	SG, BL	Trip Date:	15-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: March 10, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	2.30	0.00	0.00	0.000	0.000	0.000	0.9	2.30	2.45	0.15	0.10	0.013	0.012	0.02	0.000	0%
1	2.60	0.60	0.20	0.053			0.9	2.45	2.80	0.35	0.40	0.053	0.048	0.14	0.007	2%
2	3.00	0.88	0.30	0.002			0.9	2.80	3.13	0.33	0.58	0.002	0.002	0.19	0.000	0%
3	3.25	1.00	0.30	0.002			0.9	3.13	3.45	0.33	0.70	0.002	0.002	0.23	0.000	0%
4	3.65	1.10	0.30		0.002	0.002	1.0	3.45	3.83	0.38	0.80	0.002	0.002	0.30	0.001	0%
5	4.00	1.30	0.30		0.003	0.004	1.0	3.83	4.20	0.38	1.00	0.004	0.004	0.38	0.001	0%
6	4.40	1.40	0.30		0.022	0.018	1.0	4.20	4.55	0.35	1.10	0.020	0.020	0.39	0.008	3%
7	4.70	1.40	0.30		0.043	0.058	1.0	4.55	4.85	0.30	1.10	0.051	0.051	0.33	0.017	6%
8	5.00	1.42	0.30		0.081	0.050	1.0	4.85	5.15	0.30	1.12	0.066	0.066	0.34	0.022	8%
9	5.30	1.37	0.35		0.175	0.092	1.0	5.15	5.50	0.35	1.02	0.134	0.134	0.36	0.048	18%
10	5.70	1.45	0.38		0.109	0.050	1.0	5.50	5.85	0.35	1.07	0.080	0.080	0.37	0.030	11%
11	6.00	1.40	0.40	0.046			0.9	5.85	6.13	0.28	1.00	0.046	0.041	0.28	0.011	4%
12	6.25	1.30	0.38	0.077			0.9	6.13	6.48	0.35	0.92	0.077	0.069	0.32	0.022	8%
13	6.70	1.28	0.30	0.127			0.9	6.48	6.90	0.43	0.98	0.127	0.114	0.42	0.048	18%
14	7.10	1.25	0.30	0.064			0.9	6.90	7.28	0.38	0.95	0.064	0.058	0.36	0.021	8%
15	7.45	1.22	0.30	0.023			0.9	7.28	7.65	0.38	0.92	0.023	0.021	0.35	0.007	3%
16	7.85	1.18	0.20	0.020			0.9	7.65	8.08	0.42	0.98	0.020	0.018	0.42	0.007	3%
17	8.30	1.20	0.10	0.020			0.9	8.08	8.40	0.33	1.10	0.020	0.018	0.36	0.006	2%
18	8.50	1.00	0.10	0.020			0.9	8.40	9.00	0.60	0.90	0.020	0.018	0.54	0.010	4%
19	9.50	0.70	0.15	0.006			0.9	9.00	9.75	0.75	0.55	0.006	0.005	0.41	0.002	1%
LB	10.00	0.00	0.00	0.000	0.000	0.000	1.0	9.75	10.00	0.25	0.14	0.002	0.002	0.03	0.000	0%
Total Flow															0.268	

Measurement Details:

Start Time (MST):	12:45
End Time (MST):	13:40
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	-23 °C, Pt. cloudy w/ gusts

Flow characteristics:

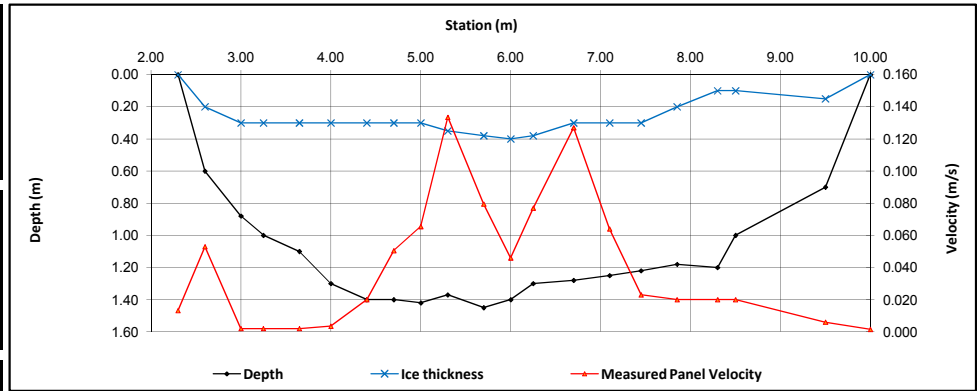
Total Flow:	0.268	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	6.50	(m ²)
Wetted Width:	7.70	(m)
Hydraulic Depth:	0.845	(m)
Mean Velocity:	0.041	(m/s)
Froude Number:	0.014	

Datalogger Details:

	Before	After
Transducer Reading:		1.036
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

SG checked data remotely, no download.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.862	281.740	0.845	281.740	-
Bench Mark 2:	Pipe with flagging	1.138	281.550	1.119	281.550	-
Top of Ice:		2.903	279.699	2.886	279.699	279.699
Water Level:		2.983	279.619	2.966	279.619	279.619
Transducer Reading:		1.036	278.583	1.036	278.583	278.583
Other:						

General Notes:

Field Personnel:	GB, BL	Trip Date:	10-Mar-11
Data Entry Personnel:	CM	Date:	22-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: April 5, 2011



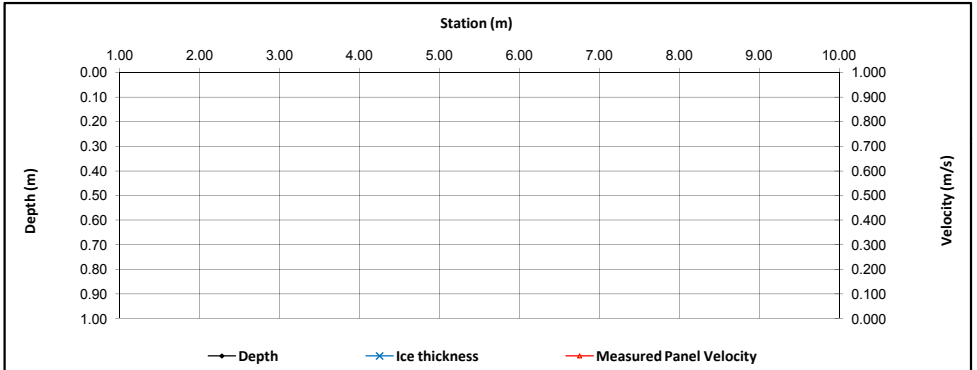
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	12:00
End Time (MST):	12:05
Equipment:	ADV
Method:	Ice
River Condition:	Open
Quality/Error (see reverse):	-
Weather:	Clear

Flow characteristics:		
Total Flow:	-	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		1.121
Battery (Main):	14.5	
Battery (Aux):	-	
Datalogger Clock:	11:05	
Laptop Clock:	11:03	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.4	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe		281.740		281.740	-
Bench Mark 2:	Pipe with flagging		281.550		281.550	-
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:
 Conditions deemed unsafe due to river open for 3/4 width (see photos). Water level not possible due to thin ice at channel edge and verticle banks. No access to water.

Field Personnel:	JO, BL	Trip Date:	5-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: April 20, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	10.30	0.00		0.000	0.000	0.000	1.0	10.30	10.15	0.15	0.32	0.032	0.032	0.05	0.002	0%
1	10.00	1.26			0.007	0.249	1.0	10.15	9.80	0.35	1.26	0.128	0.128	0.44	0.056	2%
2	9.60	1.46			0.282	0.192	1.0	9.80	9.40	0.40	1.46	0.237	0.237	0.58	0.138	4%
3	9.20	1.78			0.258	0.130	1.0	9.40	8.90	0.50	1.78	0.194	0.194	0.89	0.173	5%
4	8.60	1.90			0.293	0.157	1.0	8.90	8.50	0.40	1.90	0.225	0.225	0.76	0.171	5%
5	8.40	1.90			0.364	0.231	1.0	8.50	8.20	0.30	1.90	0.298	0.298	0.57	0.170	5%
6	8.00	2.00			0.396	0.446	1.0	8.20	7.80	0.40	2.00	0.421	0.421	0.80	0.337	10%
7	7.60	2.05			0.389	0.414	1.0	7.80	7.40	0.40	2.05	0.402	0.402	0.82	0.329	10%
8	7.20	2.00			0.360	0.431	1.0	7.40	7.00	0.40	2.00	0.396	0.396	0.80	0.316	9%
9	6.80	2.00			0.514	0.389	1.0	7.00	6.60	0.40	2.00	0.452	0.452	0.80	0.361	10%
10	6.40	1.90			0.456	0.377	1.0	6.60	6.20	0.40	1.90	0.417	0.417	0.76	0.317	9%
11	6.00	2.00			0.460	0.286	1.0	6.20	5.80	0.40	2.00	0.373	0.373	0.80	0.298	9%
12	5.60	2.00			0.466	0.282	1.0	5.80	5.40	0.40	2.00	0.374	0.374	0.80	0.299	9%
13	5.20	1.90			0.340	0.250	1.0	5.40	5.00	0.40	1.90	0.295	0.295	0.76	0.224	7%
14	4.80	1.90			0.285	0.197	1.0	5.00	4.60	0.40	1.90	0.241	0.241	0.76	0.183	5%
15	4.40	1.85			0.094	0.169	1.0	4.60	4.20	0.40	1.85	0.132	0.132	0.74	0.097	3%
16	4.00	1.66			0.062	0.100	1.0	4.20	3.80	0.40	1.66	0.081	0.081	0.66	0.054	2%
17	3.60	1.50			-0.041	-0.056	1.0	3.80	3.40	0.40	1.50	-0.049	-0.049	0.60	-0.029	-1%
18	3.20	1.36			-0.079	-0.070	1.0	3.40	3.00	0.40	1.36	-0.075	-0.075	0.54	-0.041	-1%
19	2.80	0.66		-0.046			1.0	3.00	2.63	0.38	0.66	-0.046	-0.046	0.25	-0.011	0%
Left	2.45	0.00		0.000	0.000	0.000	1.0	2.63	2.45	0.18	0.17	-0.012	-0.012	0.03	0.000	0%
Total Flow															3.444	

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	12:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Clear, 2°C

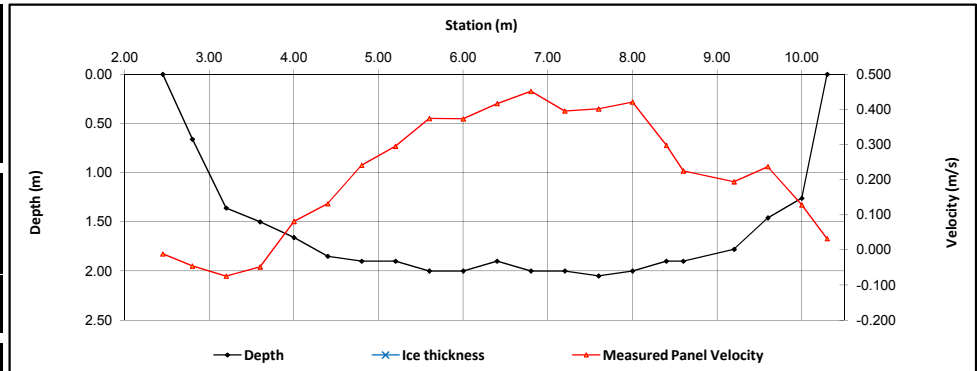
Flow characteristics:

Total Flow:	3.444	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	13.22	(m ²)
Wetted Width:	7.53	(m)
Hydraulic Depth:	1.756	(m)
Mean Velocity:	0.261	(m/s)
Froude Number:	0.063	

Datalogger Details:

	Before	After
Transducer Reading:		1.6999
Battery (Main):	14.6	
Battery (Aux):	-	
Datalogger Clock:	10:00	
Laptop Clock:	9:58	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.7	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.745	281.740	0.735	281.740	-
Bench Mark 2:	Pipe with flagging	1.045	281.550	1.036	281.550	-
Top of Ice:						
Water Level:		2.235	280.360	2.221	280.365	280.363
Transducer Reading:		1.700	278.660	1.700	278.665	278.663
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	20-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: June 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TL	1.45	0.00	0.00	0.000	0.000	0.000	1.0	1.45	1.48	0.03	0.03	0.000	0.000	0.00	0.000	0%
1	1.50	0.12		-0.001			1.0	1.48	1.75	0.28	0.12	-0.001	-0.001	0.03	0.000	0%
2	2.00	0.79			-0.032	-0.011	1.0	1.75	2.25	0.50	0.79	-0.022	-0.022	0.40	-0.008	-1%
3	2.50	0.98			0.047	-0.029	1.0	2.25	2.75	0.50	0.98	0.009	0.009	0.49	0.004	1%
4	3.00	1.16			0.069	0.070	1.0	2.75	3.25	0.50	1.16	0.070	0.070	0.58	0.040	5%
5	3.50	1.30			0.130	0.076	1.0	3.25	3.75	0.50	1.30	0.103	0.103	0.65	0.067	8%
6	4.00	1.46			0.109	0.100	1.0	3.75	4.25	0.50	1.46	0.105	0.105	0.73	0.076	10%
7	4.50	1.48			0.153	0.133	1.0	4.25	4.75	0.50	1.48	0.143	0.143	0.74	0.106	13%
8	5.00	1.48			0.188	0.155	1.0	4.75	5.25	0.50	1.48	0.172	0.172	0.74	0.127	16%
9	5.50	1.45			0.088	0.151	1.0	5.25	5.75	0.50	1.45	0.120	0.120	0.73	0.087	11%
10	6.00	1.40			0.110	0.106	1.0	5.75	6.25	0.50	1.40	0.108	0.108	0.70	0.076	10%
11	6.50	1.48			0.039	0.160	1.0	6.25	6.75	0.50	1.48	0.100	0.100	0.74	0.074	9%
12	7.00	1.46			0.104	0.102	1.0	6.75	7.25	0.50	1.46	0.103	0.103	0.73	0.075	10%
13	7.50	1.34			0.115	0.050	1.0	7.25	7.75	0.50	1.34	0.083	0.083	0.67	0.055	7%
14	8.00	1.36			0.033	0.030	1.0	7.75	8.25	0.50	1.36	0.032	0.032	0.68	0.021	3%
15	8.50	0.90			-0.026	-0.010	1.0	8.25	8.75	0.50	0.90	-0.018	-0.018	0.45	-0.008	-1%
16	9.00	0.80			-0.016	-0.018	1.0	8.75	9.05	0.30	0.80	-0.017	-0.017	0.24	-0.004	-1%
TR	9.10	0.00	0.00	0.000	0.000	0.000	1.0	9.05	9.10	0.05	0.20	-0.004	-0.004	0.01	0.000	0%
Total Flow															0.788	

Measurement Details:

Start Time (MST):	12:45
End Time (MST):	14:00
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Clear, 22 deg C

Flow characteristics:

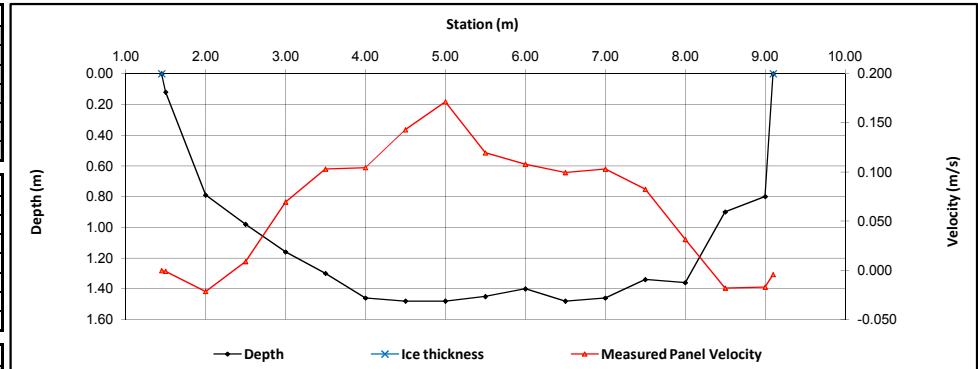
Total Flow:	0.788	(m ³ /s)
Perceived Measuremt Quality:	Good	
Cross Section Area:	9.30	(m ²)
Wetted Width:	7.65	(m)
Hydraulic Depth:	1.216	(m)
Mean Velocity:	0.085	(m/s)
Froude Number:	0.025	

Datalogger Details:

	Before	After
Transducer Reading:		1.094
Battery (Main):	14.2	
Battery (Aux):	-	
Datalogger Clock:	11:48	
Laptop Clock:	11:48	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	17.7	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

OS Update to v 22: Checked: OK



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.630	281.740	0.625	281.740	-
Bench Mark 2:	Pipe with flagging	0.925	281.550	0.920	281.550	-
Top of Ice:						
Water Level:		2.735	279.740	2.732	279.738	279.739
Transducer Reading:		1.094	278.646	1.094	278.644	278.645
Other:						

General Notes:

Field Personnel:	JO, SM	Trip Date:	15-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG	Date:	1-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: August 8, 2011



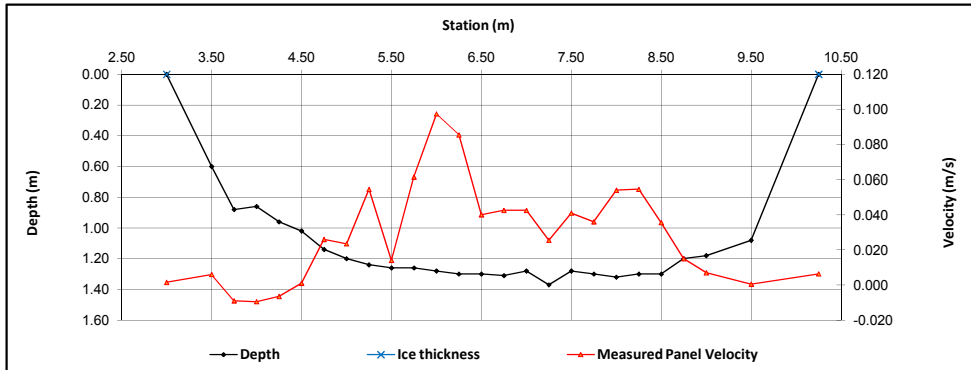
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.25	0.25	0.15	0.002	0.002	0.04	0.000	0%
1	3.50	0.60		0.006			1.0	3.25	3.63	0.38	0.60	0.006	0.006	0.23	0.001	1%
2	3.75	0.88			-0.004	-0.014	1.0	3.63	3.88	0.25	0.88	-0.009	-0.009	0.22	-0.002	-1%
3	4.00	0.86			-0.006	-0.013	1.0	3.88	4.13	0.25	0.86	-0.010	-0.010	0.22	-0.002	-1%
4	4.25	0.96			0.006	-0.019	1.0	4.13	4.38	0.25	0.96	-0.007	-0.007	0.24	-0.002	-1%
5	4.50	1.02			0.004	-0.002	1.0	4.38	4.63	0.25	1.02	0.001	0.001	0.26	0.000	0%
6	4.75	1.14			0.017	0.035	1.0	4.63	4.88	0.25	1.14	0.026	0.026	0.29	0.007	3%
7	5.00	1.20			0.026	0.021	1.0	4.88	5.13	0.25	1.20	0.024	0.024	0.30	0.007	3%
8	5.25	1.24			0.043	0.066	1.0	5.13	5.38	0.25	1.24	0.055	0.055	0.31	0.017	7%
9	5.50	1.26			0.019	0.009	1.0	5.38	5.63	0.25	1.26	0.014	0.014	0.32	0.004	2%
10	5.75	1.26			0.069	0.054	1.0	5.63	5.88	0.25	1.26	0.062	0.062	0.32	0.019	8%
11	6.00	1.28			0.075	0.120	1.0	5.88	6.13	0.25	1.28	0.098	0.098	0.32	0.031	13%
12	6.25	1.30			0.069	0.102	1.0	6.13	6.38	0.25	1.30	0.086	0.086	0.33	0.028	11%
13	6.50	1.30			0.049	0.031	1.0	6.38	6.63	0.25	1.30	0.040	0.040	0.33	0.013	5%
14	6.75	1.31			0.024	0.061	1.0	6.63	6.88	0.25	1.31	0.043	0.043	0.33	0.014	6%
15	7.00	1.28			0.028	0.057	1.0	6.88	7.13	0.25	1.28	0.043	0.043	0.32	0.014	6%
16	7.25	1.37			0.011	0.040	1.0	7.13	7.38	0.25	1.37	0.026	0.026	0.34	0.009	4%
17	7.50	1.28			0.009	0.073	1.0	7.38	7.63	0.25	1.28	0.041	0.041	0.32	0.013	5%
18	7.75	1.30			0.014	0.058	1.0	7.63	7.88	0.25	1.30	0.036	0.036	0.33	0.012	5%
19	8.00	1.32			0.026	0.082	1.0	7.88	8.13	0.25	1.32	0.054	0.054	0.33	0.018	7%
20	8.25	1.30			0.024	0.085	1.0	8.13	8.38	0.25	1.30	0.055	0.055	0.33	0.018	7%
21	8.50	1.30			0.010	0.061	1.0	8.38	8.63	0.25	1.30	0.036	0.036	0.33	0.012	5%
22	8.75	1.20			0.012	0.018	1.0	8.63	8.88	0.25	1.20	0.015	0.015	0.30	0.005	2%
23	9.00	1.18			0.015	-0.001	1.0	8.88	9.25	0.38	1.18	0.007	0.007	0.44	0.003	1%
24	9.50	1.08			0.002	-0.001	1.0	9.25	9.88	0.63	1.08	0.001	0.001	0.68	0.000	0%
RB	10.25	0.00	0.00	0.000	0.000	0.000	1.0	8.75	10.25	1.50	0.34	0.006	0.006	0.51	0.003	1%
Total Flow															0.243	

Measurement Details:	
Start Time (MST):	11:00
End Time (MST):	12:15
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Sunny, 25oC

Flow characteristics:	
Total Flow:	0.243 (m ³ /s)
Perceived Measurement Quality:	Good
Cross Section Area:	8.23 (m ²)
Wetted Width:	7.25 (m)
Hydraulic Depth:	1.136 (m)
Mean Velocity:	0.029 (m/s)
Froude Number:	0.009

Datalogger Details:		Before	After
Transducer Reading:		1.005	0.802
Battery (Main):		14.0	
Battery (Aux):		-	
Datalogger Clock:		11:05	
Laptop Clock:		11:07	
Air Temperature °C:		-	
Air Pressure:		-	
RH:		-	
Water °C:		20.2	21.9
Memory Used:		-	
Dessicant:		Changed	
Logger# (if Δ):			
PT# (if Δ):			

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.578	281.740	0.557	281.740	-
Bench Mark 2:	Pipe with flagging	0.867	281.550	0.844	281.550	-
Top of Ice:						
Water Level:		2.735	279.682	2.715	279.679	279.681
Transducer Reading:		0.802	278.880	0.802	278.877	278.879
Other:						

General Notes:

Field Personnel:		SG SM	Trip Date:	8-Aug-11
Data Entry Personnel:	DB		Date:	23-Aug-11
Data Check Personnel:	JP		Date:	26-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: September 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	3.40	0.00	0.00	0.000	0.000	0.000	1.0	3.40	3.70	0.30	0.10	0.001	0.001	0.03	0.000	0%
1	4.00	0.38		0.005			1.0	3.70	4.20	0.50	0.38	0.005	0.005	0.19	0.001	1%
2	4.40	0.46		0.001			1.0	4.20	4.60	0.40	0.46	0.001	0.001	0.18	0.000	0%
3	4.80	0.78		0.005			1.0	4.60	5.00	0.40	0.78	0.005	0.005	0.31	0.002	1%
4	5.20	1.00			0.004	0.017	1.0	5.00	5.40	0.40	1.00	0.011	0.011	0.40	0.004	3%
5	5.60	1.18			0.006	0.020	1.0	5.40	5.80	0.40	1.18	0.013	0.013	0.47	0.006	4%
6	6.00	1.20			0.003	0.008	1.0	5.80	6.20	0.40	1.20	0.006	0.006	0.48	0.003	2%
7	6.40	1.38			0.021	0.024	1.0	6.20	6.60	0.40	1.38	0.023	0.023	0.55	0.012	8%
8	6.80	1.38			0.038	0.032	1.0	6.60	7.00	0.40	1.38	0.035	0.035	0.55	0.019	13%
9	7.20	1.40			0.026	0.040	1.0	7.00	7.40	0.40	1.40	0.033	0.033	0.56	0.018	13%
10	7.60	1.38			0.026	0.029	1.0	7.40	7.80	0.40	1.38	0.028	0.028	0.55	0.015	10%
11	8.00	1.36			0.038	0.024	1.0	7.80	8.20	0.40	1.36	0.031	0.031	0.54	0.017	11%
12	8.40	1.32			0.025	0.021	1.0	8.20	8.60	0.40	1.32	0.023	0.023	0.53	0.012	8%
13	8.80	1.36			0.026	0.031	1.0	8.60	9.00	0.40	1.36	0.029	0.029	0.54	0.016	11%
14	9.20	1.38			0.025	0.022	1.0	9.00	9.40	0.40	1.38	0.024	0.024	0.55	0.013	9%
15	9.60	1.38			0.014	0.010	1.0	9.40	9.80	0.40	1.38	0.012	0.012	0.55	0.007	5%
16	10.00	1.30			-0.003	0.008	1.0	9.80	10.20	0.40	1.30	0.003	0.003	0.52	0.001	1%
17	10.40	1.22			-0.001	0.006	1.0	10.20	10.60	0.40	1.22	0.003	0.003	0.49	0.001	1%
18	10.80	1.28			-0.003	0.003	1.0	10.60	11.00	0.40	1.28	0.000	0.000	0.51	0.000	0%
19	11.20	0.96			-0.004	0.002	1.0	11.00	11.40	0.40	0.96	-0.001	-0.001	0.38	0.000	0%
20	11.60	0.88			-0.001	-0.002	1.0	11.40	11.75	0.35	0.88	-0.002	-0.002	0.31	0.000	0%
RB	11.90	0.00	0.00	0.000	0.000	0.000	1.0	11.75	11.90	0.15	0.22	0.000	0.000	0.03	0.000	0%
Total Flow															0.147	

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	12:47
Equipment:	-
Method:	-
River Condition:	low flow, open
Quality/Error (see reverse):	Good
Weather:	17°C, clear, breezy

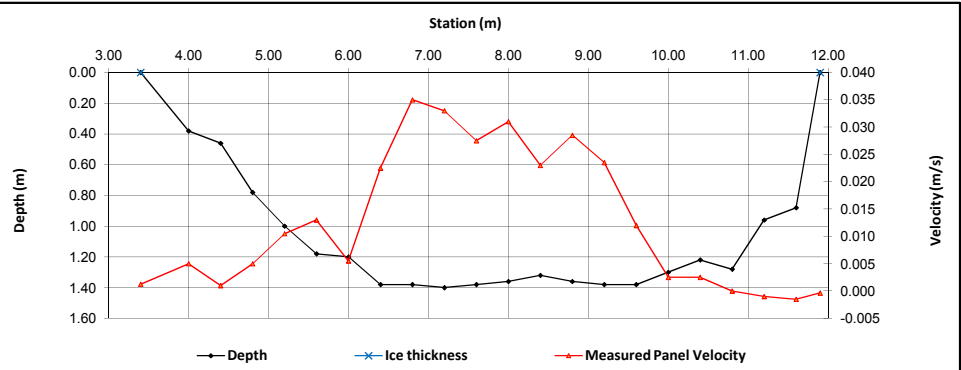
Flow characteristics:

Total Flow:	0.147	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	9.25	(m ²)
Wetted Width:	8.50	(m)
Hydraulic Depth:	1.088	(m)
Mean Velocity:	0.016	(m/s)
Froude Number:	0.005	

Datalogger Details:

	Before	After
Transducer Reading:		0.874
Battery (Main):	14.4	
Battery (Aux):	-	
Datalogger Clock:	10:58	
Laptop Clock:	11:00	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	13.5	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.567	281.740	0.544	281.740	-
Bench Mark 2:	Pipe with flagging	0.856	281.550	0.830	281.550	-
Top of Ice:						
Water Level:		2.655	279.751	2.630	279.750	279.751
Transducer Reading:		0.874	278.877	0.874	278.876	278.877
Other:						

General Notes:

Field Personnel:	SM, GB	Trip Date:	26-Sep-11
Data Entry Personnel:	tk	Date:	30-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: November 4, 2011



Flow Measurement:

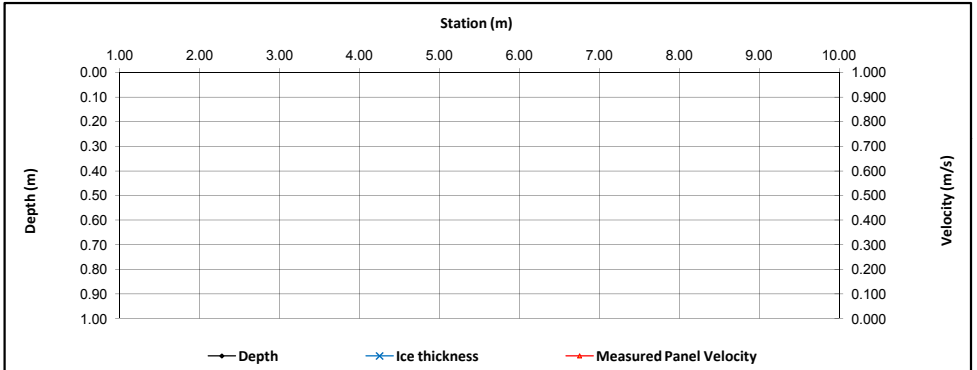
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	11:00
End Time (MST):	11:45
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear, breezy, -8

Flow characteristics:	
Total Flow:	- (m ³ /s)
Perceived Measurement Quality:	-
Cross Section Area:	- (m ²)
Wetted Width:	0.00 (m)
Hydraulic Depth:	- (m)
Mean Velocity:	- (m/s)
Froude Number:	-

Datalogger Details:		
	Before	After
Transducer Reading:		1.013
Battery (Main):	15.1	
Battery (Aux):	-	
Datalogger Clock:	10:56	
Laptop Clock:	10:58	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.9	
Memory Used:	replaced	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 Repaired kink in PLS vent tube tubing



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar in PVC pipe	0.567	281.740	0.547	281.740	-
Bench Mark 2:	Pipe with flagging	0.853	281.550	0.833	281.550	-
Top of Ice:						
Water Level:		2.510	279.893	2.488	279.895	279.894
Transducer Reading:		1.013	278.880	1.013	278.882	278.881
Other:						

General Notes:
 Flow measurement not performed due to ice conditions
 BM2: 0.6m
 BM1: 0.38m

Field Personnel:	SM, GB	Trip Date:	4-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S33 - Muskeg River @ Aurora / Albion Boundary

UTM Location: 474876 E, 6350204 N

Site Visit Date: December 5, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	2.60	0.00	0.00	0.000	0.000	0.000	0.9	2.60	2.90	0.30	0.17	0.002	0.002	0.05	0.000	0%
1	3.20	0.80	0.12	0.007			0.9	2.90	3.38	0.48	0.68	0.007	0.006	0.32	0.002	1%
2	3.55	0.87	0.14	0.013			0.9	3.38	3.73	0.35	0.73	0.013	0.012	0.26	0.003	1%
3	3.90	1.09	0.13		0.026	0.017	1.0	3.73	4.08	0.35	0.96	0.022	0.022	0.34	0.007	3%
4	4.25	1.30	0.15		0.017	0.037	1.0	4.08	4.50	0.43	1.15	0.027	0.027	0.49	0.013	6%
5	4.75	1.35	0.20		0.042	0.041	1.0	4.50	4.95	0.45	1.15	0.042	0.042	0.52	0.021	10%
6	5.15	1.45	0.20		0.036	0.038	1.0	4.95	5.35	0.40	1.25	0.037	0.037	0.50	0.019	8%
7	5.55	1.50	0.21		0.044	0.045	1.0	5.35	5.75	0.40	1.29	0.045	0.045	0.52	0.023	10%
8	5.95	1.40	0.20		0.053	0.056	1.0	5.75	6.13	0.38	1.20	0.055	0.055	0.45	0.025	11%
9	6.30	1.50	0.20		0.049	0.059	1.0	6.13	6.50	0.38	1.30	0.054	0.054	0.49	0.026	12%
10	6.70	1.45	0.20		0.043	0.054	1.0	6.50	6.90	0.40	1.25	0.049	0.049	0.50	0.024	11%
11	7.10	1.45	0.20		0.042	0.051	1.0	6.90	7.33	0.42	1.25	0.047	0.047	0.53	0.025	11%
12	7.55	1.45	0.21		0.015	0.031	1.0	7.33	7.75	0.43	1.24	0.023	0.023	0.53	0.012	5%
13	7.95	1.40	0.20		0.027	0.033	1.0	7.75	8.18	0.43	1.20	0.030	0.030	0.51	0.015	7%
14	8.40	1.37	0.16		0.010	0.017	1.0	8.18	8.63	0.45	1.21	0.014	0.014	0.54	0.007	3%
15	8.85	1.30	0.15		0.005	0.012	1.0	8.63	9.08	0.45	1.15	0.009	0.009	0.52	0.004	2%
16	9.30	1.25	0.14		0.002	0.004	1.0	9.08	9.50	0.43	1.11	0.003	0.003	0.47	0.001	1%
17	9.70	1.15	0.14		-0.004	0.006	1.0	9.50	9.95	0.45	1.01	0.001	0.001	0.45	0.000	0%
18	10.20	0.95	0.14		-0.005	0.001	1.0	9.95	10.43	0.48	0.81	-0.002	-0.002	0.38	-0.001	0%
19	10.65	0.89	0.15	-0.008			0.9	10.43	10.90	0.48	0.74	-0.008	-0.007	0.35	-0.003	-1%
20	11.15	0.70	0.13	-0.007			0.9	10.90	11.33	0.42	0.57	-0.007	-0.006	0.24	-0.002	-1%
R	11.50	0.00	0.00	0.000	0.000	0.000	1.0	11.33	11.50	0.18	0.14	-0.002	-0.002	0.02	0.000	0%
Total Flow															0.224	

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	14:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, Calm, 0C

Flow characteristics:

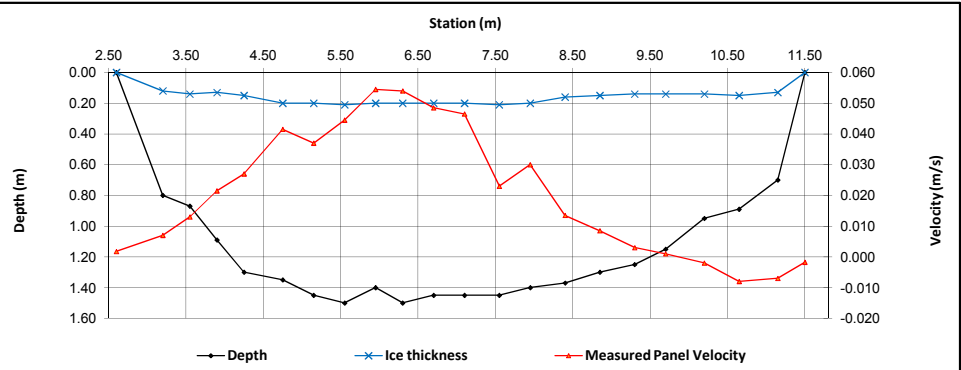
Total Flow:	0.224	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	8.99	(m ²)
Wetted Width:	8.90	(m)
Hydraulic Depth:	1.010	(m)
Mean Velocity:	0.025	(m/s)
Froude Number:	0.008	

Datalogger Details:

	Before	After
Transducer Reading:		0.908
Battery (Main):	12.7	
Battery (Aux):	-	
Datalogger Clock:	13:02	
Laptop Clock:	13:04	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.4	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

updated pokbus-133



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Rebar in PVC pipe	0.762	281.740	0.748	281.740	-
Bench Mark 2:	Pipe with flagging	1.044	281.550	1.031	281.550	-
Top of Ice:		2.788	279.714	2.776	279.712	279.713
Water Level:		2.804	279.790	2.791	279.790	279.790
Transducer Reading:		0.908	278.882	0.908	278.882	278.882
Other:						

General Notes:

Installed isolator for modem communications

Field Personnel:	SM, SG	Trip Date:	5-Dec-11
Data Entry Personnel:	DW	Date:	12-Dec-11
Data Check Personnel:		Date:	

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake

UTM Location: 440712 E, 6361615 N

Site Visit Date: January 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
Right		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	12:00
End Time (MST):	13:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear, -30°C

Flow characteristics:

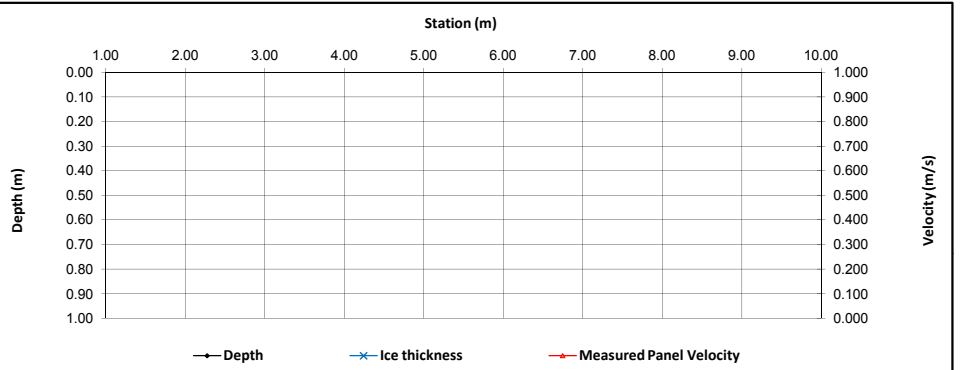
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.267
Battery (Main):	15.4	
Battery (Aux):	-	
Datalogger Clock:	12:16	
Laptop Clock:	12:18	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Battery changed.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	1.125	98.630	1.115	98.630	-
Bench Mark 2:	Nail in base of logger tree	1.241	98.656	1.233	98.656	-
Top of Ice:		2.399	97.356	2.390	97.355	97.356
Water Level:		2.870	96.885	2.863	96.882	96.884
Transducer Reading:		0.267	96.618	0.267	96.615	96.617
Other:						

General Notes:

Three holes drilled but augering suspended due to heavy shaking and multiple ice layers. Top layer approx 3".

Field Personnel:	DB, JO	Trip Date:	17-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake
 UTM Location: 440712 E, 6361615 N

Site Visit Date: February 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	13:40
End Time (MST):	14:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Partly cloudy

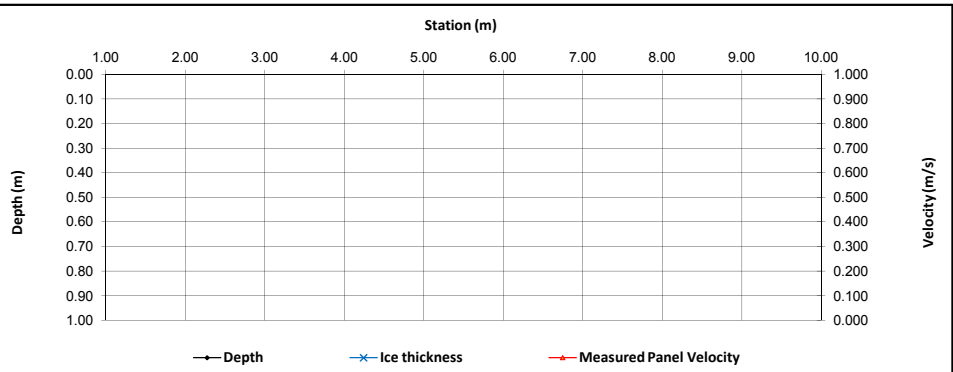
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.380
Battery (Main):	14.9	
Battery (Aux):	-	
Datalogger Clock:	13:47	
Laptop Clock:	13:40	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	Good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	1.325	98.630	1.324	98.630	-
Bench Mark 2:	Nail in base of logger tree	1.440	98.656	1.440	98.656	-
Top of Ice:		2.658	97.297	2.659	97.295	97.296
Water Level:		2.973	96.982	2.973	96.981	96.982
Transducer Reading:		0.380	96.602	0.380	96.601	96.602
Other:						

General Notes:

Dry, three holes drilled - 5cm of water velocity.

Field Personnel:	BL, SG	Trip Date:	13-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake
 UTM Location: 440712 E, 6361615 N

Site Visit Date: March 8, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:

Start Time (MST):	13:45
End Time (MST):	13:55
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear

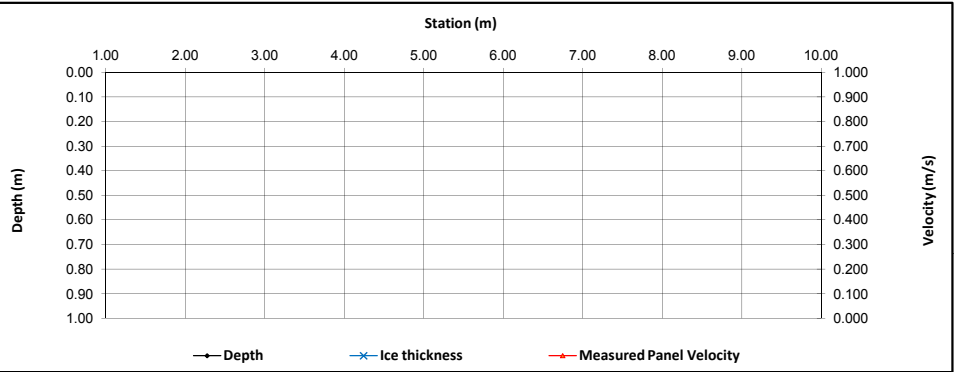
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.346
Battery (Main):	14.9	
Battery (Aux):	-	
Datalogger Clock:	13:50	
Laptop Clock:	13:47	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	1.402	98.630	1.395	98.630	-
Bench Mark 2:	Nail in base of logger tree	1.519	98.656	1.511	98.656	-
Top of Ice:		2.749	97.283	2.755	97.270	97.277
Water Level:		3.358	96.674	3.551	96.474	96.574
Transducer Reading:		0.346	96.328	0.346	96.128	96.228
Other:						

General Notes:

Dry, two holes drilled but completely dry.

Field Personnel:	JO, BL	Trip Date:	8-Mar-11
Data Entry Personnel:	CM	Date:	22-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake

UTM Location: 440712 E, 6361615 N

Site Visit Date: March 31, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	12:20
End Time (MST):	12:30
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	-

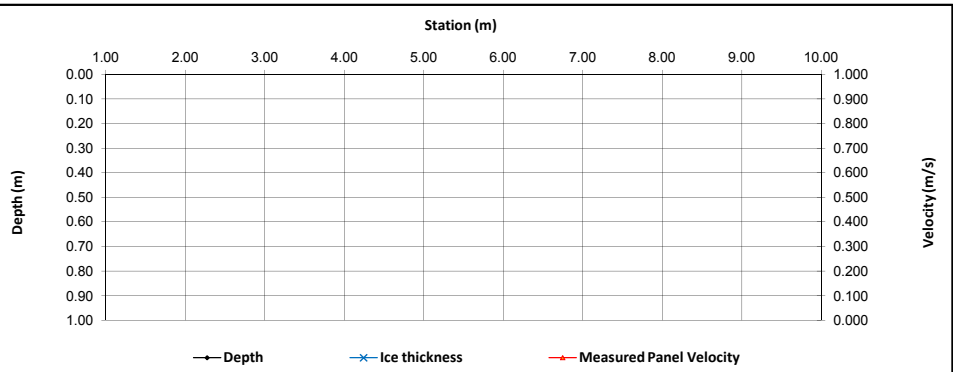
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.427
Battery (Main):	14.5	
Battery (Aux):	-	
Datalogger Clock:	11:30	
Laptop Clock:	11:27	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging		98.630		98.630	-
Bench Mark 2:	Nail in base of logger tree		98.656		98.656	-
Top of Ice:						
Water Level:			98.630		98.630	98.630
Transducer Reading:		0.427	98.203	0.427	98.203	98.203
Other:						

General Notes:

No flow survey completed due to lack of flow in creek.

Field Personnel:	JO, SG	Trip Date:	31-Mar-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake

UTM Location: 440712 E, 6361615 N

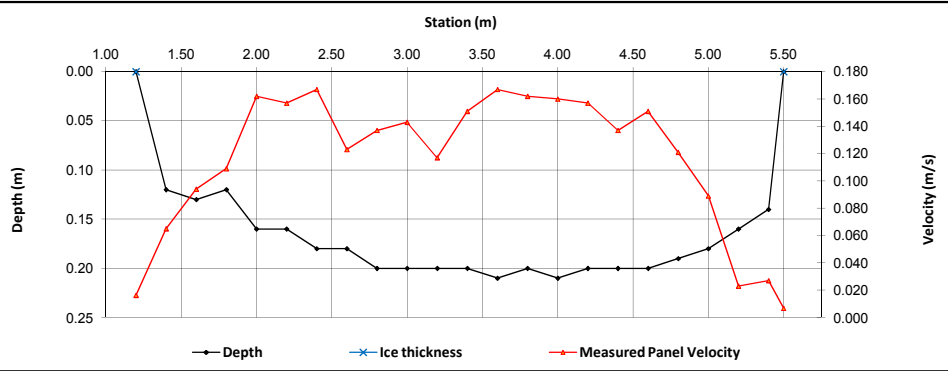
Site Visit Date: April 24, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	1.20	0.00	0.00	0.000	0.000	0.000	1.0	1.20	1.30	0.10	0.03	0.016	0.016	0.00	0.000	0%
1	1.40	0.12		0.065			1.0	1.30	1.50	0.20	0.12	0.065	0.065	0.02	0.002	2%
2	1.60	0.13		0.094			1.0	1.50	1.70	0.20	0.13	0.094	0.094	0.03	0.002	3%
3	1.80	0.12		0.109			1.0	1.70	1.90	0.20	0.12	0.109	0.109	0.02	0.003	3%
4	2.00	0.16		0.162			1.0	1.90	2.10	0.20	0.16	0.162	0.162	0.03	0.005	5%
5	2.20	0.16		0.157			1.0	2.10	2.30	0.20	0.16	0.157	0.157	0.03	0.005	5%
6	2.40	0.18		0.167			1.0	2.30	2.50	0.20	0.18	0.167	0.167	0.04	0.006	6%
7	2.60	0.18		0.123			1.0	2.50	2.70	0.20	0.18	0.123	0.123	0.04	0.004	5%
8	2.80	0.20		0.137			1.0	2.70	2.90	0.20	0.20	0.137	0.137	0.04	0.005	6%
9	3.00	0.20		0.143			1.0	2.90	3.10	0.20	0.20	0.143	0.143	0.04	0.006	6%
10	3.20	0.20		0.117			1.0	3.10	3.30	0.20	0.20	0.117	0.117	0.04	0.005	5%
11	3.40	0.20		0.151			1.0	3.30	3.50	0.20	0.20	0.151	0.151	0.04	0.006	6%
12	3.60	0.21		0.167			1.0	3.50	3.70	0.20	0.21	0.167	0.167	0.04	0.007	7%
13	3.80	0.20		0.162			1.0	3.70	3.90	0.20	0.20	0.162	0.162	0.04	0.006	7%
14	4.00	0.21		0.160			1.0	3.90	4.10	0.20	0.21	0.160	0.160	0.04	0.007	7%
15	4.20	0.20		0.157			1.0	4.10	4.30	0.20	0.20	0.157	0.157	0.04	0.006	7%
16	4.40	0.20		0.137			1.0	4.30	4.50	0.20	0.20	0.137	0.137	0.04	0.005	6%
17	4.60	0.20		0.151			1.0	4.50	4.70	0.20	0.20	0.151	0.151	0.04	0.006	6%
18	4.80	0.19		0.121			1.0	4.70	4.90	0.20	0.19	0.121	0.121	0.04	0.005	5%
19	5.00	0.18		0.089			1.0	4.90	5.10	0.20	0.18	0.089	0.089	0.04	0.003	3%
20	5.20	0.16		0.023			1.0	5.10	5.30	0.20	0.16	0.023	0.023	0.03	0.001	1%
21	5.40	0.14		0.027			1.0	5.30	5.45	0.15	0.14	0.027	0.027	0.02	0.001	1%
Left	5.50	0.00	0.00	0.000	0.000	0.000	1.0	5.45	5.50	0.05	0.04	0.007	0.007	0.00	0.000	0%
Total Flow															0.096	

Measurement Details:	
Start Time (MST):	13:00
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 5°C



Flow characteristics:		
Total Flow:	0.096	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.75	(m ²)
Wetted Width:	4.30	(m)
Hydraulic Depth:	0.173	(m)
Mean Velocity:	0.129	(m/s)
Froude Number:	0.099	

Datalogger Details:		
	Before	After
Transducer Reading:		0.591
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	13:06	
Laptop Clock:	13:03	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.3	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	1.012	98.630	1.000	98.630	-
Bench Mark 2:	Nail in base of logger tree	1.126	98.656	1.112	98.656	-
Top of Ice:						
Water Level:		2.442	97.200	2.428	97.202	97.201
Transducer Reading:		0.591	96.609	0.591	96.611	96.610
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	24-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake

UTM Location: 440712 E, 6361615 N

Site Visit Date: July 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
														Total Flow	0.000	

Measurement Details:

Start Time (MST):	10:00
End Time (MST):	10:45
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	-

Flow characteristics:

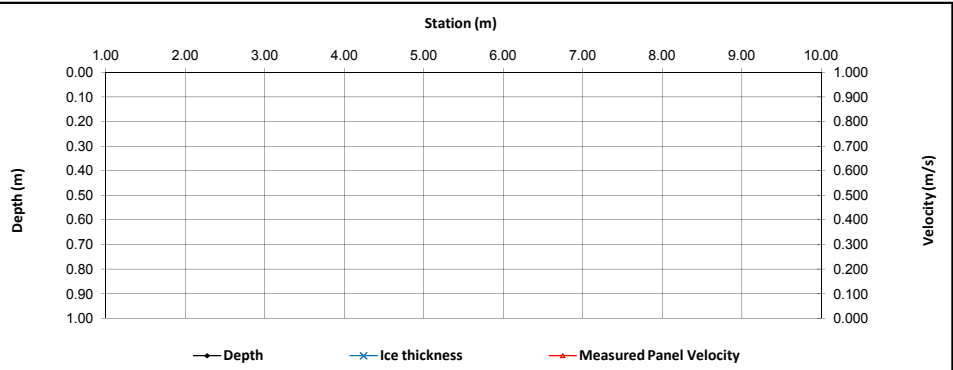
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.560
Battery (Main):	14.2	
Battery (Aux):	-	
Datalogger Clock:	10:53	
Laptop Clock:	10:52	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	13.4	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

New BM 60 cm high.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging		98.630		98.630	-
Bench Mark 2:	Nail in base of logger tree		98.656		98.656	-
Top of Ice:						
Water Level:			98.630		98.630	98.630
Transducer Reading:		0.560	98.070	0.560	98.070	98.070
Other:						

General Notes:

Purpose of trip was to check station function after fires, and to rebuild station onto a 2" pipe including a new 3/4" pipe benchmark.

Field Personnel:	DB, SM	Trip Date:	26-Jul-11
Data Entry Personnel:	JP	Date:	5-Aug-11
Data Check Personnel:	DB	Date:	25-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake
 UTM Location: 440712 E, 6361615 N

Site Visit Date: August 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	4.00	0.00	0.00	0.000	0.000	0.000	1.0	4.00	4.40	0.40	0.03	0.077	0.077	0.01	0.001	0%
1	4.80	0.13		0.308			1.0	4.40	5.00	0.60	0.13	0.308	0.308	0.08	0.024	3%
2	5.20	0.22		0.289			1.0	5.00	5.40	0.40	0.22	0.289	0.289	0.09	0.025	3%
3	5.60	0.26		0.501			1.0	5.40	5.80	0.40	0.26	0.501	0.501	0.10	0.052	6%
4	6.00	0.30		0.585			1.0	6.00	6.15	0.35	0.30	0.585	0.585	0.11	0.061	8%
5	6.30	0.34		0.534			1.0	6.15	6.45	0.30	0.34	0.534	0.534	0.10	0.054	7%
6	6.60	0.36		0.629			1.0	6.45	6.70	0.25	0.36	0.629	0.629	0.09	0.057	7%
7	6.80	0.39		0.849			1.0	6.70	6.85	0.15	0.39	0.849	0.849	0.06	0.050	6%
8	6.90	0.39		0.866			1.0	6.85	6.95	0.10	0.39	0.866	0.866	0.04	0.034	4%
9	7.00	0.38		0.869			1.0	6.95	7.05	0.10	0.38	0.869	0.869	0.04	0.033	4%
10	7.10	0.39		0.690			1.0	7.05	7.15	0.10	0.39	0.690	0.690	0.04	0.027	3%
11	7.20	0.42		0.760			1.0	7.15	7.25	0.10	0.42	0.760	0.760	0.04	0.032	4%
12	7.30	0.36		0.808			1.0	7.25	7.35	0.10	0.36	0.808	0.808	0.04	0.029	4%
13	7.40	0.40		0.827			1.0	7.35	7.45	0.10	0.40	0.827	0.827	0.04	0.033	4%
14	7.50	0.40		0.896			1.0	7.45	7.55	0.10	0.40	0.896	0.896	0.04	0.036	4%
15	7.60	0.40		0.860			1.0	7.55	7.70	0.15	0.40	0.860	0.860	0.06	0.052	6%
16	7.80	0.42		0.580			1.0	7.70	7.90	0.20	0.42	0.580	0.580	0.08	0.049	6%
17	8.00	0.41		0.670			1.0	7.90	8.10	0.20	0.41	0.670	0.670	0.08	0.055	7%
18	8.20	0.38		0.568			1.0	8.10	8.30	0.20	0.38	0.568	0.568	0.08	0.043	5%
19	8.40	0.33		0.430			1.0	8.30	8.50	0.20	0.33	0.430	0.430	0.07	0.028	3%
20	8.60	0.28		0.277			1.0	8.50	8.75	0.25	0.28	0.277	0.277	0.07	0.019	2%
21	8.90	0.24		0.170			1.0	8.75	9.20	0.45	0.24	0.170	0.170	0.11	0.018	2%
LB	9.50	0.00	0.00	0.000	0.000	0.000	1.0	9.20	9.50	0.30	0.06	0.043	0.043	0.02	0.001	0%

Total Flow 0.814

Measurement Details:

Start Time (MST):	8:55
End Time (MST):	9:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast

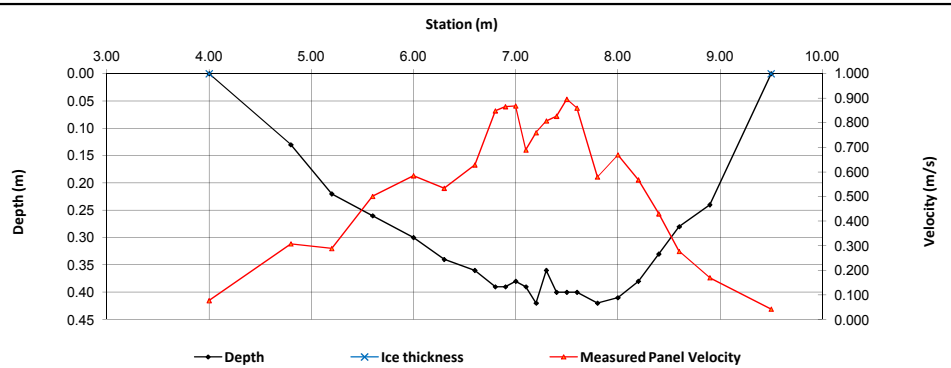
Flow characteristics:

Total Flow:	0.814	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.48	(m ²)
Wetted Width:	5.50	(m)
Hydraulic Depth:	0.268	(m)
Mean Velocity:	0.551	(m/s)
Froude Number:	0.340	

Datalogger Details:	Before	After
Transducer Reading:		0.458
Battery (Main):	14.1	
Battery (Aux):	-	
Datalogger Clock:	9:00	
Laptop Clock:	9:04	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	13.6	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

New BM 60 cm high



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	0.860	98.630	0.771	98.630	-
Bench Mark 2:	3/4" shorter pipe (not tall pipe/failed BM)	1.170	98.318	1.086	98.318	-
Top of Ice:						
Water Level:		2.395	97.095	2.310	97.091	97.093
Transducer Reading:		0.458	96.637	0.458	96.633	96.635
Other:						

General Notes:

Field Personnel:	DB KW	Trip Date:	15-Aug-11
Data Entry Personnel:	JW	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake
 UTM Location: 440712 E, 6361615 N

Site Visit Date: September 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
RB	0.60	0.00	0.00	0.000	0.000	0.000	1.0	0.60	0.65	0.05	0.02	0.000	0.000	0.00	0.000	0%
1	0.70	0.07		0.001			1.0	0.65	0.80	0.15	0.07	0.001	0.001	0.01	0.000	0%
2	0.90	0.09		0.117			1.0	0.80	1.00	0.20	0.09	0.117	0.117	0.02	0.002	1%
3	1.10	0.16		0.190			1.0	1.00	1.20	0.20	0.16	0.190	0.190	0.03	0.006	3%
4	1.30	0.17		0.143			1.0	1.20	1.40	0.20	0.17	0.143	0.143	0.03	0.005	3%
5	1.50	0.17		0.260			1.0	1.40	1.58	0.18	0.17	0.260	0.260	0.03	0.008	4%
6	1.65	0.20		0.291			1.0	1.58	1.78	0.20	0.20	0.291	0.291	0.04	0.012	6%
7	1.90	0.20		0.191			1.0	1.78	2.00	0.23	0.20	0.191	0.191	0.05	0.009	4%
8	2.10	0.22		0.387			1.0	2.00	2.20	0.20	0.22	0.387	0.387	0.04	0.017	9%
9	2.30	0.26		0.320			1.0	2.20	2.35	0.15	0.26	0.320	0.320	0.04	0.012	7%
10	2.40	0.27		0.376			1.0	2.35	2.45	0.10	0.27	0.376	0.376	0.03	0.010	5%
11	2.50	0.26		0.315			1.0	2.45	2.55	0.10	0.26	0.315	0.315	0.03	0.008	4%
12	2.60	0.22		0.351			1.0	2.55	2.65	0.10	0.22	0.351	0.351	0.02	0.008	4%
13	2.70	0.23		0.409			1.0	2.65	2.75	0.10	0.23	0.409	0.409	0.02	0.009	5%
14	2.80	0.28		0.403			1.0	2.75	2.85	0.10	0.28	0.403	0.403	0.03	0.011	6%
15	2.90	0.28		0.540			1.0	2.85	2.95	0.10	0.28	0.540	0.540	0.03	0.015	8%
16	3.00	0.28		0.429			1.0	2.95	3.05	0.10	0.28	0.429	0.429	0.03	0.012	6%
17	3.10	0.28		0.258			1.0	3.05	3.20	0.15	0.28	0.258	0.258	0.04	0.011	6%
18	3.30	0.25		0.200			1.0	3.20	3.40	0.20	0.25	0.200	0.200	0.05	0.010	5%
19	3.50	0.20		0.254			1.0	3.40	3.60	0.20	0.20	0.254	0.254	0.04	0.010	5%
20	3.70	0.21		0.144			1.0	3.60	3.80	0.20	0.21	0.144	0.144	0.04	0.006	3%
21	3.90	0.19		0.132			1.0	3.80	4.00	0.20	0.19	0.132	0.132	0.04	0.005	3%
22	4.10	0.12		0.167			1.0	4.00	4.20	0.20	0.12	0.167	0.167	0.02	0.004	2%
23	4.30	0.11		0.055			1.0	4.20	4.40	0.20	0.11	0.055	0.055	0.02	0.001	1%
24	4.50	0.08		0.011			1.0	4.40	4.60	0.20	0.08	0.011	0.011	0.02	0.000	0%
LB	4.70	0.00	0.00	0.000	0.000	0.000	1.0	4.20	4.70	0.50	0.05	0.003	0.003	0.03	0.000	0%
Total Flow															0.192	

Measurement Details:

Start Time (MST):	14:35
End Time (MST):	13:25
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, -17°C

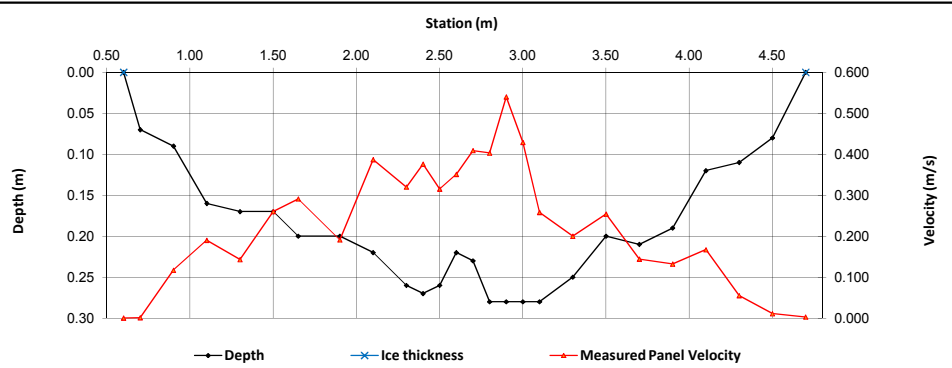
Flow characteristics:

Total Flow:	0.192	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.78	(m ²)
Wetted Width:	4.10	(m)
Hydraulic Depth:	0.189	(m)
Mean Velocity:	0.248	(m/s)
Froude Number:	0.182	

Datalogger Details:

	Before	After
Transducer Reading:		0.295
Battery (Main):	14.3	
Battery (Aux):	-	
Datalogger Clock:	14:39	
Laptop Clock:	14:41	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	7.7	
Memory Used:	-	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	0.923	98.630	0.915	98.630	-
Bench Mark 2:	3/4" short pipe (not tall failed BM)	1.233	98.318	1.227	98.318	-
Top of Ice:						
Water Level:		2.628	96.925	2.623	96.922	96.924
Transducer Reading:		0.295	96.630	0.295	96.627	96.629
Other:	BM2 replaced nail on logger tree	1.091		1.085		

General Notes:

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake
 UTM Location: 440712 E, 6361615 N

Site Visit Date: October 28, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.80	0.00	0.00	0.000	0.000	0.000	1.0	0.80	0.90	0.10	0.03	0.005	0.005	0.00	0.000	0%
1	1.00	0.10		0.021			1.0	0.90	1.10	0.20	0.10	0.021	0.021	0.02	0.000	0%
2	1.20	0.10		0.093			1.0	1.10	1.30	0.20	0.10	0.093	0.093	0.02	0.002	2%
3	1.40	0.12		0.061			1.0	1.30	1.50	0.20	0.12	0.061	0.061	0.02	0.001	1%
4	1.60	0.15		0.192			1.0	1.50	1.70	0.20	0.15	0.192	0.192	0.03	0.006	6%
5	1.80	0.17		0.142			1.0	1.70	1.90	0.20	0.17	0.142	0.142	0.03	0.005	5%
6	2.00	0.18		0.191			1.0	1.90	2.10	0.20	0.18	0.191	0.191	0.04	0.007	7%
7	2.20	0.20		0.243			1.0	2.10	2.30	0.20	0.20	0.243	0.243	0.04	0.010	9%
8	2.40	0.21		0.268			1.0	2.30	2.45	0.15	0.21	0.268	0.268	0.03	0.008	8%
9	2.50	0.20		0.270			1.0	2.45	2.55	0.10	0.20	0.270	0.270	0.02	0.005	5%
10	2.60	0.22		0.225			1.0	2.55	2.65	0.10	0.22	0.225	0.225	0.02	0.005	5%
11	2.70	0.22		0.241			1.0	2.65	2.75	0.10	0.22	0.241	0.241	0.02	0.005	5%
12	2.80	0.18		0.341			1.0	2.75	2.85	0.10	0.18	0.341	0.341	0.02	0.006	6%
13	2.90	0.23		0.373			1.0	2.85	2.95	0.10	0.23	0.373	0.373	0.02	0.009	8%
14	3.00	0.25		0.360			1.0	2.95	3.05	0.10	0.25	0.360	0.360	0.02	0.009	9%
15	3.10	0.22		0.300			1.0	3.05	3.15	0.10	0.22	0.300	0.300	0.02	0.007	6%
16	3.20	0.22		0.193			1.0	3.15	3.30	0.15	0.22	0.193	0.193	0.03	0.006	6%
17	3.40	0.24		0.101			1.0	3.30	3.50	0.20	0.24	0.101	0.101	0.05	0.005	5%
18	3.60	0.23		0.041			1.0	3.50	3.70	0.20	0.23	0.041	0.041	0.05	0.002	2%
19	3.80	0.18		0.090			1.0	3.70	3.90	0.20	0.18	0.090	0.090	0.04	0.003	3%
20	4.00	0.15		0.036			1.0	3.90	4.10	0.20	0.15	0.036	0.036	0.03	0.001	1%
21	4.20	0.11		0.020			1.0	4.10	4.40	0.30	0.11	0.020	0.020	0.03	0.001	1%
LB	4.60	0.00	0.00	0.000	0.000	0.000	1.0	4.40	4.60	0.20	0.03	0.005	0.005	0.01	0.000	0%
Total Flow															0.103	

Measurement Details:

Start Time (MST):	14:30
End Time (MST):	15:19
Equipment:	ADV
Method:	Wading
River Condition:	Open with Ice on sides
Quality/Error (see reverse):	Excellent
Weather:	clear

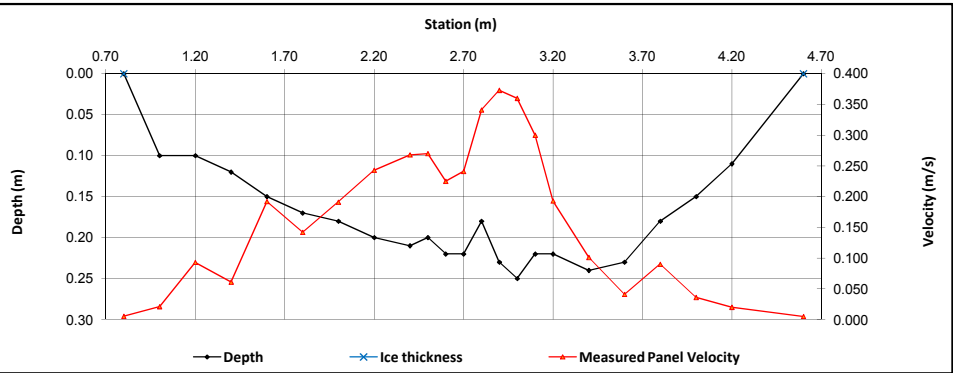
Flow characteristics:

Total Flow:	0.103	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.62	(m ²)
Wetted Width:	3.80	(m)
Hydraulic Depth:	0.164	(m)
Mean Velocity:	0.166	(m/s)
Froude Number:	0.131	

Datalogger Details:

	Before	After
Transducer Reading:		0.260
Battery (Main):	14.8	
Battery (Aux):	-	
Datalogger Clock:	1:57	
Laptop Clock:	1:55	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.3	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	0.828	98.630	0.808	98.630	-
Bench Mark 2:	3/4" short pipe (not tall failed BM)	1.143	98.318	1.122	98.318	-
Top of Ice:						
Water Level:		2.582	96.876	2.559	96.879	96.878
Transducer Reading:		0.260	96.616	0.260	96.619	96.618
Other:						

General Notes:

Heights
 BM1: 0.48 m
 BM2: 0.21 m

Field Personnel:	DW, SM	Trip Date:	28-Oct-11
Data Entry Personnel:	DW	Date:	7-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S34 - Tar River above CNRL Lake
 UTM Location: 440712 E, 6361615 N

Site Visit Date: December 7, 2011



Flow Measurement:

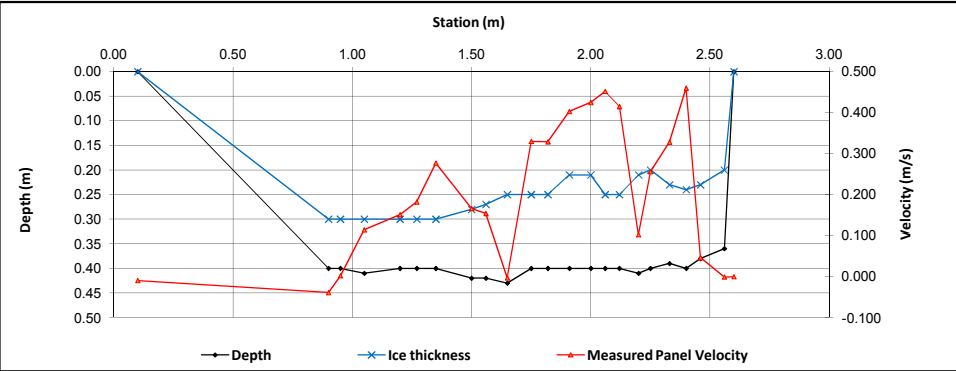
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
R	0.10	0.00	0.00	0.000	0.000	0.000	0.9	0.10	0.50	0.40	0.03	-0.010	-0.009	0.01	0.000	0%
1	0.90	0.40	0.30	-0.039			0.9	0.50	0.93	0.43	0.10	-0.039	-0.035	0.04	-0.001	-3%
2	0.95	0.40	0.30	0.002			0.9	0.93	1.00	0.08	0.10	0.002	0.002	0.01	0.000	0%
3	1.05	0.41	0.30	0.114			0.9	1.00	1.13	0.13	0.11	0.114	0.103	0.01	0.001	3%
4	1.20	0.40	0.30	0.151			0.9	1.13	1.24	0.11	0.10	0.151	0.136	0.01	0.001	3%
5	1.27	0.40	0.30	0.182			0.9	1.24	1.31	0.08	0.10	0.182	0.164	0.01	0.001	3%
6	1.35	0.40	0.30	0.277			0.9	1.31	1.43	0.12	0.10	0.277	0.249	0.01	0.003	6%
7	1.50	0.42	0.28	0.166			0.9	1.43	1.53	0.11	0.14	0.166	0.149	0.01	0.002	5%
8	1.56	0.42	0.27	0.154			0.9	1.53	1.61	0.08	0.15	0.154	0.139	0.01	0.002	3%
9	1.65	0.43	0.25	-0.003			0.9	1.61	1.70	0.10	0.18	-0.003	-0.003	0.02	0.000	0%
10	1.75	0.40	0.25	0.330			0.9	1.70	1.79	0.09	0.15	0.330	0.297	0.01	0.004	8%
11	1.82	0.40	0.25	0.329			0.9	1.79	1.87	0.08	0.15	0.329	0.296	0.01	0.004	7%
12	1.91	0.40	0.21	0.403			0.9	1.87	1.96	0.09	0.19	0.403	0.363	0.02	0.006	13%
13	2.00	0.40	0.21	0.425			0.9	1.96	2.03	0.08	0.19	0.425	0.383	0.01	0.005	11%
14	2.06	0.40	0.25	0.452			0.9	2.03	2.09	0.06	0.15	0.452	0.407	0.01	0.004	8%
15	2.12	0.40	0.25	0.415			0.9	2.09	2.16	0.07	0.15	0.415	0.374	0.01	0.004	8%
16	2.20	0.41	0.21	0.102			0.9	2.16	2.23	0.06	0.20	0.102	0.092	0.01	0.001	2%
17	2.25	0.40	0.20	0.256			0.9	2.23	2.29	0.06	0.20	0.256	0.230	0.01	0.003	6%
18	2.33	0.39	0.23	0.328			0.9	2.29	2.37	0.08	0.16	0.328	0.295	0.01	0.004	7%
19	2.40	0.40	0.24	0.460			0.9	2.37	2.43	0.06	0.16	0.460	0.414	0.01	0.004	9%
20	2.46	0.38	0.23	0.046			0.9	2.43	2.51	0.08	0.15	0.046	0.041	0.01	0.000	1%
21	2.56	0.36	0.20	-0.001			0.9	2.51	2.58	0.07	0.16	-0.001	-0.001	0.01	0.000	0%
L	2.60	0.00	0.00	0.000	0.000	0.000	1.0	2.58	2.60	0.02	0.04	0.000	0.000	0.00	0.000	0%
Total Flow															0.048	

Measurement Details:	
Start Time (MST):	12:40
End Time (MST):	13:45
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear, Windy -14

Flow characteristics:		
Total Flow:	0.048	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.29	(m ²)
Wetted Width:	2.50	(m)
Hydraulic Depth:	0.118	(m)
Mean Velocity:	0.164	(m/s)
Froude Number:	0.152	

Datalogger Details:		
	Before	After
Transducer Reading:		0.335
Battery (Main):	14.27	
Battery (Aux):	-	
Datalogger Clock:	12:48	
Laptop Clock:	12:47	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Rebar w/flagging	0.998	98.630	0.987	98.630	-
Bench Mark 2:	Nail in base of logger tree	1.322	98.318	1.309	98.318	-
Top of Ice:		2.672	96.956	2.663	96.954	96.955
Water Level:		2.720	96.920	2.710	96.917	96.919
Transducer Reading:		0.335	96.585	0.335	96.582	96.584
Other:						

General Notes:
 Majority of flow is on river left

Field Personnel:	SM, BL	Trip Date:	7-Dec-11
Data Entry Personnel:	DW	Date:	30-Dec-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S35 - McClelland Lake Creek
 UTM Location: 483430 E, 6371950 N

Site Visit Date: April 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	0.05	0.05	0.05	0.000	0.000	0.00	0.000	0%
1	0.10	0.21		0.000			1.0	0.05	0.15	0.10	0.21	0.000	0.000	0.02	0.000	0%
2	0.20	0.13		0.021			1.0	0.15	0.25	0.10	0.13	0.021	0.021	0.01	0.000	42%
3	0.30	0.12		0.017			1.0	0.25	0.35	0.10	0.12	0.017	0.017	0.01	0.000	32%
4	0.40	0.10		0.002			1.0	0.35	0.45	0.10	0.10	0.002	0.002	0.01	0.000	3%
5	0.50	0.10		0.009			1.0	0.45	0.55	0.10	0.10	0.009	0.009	0.01	0.000	14%
6	0.60	0.12		0.005			1.0	0.55	0.65	0.10	0.12	0.005	0.005	0.01	0.000	9%
7	0.70	0.12		0.000			1.0	0.65	0.80	0.15	0.12	0.000	0.000	0.02	0.000	0%
Right	0.90	0.00	0.00	0.000	0.000	0.000	1.0	0.80	0.90	0.10	0.03	0.000	0.000	0.00	0.000	0%
Total Flow															0.001	

Measurement Details:

Start Time (MST):	10:20
End Time (MST):	10:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Poor
Weather:	Sunny, 0°C

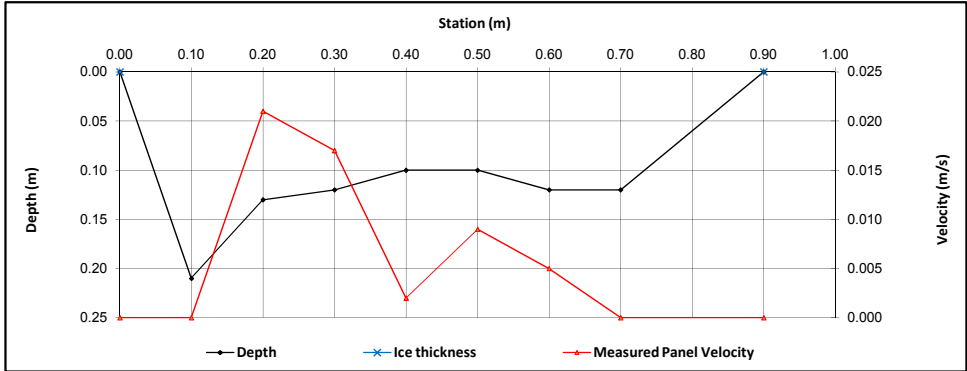
Flow characteristics:

Total Flow:	0.001	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	0.10	(m ²)
Wetted Width:	0.90	(m)
Hydraulic Depth:	0.113	(m)
Mean Velocity:	0.006	(m/s)
Froude Number:	0.006	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:					0.000	-
Bench Mark 2:					0.000	-
Top of Ice:						
Water Level:			0.000		0.000	0.000
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S35 - McClelland Lake Creek
 UTM Location: 483430 E, 6371950 N

Site Visit Date: August 13, 2011



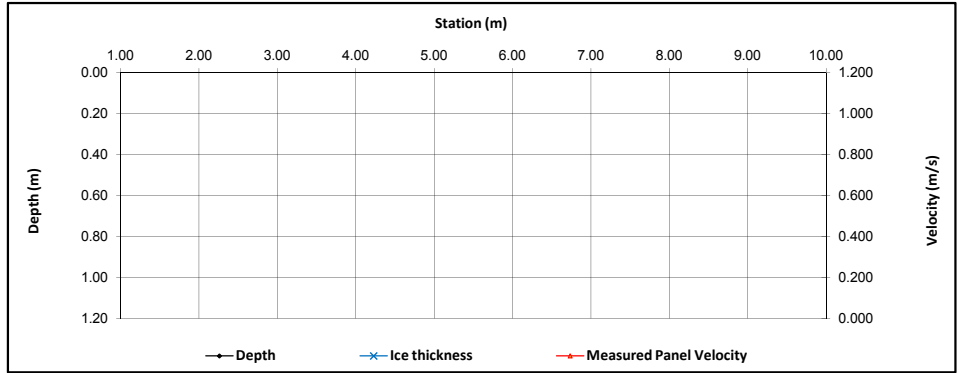
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
No measurable water observed while walking around this area on this date/time. See photos																
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	17:55
End Time (MST):	18:05
Equipment:	-
Method:	-
River Condition:	Dry
Quality/Error (see reverse):	-
Weather:	Partly cloudy

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:					0.000	-
Bench Mark 2:					0.000	-
Top of Ice:						
Water Level:			0.000		0.000	0.000
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	13-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	31-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S35 - McClelland Lake Creek
 UTM Location: 483430 E, 6371950 N

Site Visit Date: September 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
No measurable water observed while walking around this area on this date/time. See photos																
Total Flow														0.000		

Measurement Details:

Start Time (MST):	10:45
End Time (MST):	10:50
Equipment:	-
Method:	-
River Condition:	DRY
Quality/Error (see reverse):	-
Weather:	Partly cloudy, 12°C

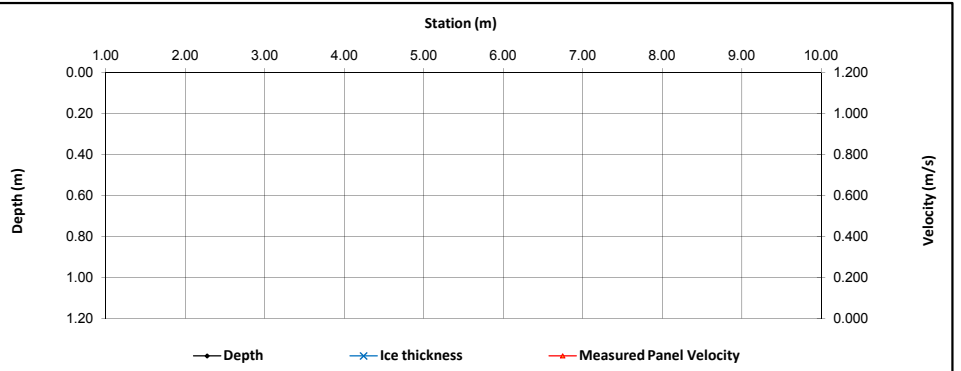
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:					0.000	-
Bench Mark 2:					0.000	-
Top of Ice:						
Water Level:			0.000		0.000	0.000
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S35 - McClelland Lake Creek
 UTM Location: 483430 E, 6371950 N

Site Visit Date: October 28, 2011



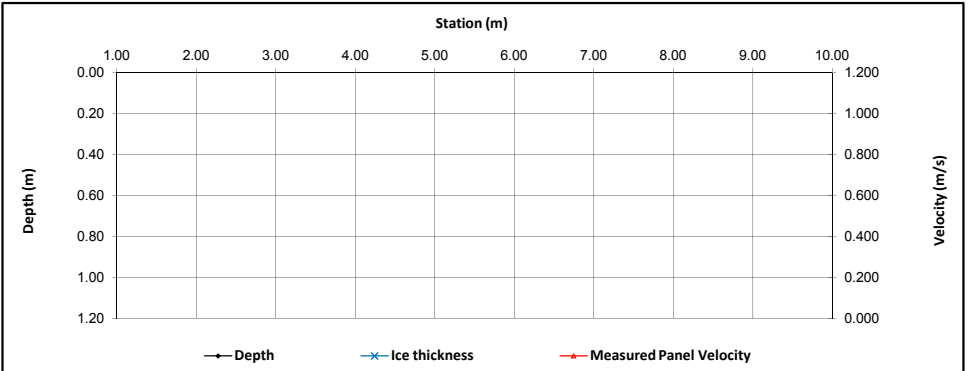
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
No measurable water observed while walking around this area on this date/time. See photos																
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	11:15
End Time (MST):	11:20
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	Clear

Flow characteristics:		
Total Flow:	0.000	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:					0.000	-
Bench Mark 2:					0.000	-
Top of Ice:						
Water Level:			0.000		0.000	0.000
Transducer Reading:						
Other:						

General Notes:
 No visible flow

Field Personnel:	DW, SM	Trip Date:	28-Oct-11
Data Entry Personnel:	DW	Date:	7-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S36 - McClelland Lake Outlet
 UTM Location: 490626 E, 6384064 N

Site Visit Date: April 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	1.30	0.00		0.000	0.000	0.000	1.0	1.30	1.40	0.10	0.05	0.057	0.057	0.00	0.000	0%
1	1.50	0.19		0.228			1.0	1.40	1.60	0.20	0.19	0.228	0.228	0.04	0.009	2%
2	1.70	0.28		0.225			1.0	1.60	1.80	0.20	0.28	0.225	0.225	0.06	0.013	3%
3	1.90	0.30		0.267			1.0	1.80	2.00	0.20	0.30	0.267	0.267	0.06	0.016	4%
4	2.10	0.40		0.361			1.0	2.00	2.20	0.20	0.40	0.361	0.361	0.08	0.029	6%
5	2.30	0.41		0.349			1.0	2.20	2.40	0.20	0.41	0.349	0.349	0.08	0.029	6%
6	2.50	0.41		0.330			1.0	2.40	2.60	0.20	0.41	0.330	0.330	0.08	0.027	6%
7	2.70	0.44		0.318			1.0	2.60	2.80	0.20	0.44	0.318	0.318	0.09	0.028	6%
8	2.90	0.38		0.376			1.0	2.80	3.00	0.20	0.38	0.376	0.376	0.08	0.029	6%
9	3.10	0.40		0.401			1.0	3.00	3.20	0.20	0.40	0.401	0.401	0.08	0.032	7%
10	3.30	0.39		0.369			1.0	3.20	3.40	0.20	0.39	0.369	0.369	0.08	0.029	6%
11	3.50	0.36		0.389			1.0	3.40	3.60	0.20	0.36	0.389	0.389	0.07	0.028	6%
12	3.70	0.36		0.382			1.0	3.60	3.80	0.20	0.36	0.382	0.382	0.07	0.028	6%
13	3.90	0.37		0.381			1.0	3.80	4.00	0.20	0.37	0.381	0.381	0.07	0.028	6%
14	4.10	0.38		0.303			1.0	4.00	4.20	0.20	0.38	0.303	0.303	0.08	0.023	5%
15	4.30	0.34		0.377			1.0	4.20	4.40	0.20	0.34	0.377	0.377	0.07	0.026	6%
16	4.50	0.34		0.361			1.0	4.40	4.60	0.20	0.34	0.361	0.361	0.07	0.025	5%
17	4.70	0.32		0.384			1.0	4.60	4.80	0.20	0.32	0.384	0.384	0.06	0.025	5%
18	4.90	0.34		0.292			1.0	4.80	5.00	0.20	0.34	0.292	0.292	0.07	0.020	4%
19	5.10	0.33		0.168			1.0	5.00	5.20	0.20	0.33	0.168	0.168	0.07	0.011	2%
20	5.30	0.25		0.005			1.0	5.20	5.40	0.20	0.25	0.005	0.005	0.05	0.000	0%
21	5.50	0.21		0.002			1.0	5.40	5.60	0.20	0.21	0.002	0.002	0.04	0.000	0%
Left	5.70	0.00		0.000	0.000	0.000	1.0	5.60	5.70	0.10	0.05	0.001	0.001	0.01	0.000	0%

Total Flow 0.452

Measurement Details:

Start Time (MST):	8:50
End Time (MST):	9:40
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, 0°C

Flow characteristics:

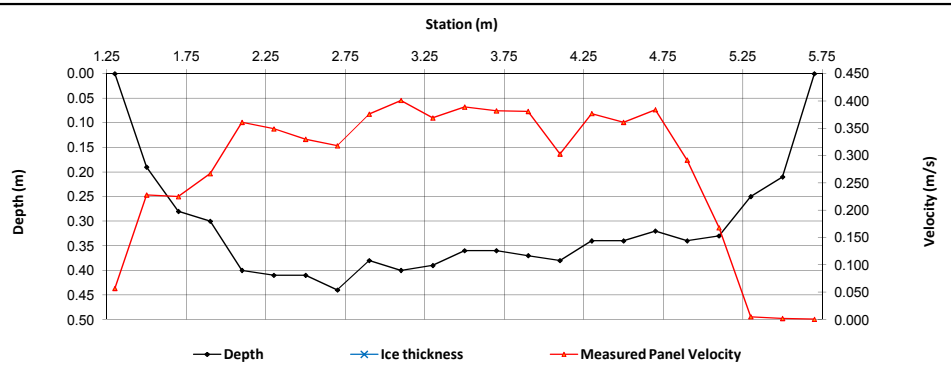
Total Flow:	0.452	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.45	(m ²)
Wetted Width:	4.40	(m)
Hydraulic Depth:	0.330	(m)
Mean Velocity:	0.312	(m/s)
Froude Number:	0.174	

Datalogger Details:

Transducer Reading:	Before	After
		0.362
Battery (Main):	4.1	
Battery (Aux):	13.1	
Datalogger Clock:	9:00	
Laptop Clock:	9:01	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	11%	
Dessicant:	New	
Logger# (if Δ):	1810	
PT# (if Δ):	602738	

Datalogger / Station Notes:

m=1.410805, b=-0.087893



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/flagging	1.307	100.000	1.301	100.000	-
Bench Mark 2:	Pipe w/flagging 3mE of BM1	1.492	99.923	1.484	99.923	-
Top of Ice:						
Water Level:		2.202	99.213	2.191	99.216	99.215
Transducer Reading:		0.362	98.851	0.362	98.854	98.853
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S36 - McClelland Lake Outlet
 UTM Location: 490626 E, 6384064 N

Site Visit Date: July 27, 2011



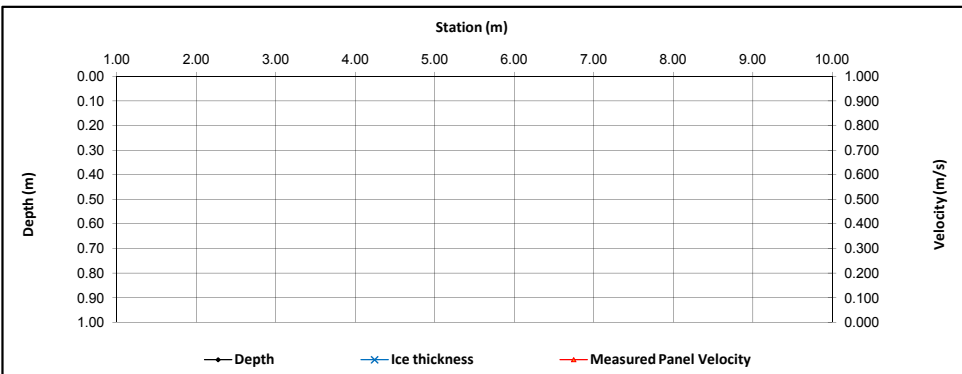
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	16:15
End Time (MST):	17:10
Equipment:	-
Method:	-
River Condition:	Open
Quality/Error (see reverse):	-
Weather:	-

Flow characteristics:		
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:		
	Before	After
Transducer Reading:	3.439	0.480
Battery (Main):	4.2	14.2
Battery (Aux):	14.3	
Datalogger Clock:	16:06	
Laptop Clock:	16:13	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	17.4
Memory Used:	10%	
Dessicant:	Old	
Logger# (if Δ):	DD	CR800
PT# (if Δ):		

Datalogger / Station Notes:
 Ground wires pulled out. Data corrupt from May 8 onward.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Nail in tree w/flagging		100.000		100.000	-
Bench Mark 2:	Pipe w/flagging 3mE of BM1		99.923		99.923	-
Top of Ice:						
Water Level:			100.000		100.000	100.000
Transducer Reading:		3.439	96.561	3.439	96.561	96.561
Other:						

General Notes:
 Burn marks from forest fire >500m away, most directions. Purpose of trip was to check station function after fires, and to upgrade station to Campbell Scientific hardware.
 Data were not recoverable after May-8 due to wiring displaced by possible ice or wildlife.

Field Personnel:	DB, SM	Trip Date:	27-Jul-11
Data Entry Personnel:	JP	Date:	5-Aug-11
Data Check Personnel:	SG	Date:	7-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S36 - McClelland Lake Outlet
 UTM Location: 490626 E, 6384064 N

Site Visit Date: August 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	6.00	0.00	0.00	0.000	0.000	0.000	1.0	6.00	6.05	0.05	0.08	-0.002	-0.002	0.00	0.000	0%
1	6.10	0.30		-0.007			1.0	6.05	6.25	0.20	0.30	-0.007	-0.007	0.06	0.000	0%
2	6.40	0.50		0.024			1.0	6.25	6.55	0.30	0.50	0.024	0.024	0.15	0.004	1%
3	6.70	0.54		0.013			1.0	6.55	6.85	0.30	0.54	0.013	0.013	0.16	0.002	1%
4	7.00	0.59		0.049			1.0	6.85	7.13	0.28	0.59	0.049	0.049	0.16	0.008	2%
5	7.25	0.60		0.148			1.0	7.13	7.38	0.25	0.60	0.148	0.148	0.15	0.022	6%
6	7.50	0.60		0.189			1.0	7.38	7.63	0.25	0.60	0.189	0.189	0.15	0.028	8%
7	7.75	0.60		0.251			1.0	7.63	7.88	0.25	0.60	0.251	0.251	0.15	0.038	11%
8	8.00	0.56		0.266			1.0	7.88	8.13	0.25	0.56	0.266	0.266	0.14	0.037	10%
9	8.25	0.54		0.274			1.0	8.13	8.38	0.25	0.54	0.274	0.274	0.14	0.037	10%
10	8.50	0.56		0.227			1.0	8.38	8.63	0.25	0.56	0.227	0.227	0.14	0.032	9%
11	8.75	0.56		0.260			1.0	8.63	8.88	0.25	0.56	0.260	0.260	0.14	0.036	10%
12	9.00	0.58		0.241			1.0	8.88	9.13	0.25	0.58	0.241	0.241	0.15	0.035	10%
13	9.25	0.60		0.258			1.0	9.13	9.38	0.25	0.60	0.258	0.258	0.15	0.039	11%
14	9.50	0.59		0.162			1.0	9.38	9.63	0.25	0.59	0.162	0.162	0.15	0.024	7%
15	9.75	0.50		0.059			1.0	9.63	9.90	0.28	0.50	0.059	0.059	0.14	0.008	2%
16	10.05	0.46		0.001			1.0	9.90	10.28	0.38	0.46	0.001	0.001	0.17	0.000	0%
17	10.50	0.34		0.038			1.0	10.28	10.75	0.48	0.34	0.038	0.038	0.16	0.006	2%
RB	11.00	0.00	0.00	0.000	0.000	0.000	1.0	10.75	11.00	0.25	0.09	0.010	0.010	0.02	0.000	0%
Total Flow															0.356	

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	15:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Partly Cloudy

Flow characteristics:

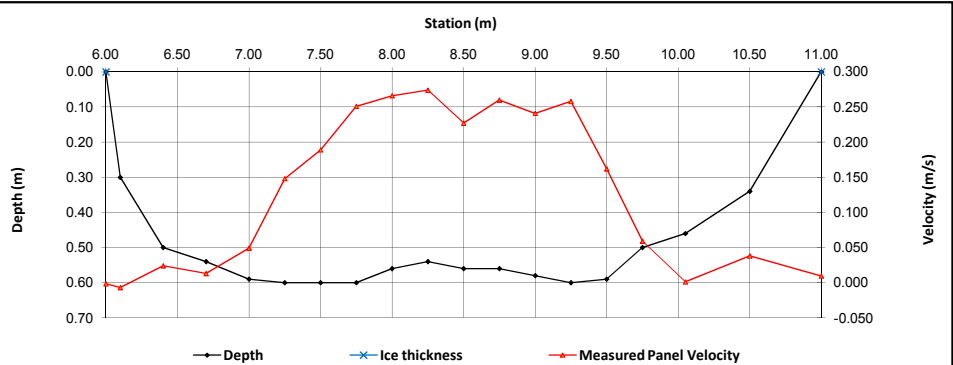
Total Flow:	0.356	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	2.48	(m ²)
Wetted Width:	5.00	(m)
Hydraulic Depth:	0.496	(m)
Mean Velocity:	0.144	(m/s)
Froude Number:	0.065	

Datalogger Details:

	Before	After
Transducer Reading:		0.56
Battery (Main):	14.2	
Battery (Aux):	-	
Datalogger Clock:	15:10	
Laptop Clock:	15:10	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	16.0	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

PT checked manually, 0.57m



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/flagging	0.877	100.000	0.863	100.000	-
Bench Mark 2:	Pipe w/flagging 3mE of BM1	0.998	99.923	0.984	99.923	-
Top of Ice:						
Water Level:		1.592	99.329	1.582	99.325	99.327
Transducer Reading:		0.560	98.769	0.560	98.765	98.767
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	13-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S36 - McClelland Lake Outlet
 UTM Location: 490626 E, 6384064 N

Site Visit Date: September 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	6.80	0.00	0.00	0.000	0.000	0.000	1.0	6.80	6.90	0.10	0.14	0.002	0.002	0.01	0.000	0%
1	7.00	0.54		0.007			1.0	6.90	7.13	0.23	0.54	0.007	0.007	0.12	0.001	0%
2	7.25	0.54		0.000			1.0	7.13	7.38	0.25	0.54	0.000	0.000	0.14	0.000	0%
3	7.50	0.55		0.046			1.0	7.38	7.63	0.25	0.55	0.046	0.046	0.14	0.006	2%
4	7.75	0.62		0.172			1.0	7.63	7.88	0.25	0.62	0.172	0.172	0.16	0.027	8%
5	8.00	0.59		0.221			1.0	7.88	8.10	0.23	0.59	0.221	0.221	0.13	0.029	8%
6	8.20	0.62		0.247			1.0	8.10	8.30	0.20	0.62	0.247	0.247	0.12	0.031	9%
7	8.40	0.61		0.251			1.0	8.30	8.50	0.20	0.61	0.251	0.251	0.12	0.031	9%
8	8.60	0.60		0.263			1.0	8.50	8.70	0.20	0.60	0.263	0.263	0.12	0.032	9%
9	8.80	0.60		0.211			1.0	8.70	8.90	0.20	0.60	0.211	0.211	0.12	0.025	7%
10	9.00	0.61		0.225			1.0	8.90	9.10	0.20	0.61	0.225	0.225	0.12	0.027	8%
11	9.20	0.62		0.199			1.0	9.10	9.30	0.20	0.62	0.199	0.199	0.12	0.025	7%
12	9.40	0.62		0.223			1.0	9.30	9.50	0.20	0.62	0.223	0.223	0.12	0.028	8%
13	9.60	0.63		0.233			1.0	9.50	9.70	0.20	0.63	0.233	0.233	0.13	0.029	8%
14	9.80	0.66		0.175			1.0	9.70	9.90	0.20	0.66	0.175	0.175	0.13	0.023	7%
15	10.00	0.68		0.130			1.0	9.90	10.10	0.20	0.68	0.130	0.130	0.14	0.018	5%
16	10.20	0.68		0.134			1.0	10.10	10.30	0.20	0.68	0.134	0.134	0.14	0.018	5%
17	10.40	0.64		0.020			1.0	10.30	10.50	0.20	0.64	0.020	0.020	0.13	0.003	1%
18	10.60	0.58		0.007			1.0	10.50	10.70	0.20	0.58	0.007	0.007	0.12	0.001	0%
19	10.80	0.52		0.018			1.0	10.70	10.90	0.20	0.52	0.018	0.018	0.10	0.002	1%
20	11.00	0.50		0.001			1.0	10.90	11.05	0.15	0.50	0.001	0.001	0.08	0.000	0%
LB	11.10	0.00	0.00	0.000	0.000	0.000	1.0	11.05	11.10	0.05	0.13	0.000	0.000	0.01	0.000	0%
Total Flow														0.355		

Measurement Details:

Start Time (MST):	9:15
End Time (MST):	10:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, ~10°C

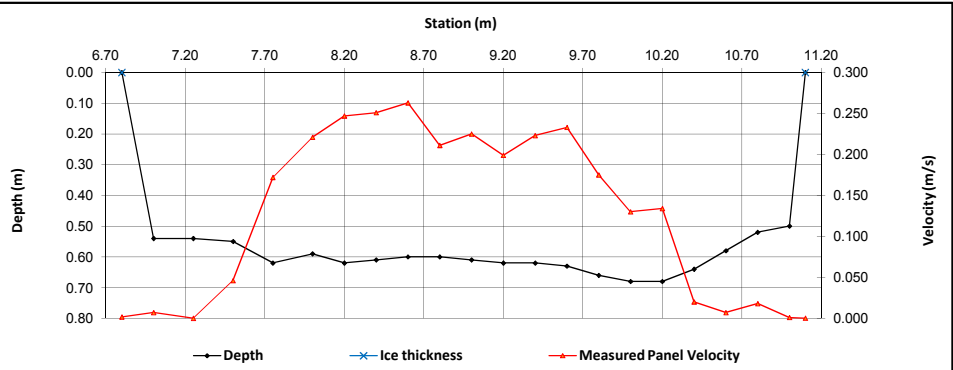
Flow characteristics:

Total Flow:	0.355	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	2.51	(m ²)
Wetted Width:	4.30	(m)
Hydraulic Depth:	0.584	(m)
Mean Velocity:	0.141	(m/s)
Froude Number:	0.059	

Datalogger Details:

	Before	After
Transducer Reading:		0.622
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	9:20	
Laptop Clock:	9:20	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	5.9	
Memory Used:	-	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/flagging	1.342	100.000	1.327	100.000	-
Bench Mark 2:	Pipe w/flagging 3mE of BM1	1.412	99.923	1.399	99.923	-
Top of Ice:						
Water Level:		1.949	99.386	1.935	99.387	99.387
Transducer Reading:		0.622	98.764	0.622	98.765	98.765
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S36 - McClelland Lake Outlet
 UTM Location: 490626 E, 6384064 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	5.00	0.00	0.00	0.000	0.000	0.000	1.0	5.00	5.05	0.05	0.15	-0.001	-0.001	0.01	0.000	0%
1	5.10	0.58		-0.003			1.0	5.05	5.18	0.13	0.58	-0.003	-0.003	0.07	0.000	0%
2	5.25	0.63		-0.001			1.0	5.18	5.38	0.20	0.63	-0.001	-0.001	0.13	0.000	0%
3	5.50	0.62		0.016			1.0	5.38	5.63	0.25	0.62	0.016	0.016	0.16	0.002	1%
4	5.75	0.70		0.138			1.0	5.63	5.88	0.25	0.70	0.138	0.138	0.18	0.024	6%
5	6.00	0.72		0.192			1.0	5.88	6.13	0.25	0.72	0.192	0.192	0.18	0.035	9%
6	6.25	0.71		0.161			1.0	6.13	6.38	0.25	0.71	0.161	0.161	0.18	0.029	7%
7	6.50	0.67		0.166			1.0	6.38	6.63	0.25	0.67	0.166	0.166	0.17	0.028	7%
8	6.75	0.66		0.205			1.0	6.63	6.80	0.18	0.66	0.205	0.205	0.12	0.024	6%
9	6.85	0.65		0.217			1.0	6.80	6.93	0.13	0.65	0.217	0.217	0.08	0.018	5%
10	7.00	0.66		0.191			1.0	6.93	7.08	0.15	0.66	0.191	0.191	0.10	0.019	5%
11	7.15	0.62		0.175			1.0	7.08	7.20	0.13	0.62	0.175	0.175	0.08	0.014	4%
12	7.25	0.63		0.167			1.0	7.20	7.38	0.18	0.63	0.167	0.167	0.11	0.018	5%
13	7.50	0.63		0.171			1.0	7.38	7.63	0.25	0.63	0.171	0.171	0.16	0.027	7%
14	7.75	0.66		0.191			1.0	7.63	7.88	0.25	0.66	0.191	0.191	0.17	0.032	8%
15	8.00	0.65		0.173			1.0	7.88	8.13	0.25	0.65	0.173	0.173	0.16	0.028	7%
16	8.25	0.64		0.192			1.0	8.13	8.38	0.25	0.64	0.192	0.192	0.16	0.031	8%
17	8.50	0.61		0.123			1.0	8.38	8.63	0.25	0.61	0.123	0.123	0.15	0.019	5%
18	8.75	0.54		0.175			1.0	8.63	8.88	0.25	0.54	0.175	0.175	0.14	0.024	6%
19	9.00	0.53		0.074			1.0	8.88	9.13	0.25	0.53	0.074	0.074	0.13	0.010	3%
	9.25	0.48		0.034			1.0	9.13	9.38	0.25	0.48	0.034	0.034	0.12	0.004	1%
	9.50	0.40		0.007			1.0	9.38	9.63	0.25	0.40	0.007	0.007	0.10	0.001	0%
RB	9.75	0.00	0.00	0.000	0.000	0.000	1.0	9.63	9.75	0.13	0.10	0.002	0.002	0.01	0.000	0%

Total Flow 0.384

Measurement Details:

Start Time (MST):	8:02
End Time (MST):	8:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	0°C, Clear

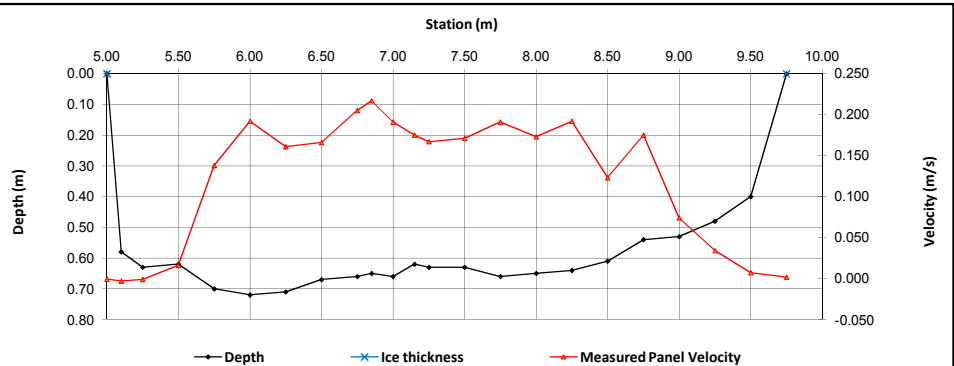
Flow characteristics:

Total Flow:	0.384	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	2.84	(m ²)
Wetted Width:	4.75	(m)
Hydraulic Depth:	0.598	(m)
Mean Velocity:	0.135	(m/s)
Froude Number:	0.056	

Datalogger Details:

	Before	After
Transducer Reading:		0.651
Battery (Main):	12.8	
Battery (Aux):	-	
Datalogger Clock:	8:08	
Laptop Clock:	8:07	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	2.1	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in tree w/flagging	0.929	100.000	0.907	100.000	-
Bench Mark 2:	Pipe w/flagging 3mE of BM1	0.998	99.923	0.977	99.923	-
Top of Ice:						
Water Level:		1.513	99.408	1.494	99.406	99.407
Transducer Reading:		0.651	98.757	0.651	98.755	98.756
Other:						

General Notes:

Heights
 BM2: 0.29 m

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	7-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S37 - East Jackpine Creek (487840 E, 6325424 N)

UTM Location: 487840 E, 6325424 N

Site Visit Date: April 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	3.15	0.00		0.000	0.000	0.000	1.0	3.15	3.13	0.02	0.10	0.041	0.041	0.00	0.000	0%
1	3.10	0.38		0.164			1.0	3.13	3.05	0.08	0.38	0.164	0.164	0.03	0.005	4%
2	3.00	0.37		0.235			1.0	3.05	2.95	0.10	0.37	0.235	0.235	0.04	0.009	8%
3	2.90	0.36		0.181			1.0	2.95	2.85	0.10	0.36	0.181	0.181	0.04	0.007	6%
4	2.80	0.40		0.215			1.0	2.85	2.75	0.10	0.40	0.215	0.215	0.04	0.009	8%
5	2.70	0.36		0.210			1.0	2.75	2.65	0.10	0.36	0.210	0.210	0.04	0.008	7%
6	2.60	0.35		0.176			1.0	2.65	2.55	0.10	0.35	0.176	0.176	0.04	0.006	6%
7	2.50	0.36		0.210			1.0	2.55	2.45	0.10	0.36	0.210	0.210	0.04	0.008	7%
8	2.40	0.36		0.211			1.0	2.45	2.35	0.10	0.36	0.211	0.211	0.04	0.008	7%
9	2.30	0.36		0.162			1.0	2.35	2.25	0.10	0.36	0.162	0.162	0.04	0.006	5%
10	2.20	0.36		0.248			1.0	2.25	2.15	0.10	0.36	0.248	0.248	0.04	0.009	8%
11	2.10	0.37		0.187			1.0	2.15	2.05	0.10	0.37	0.187	0.187	0.04	0.007	6%
12	2.00	0.36		0.161			1.0	2.05	1.95	0.10	0.36	0.161	0.161	0.04	0.006	5%
13	1.90	0.36		0.251			1.0	1.95	1.85	0.10	0.36	0.251	0.251	0.04	0.009	8%
14	1.80	0.36		0.175			1.0	1.85	1.75	0.10	0.36	0.175	0.175	0.04	0.006	6%
15	1.70	0.36		0.190			1.0	1.75	1.65	0.10	0.36	0.190	0.190	0.04	0.007	6%
16	1.60	0.36		0.027			1.0	1.65	1.55	0.10	0.36	0.027	0.027	0.04	0.001	1%
17	1.50	0.34		-0.031			1.0	1.55	1.45	0.10	0.34	-0.031	-0.031	0.03	-0.001	-1%
Left	1.40	0.00		0.000	0.000	0.000	1.0	1.45	1.40	0.05	0.09	-0.008	-0.008	0.00	0.000	0%
Total Flow														0.107		

Measurement Details:

Start Time (MST):	14:15
End Time (MST):	14:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 5°C

Flow characteristics:

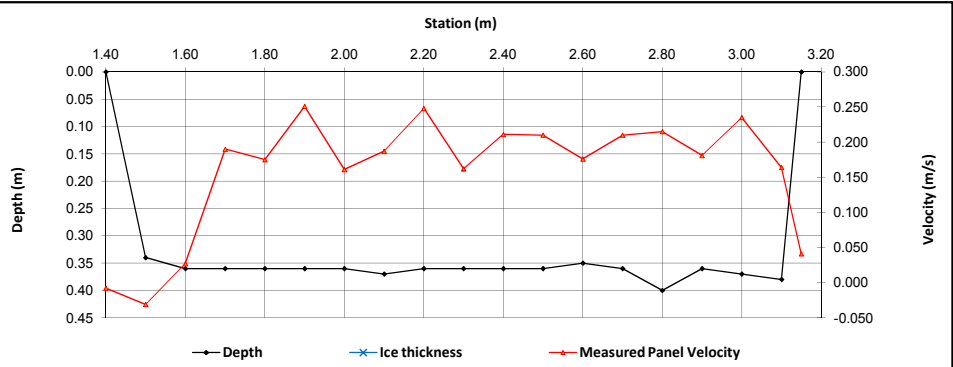
Total Flow:	0.107	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.61	(m ²)
Wetted Width:	1.68	(m)
Hydraulic Depth:	0.367	(m)
Mean Velocity:	0.174	(m/s)
Froude Number:	0.092	

Datalogger Details:

	Before	After
Transducer Reading:		0.178
Battery (Main):	4.4	
Battery (Aux):	14.6	
Datalogger Clock:	14:17	
Laptop Clock:	14:17	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	0%	
Dessicant:	New	
Logger# (if Δ):	269	
PT# (if Δ):	101353	

Datalogger / Station Notes:

m=0.86128, b=-0.416573



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in stump by river	2.208	100.000	2.202	100.000	-
Bench Mark 2:	Nail in tree w/logger	0.892	101.365	0.886	101.365	-
Top of Ice:						
Water Level:		2.150	100.058	2.143	100.059	100.059
Transducer Reading:		0.178	99.880	0.178	99.881	99.881
Other:						

General Notes:

Some ice still in channel

Field Personnel:	SG, DB	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S37 - East Jackpine Creek (487840 E, 6325424 N)

UTM Location: 487840 E, 6325424 N

Site Visit Date: August 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.60	0.00	0.00	0.000	0.000	0.000	1.0	0.60	0.75	0.15	0.04	0.005	0.005	0.01	0.000	0%
1	0.90	0.14		0.019			1.0	0.75	0.95	0.20	0.14	0.019	0.019	0.03	0.001	2%
2	1.00	0.15		0.046			1.0	0.95	1.05	0.10	0.15	0.046	0.046	0.02	0.001	2%
3	1.10	0.16		0.056			1.0	1.05	1.15	0.10	0.16	0.056	0.056	0.02	0.001	3%
4	1.20	0.15		0.085			1.0	1.15	1.25	0.10	0.15	0.085	0.085	0.02	0.001	4%
5	1.30	0.15		0.086			1.0	1.25	1.35	0.10	0.15	0.086	0.086	0.02	0.001	4%
6	1.40	0.16		0.051			1.0	1.35	1.45	0.10	0.16	0.051	0.051	0.02	0.001	3%
7	1.50	0.15		0.064			1.0	1.45	1.55	0.10	0.15	0.064	0.064	0.02	0.001	3%
8	1.60	0.16		0.071			1.0	1.55	1.65	0.10	0.16	0.071	0.071	0.02	0.001	4%
9	1.70	0.18		0.083			1.0	1.65	1.75	0.10	0.18	0.083	0.083	0.02	0.001	5%
10	1.80	0.20		0.093			1.0	1.75	1.85	0.10	0.20	0.093	0.093	0.02	0.002	6%
11	1.90	0.20		0.066			1.0	1.85	1.95	0.10	0.20	0.066	0.066	0.02	0.001	4%
12	2.00	0.20		0.086			1.0	1.95	2.05	0.10	0.20	0.086	0.086	0.02	0.002	6%
13	2.10	0.19		0.053			1.0	2.05	2.15	0.10	0.19	0.053	0.053	0.02	0.001	3%
14	2.20	0.19		0.086			1.0	2.15	2.25	0.10	0.19	0.086	0.086	0.02	0.002	5%
15	2.30	0.19		0.080			1.0	2.25	2.35	0.10	0.19	0.080	0.080	0.02	0.002	5%
16	2.40	0.20		0.083			1.0	2.35	2.45	0.10	0.20	0.083	0.083	0.02	0.002	5%
17	2.50	0.20		0.092			1.0	2.45	2.55	0.10	0.20	0.092	0.092	0.02	0.002	6%
18	2.60	0.24		0.067			1.0	2.55	2.65	0.10	0.24	0.067	0.067	0.02	0.002	5%
19	2.70	0.21		0.106			1.0	2.65	2.75	0.10	0.21	0.106	0.106	0.02	0.002	7%
20	2.80	0.25		0.051			1.0	2.75	2.85	0.10	0.25	0.051	0.051	0.02	0.001	4%
21	2.90	0.22		0.057			1.0	2.85	2.95	0.10	0.22	0.057	0.057	0.02	0.001	4%
22	3.00	0.20		0.095			1.0	2.95	3.03	0.07	0.20	0.095	0.095	0.01	0.001	5%
23	3.05	0.22		0.086			1.0	3.03	3.08	0.05	0.22	0.086	0.086	0.01	0.001	3%
RB	3.10	0.00	0.00	0.000	0.000	0.000	1.0	3.08	3.10	0.02	0.06	0.022	0.022	0.00	0.000	0%
Total Flow															0.030	

Measurement Details:

Start Time (MST):	15:30
End Time (MST):	16:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast

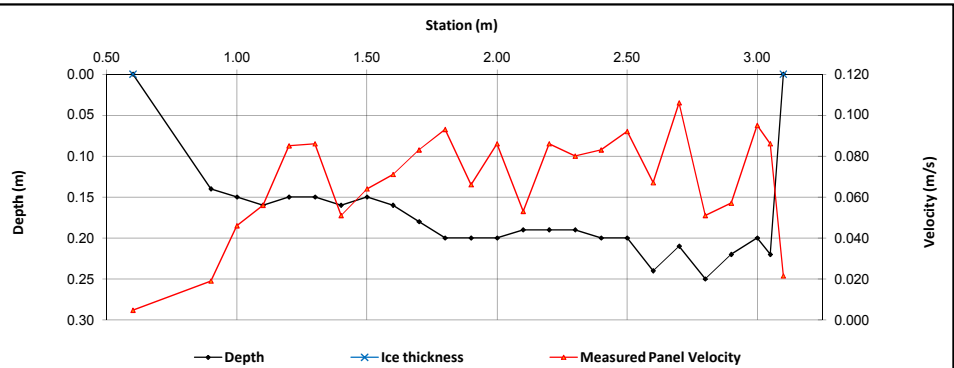
Flow characteristics:

Total Flow:	0.030	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.44	(m ²)
Wetted Width:	2.50	(m)
Hydraulic Depth:	0.174	(m)
Mean Velocity:	0.070	(m/s)
Froude Number:	0.053	

Datalogger Details:

	Before	After
Transducer Reading:	0.278	0.338
Battery (Main):	4.5	4.5
Battery (Aux):	14.3	14.4
Datalogger Clock:	15:27	16:45
Laptop Clock:	15:30	16:47
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	22%	22%
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in stump by river	1.978	100.000	1.970	100.000	-
Bench Mark 2:	3/4" pipe 3m to S of station	0.673	100.000	0.661	100.000	-
Top of Ice:						
Water Level:		2.206	99.772	2.198	99.772	99.772
Transducer Reading:		0.338	99.434	0.338	99.434	99.434
Other:	BM2 replaced nail at base of tree with logger	0.673				

General Notes:

Field Personnel:	DB, KW	Trip Date:	15-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S37 - East Jackpine Creek (487840 E, 6325424 N)

UTM Location: 487840 E, 6325424 N

Site Visit Date: September 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.60	0.00	0.00	0.000	0.000	0.000	1.0	0.60	0.63	0.03	0.04	0.005	0.005	0.00	0.000	0%
1	0.65	0.14		0.019			1.0	0.63	0.70	0.08	0.14	0.019	0.019	0.01	0.000	4%
2	0.75	0.13		0.011			1.0	0.70	0.80	0.10	0.13	0.011	0.011	0.01	0.000	3%
3	0.85	0.13		0.013			1.0	0.80	0.90	0.10	0.13	0.013	0.013	0.01	0.000	4%
4	0.95	0.14		0.023			1.0	0.90	1.00	0.10	0.14	0.023	0.023	0.01	0.000	7%
5	1.05	0.18		0.015			1.0	1.00	1.10	0.10	0.18	0.015	0.015	0.02	0.000	6%
6	1.15	0.16		0.014			1.0	1.10	1.18	0.07	0.16	0.014	0.014	0.01	0.000	4%
7	1.20	0.16		0.018			1.0	1.18	1.23	0.05	0.16	0.018	0.018	0.01	0.000	3%
8	1.25	0.14		0.040			1.0	1.23	1.28	0.05	0.14	0.040	0.040	0.01	0.000	6%
9	1.30	0.14		0.045			1.0	1.28	1.33	0.05	0.14	0.045	0.045	0.01	0.000	7%
10	1.35	0.13		0.027			1.0	1.33	1.38	0.05	0.13	0.027	0.027	0.01	0.000	4%
11	1.40	0.12		0.028			1.0	1.38	1.43	0.05	0.12	0.028	0.028	0.01	0.000	4%
12	1.45	0.12		0.026			1.0	1.43	1.50	0.08	0.12	0.026	0.026	0.01	0.000	5%
13	1.55	0.12		0.030			1.0	1.50	1.60	0.10	0.12	0.030	0.030	0.01	0.000	8%
14	1.65	0.12		0.020			1.0	1.60	1.70	0.10	0.12	0.020	0.020	0.01	0.000	5%
15	1.75	0.12		0.013			1.0	1.70	1.80	0.10	0.12	0.013	0.013	0.01	0.000	4%
16	1.85	0.12		0.023			1.0	1.80	1.90	0.10	0.12	0.023	0.023	0.01	0.000	6%
17	1.95	0.12		0.035			1.0	1.90	2.00	0.10	0.12	0.035	0.035	0.01	0.000	9%
18	2.05	0.10		0.015			1.0	2.00	2.10	0.10	0.10	0.015	0.015	0.01	0.000	3%
19	2.15	0.09		0.012			1.0	2.10	2.20	0.10	0.09	0.012	0.012	0.01	0.000	2%
20	2.25	0.09		0.007			1.0	2.20	2.30	0.10	0.09	0.007	0.007	0.01	0.000	1%
21	2.35	0.08		0.002			1.0	2.30	2.40	0.10	0.08	0.002	0.002	0.01	0.000	0%
22	2.45	0.08		0.002			1.0	2.40	2.73	0.33	0.08	0.002	0.002	0.03	0.000	1%
LB	3.00	0.00	0.00	0.000	0.000	0.000	1.0	2.63	3.00	0.38	0.02	0.001	0.001	0.01	0.000	0%
Total Flow															0.004	

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	16:20
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Rain, ~10°C

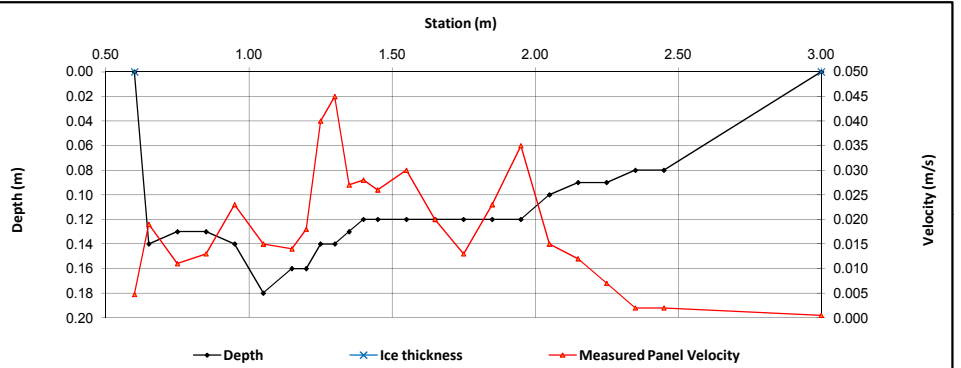
Flow characteristics:

Total Flow:	0.004	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.26	(m ²)
Wetted Width:	2.40	(m)
Hydraulic Depth:	0.106	(m)
Mean Velocity:	0.017	(m/s)
Froude Number:	0.017	

Datalogger Details:

	Before	After
Transducer Reading:		0.261
Battery (Main):	4.5	
Battery (Aux):	12.7	
Datalogger Clock:	14:58	
Laptop Clock:	15:00	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	26%	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Nail in stump by river	1.985	100.000	1.972	100.000	-
Bench Mark 2:	3/4 pipe 3m to S of station	1.147	101.365	1.133	101.365	-
Top of Ice:						
Water Level:		2.272	99.713	2.261	99.711	99.712
Transducer Reading:		0.261	99.452	0.261	99.450	99.451
Other:	BM2 replaced nail on logger tree					

General Notes:

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S37 - East Jackpine Creek (487840 E, 6325424 N)

UTM Location: 487840 E, 6325424 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.60	0.00	0.00	0.000	0.000	0.000	1.0	0.60	0.73	0.13	0.02	0.002	0.002	0.00	0.000	0%
1	0.85	0.08		0.009			1.0	0.73	0.93	0.20	0.08	0.009	0.009	0.02	0.000	1%
2	1.00	0.10		0.007			1.0	0.93	1.08	0.15	0.10	0.007	0.007	0.02	0.000	1%
3	1.15	0.12		0.000			1.0	1.08	1.23	0.15	0.12	0.000	0.000	0.02	0.000	0%
4	1.30	0.12		0.003			1.0	1.23	1.38	0.15	0.12	0.003	0.003	0.02	0.000	0%
5	1.45	0.12		0.066			1.0	1.38	1.53	0.15	0.12	0.066	0.066	0.02	0.001	9%
6	1.60	0.12		0.062			1.0	1.53	1.68	0.15	0.12	0.062	0.062	0.02	0.001	9%
7	1.75	0.15		0.036			1.0	1.68	1.79	0.12	0.15	0.036	0.036	0.02	0.001	5%
8	1.83	0.16		0.059			1.0	1.79	1.87	0.08	0.16	0.059	0.059	0.01	0.001	6%
9	1.90	0.16		0.042			1.0	1.87	1.94	0.07	0.16	0.042	0.042	0.01	0.000	4%
10	1.97	0.16		0.023			1.0	1.94	2.01	0.07	0.16	0.023	0.023	0.01	0.000	2%
11	2.05	0.16		0.048			1.0	2.01	2.09	0.08	0.16	0.048	0.048	0.01	0.001	5%
12	2.13	0.16		0.047			1.0	2.09	2.17	0.08	0.16	0.047	0.047	0.01	0.001	4%
13	2.20	0.17		0.042			1.0	2.17	2.24	0.07	0.17	0.042	0.042	0.01	0.000	4%
14	2.27	0.15		0.073			1.0	2.24	2.31	0.07	0.15	0.073	0.073	0.01	0.001	6%
15	2.35	0.16		0.063			1.0	2.31	2.39	0.08	0.16	0.063	0.063	0.01	0.001	6%
16	2.43	0.17		0.087			1.0	2.39	2.47	0.07	0.17	0.087	0.087	0.01	0.001	9%
17	2.50	0.18		0.019			1.0	2.47	2.58	0.11	0.18	0.019	0.019	0.02	0.000	3%
18	2.65	0.18		0.066			1.0	2.58	2.73	0.15	0.18	0.066	0.066	0.03	0.002	14%
19	2.80	0.14		0.011			1.0	2.73	2.88	0.15	0.14	0.011	0.011	0.02	0.000	2%
20	2.95	0.20		0.048			1.0	2.88	3.00	0.13	0.20	0.048	0.048	0.03	0.001	9%
RB	3.05	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.05	0.05	0.05	0.012	0.012	0.00	0.000	0%
Total Flow														0.013		

Measurement Details:

Start Time (MST):	15:55
End Time (MST):	17:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Clear, 2°C

Flow Characteristics:

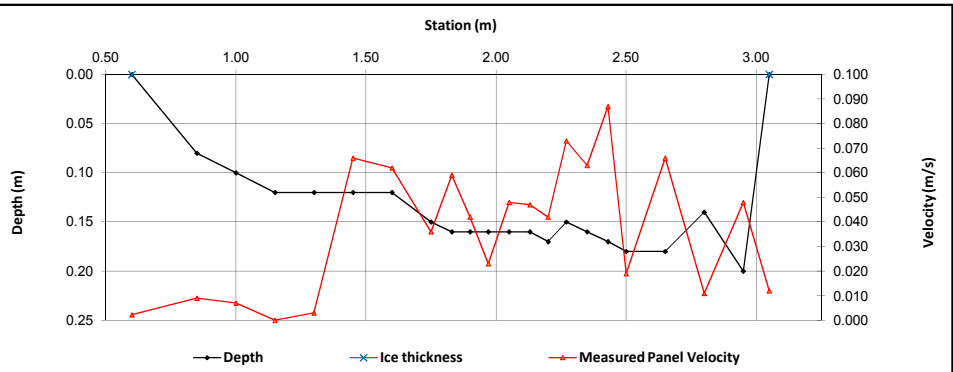
Total Flow:	0.013	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.33	(m ²)
Wetted Width:	2.45	(m)
Hydraulic Depth:	0.133	(m)
Mean Velocity:	0.039	(m/s)
Froude Number:	0.034	

Datalogger Details:

	Before	After
Transducer Reading:		0.214
Battery (Main):	4.4	
Battery (Aux):	13.4	
Datalogger Clock:	15:59	
Laptop Clock:	16:02	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	32%	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Removed DD128, keller, battery, CR800



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in stump by river	2.021	100.000	2.010	100.000	-
Bench Mark 2:	3/4" pipe 3 m to S of station	1.183	101.365	1.172	101.365	-
Top of Ice:						
Water Level:		2.282	99.739	2.275	99.735	99.737
Transducer Reading:		0.214	99.525	0.214	99.521	99.523
Other:						

General Notes:

BM Heights
BM2: 0.24 m
PLS weight left at base

Field Personnel:	SM, DW	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	24-Nov-11

Hydrometric Measurement / Site Visit Record

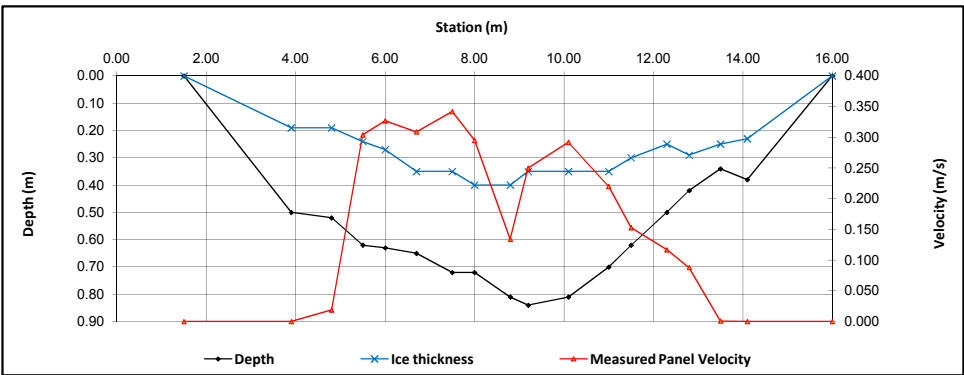
Site: S38 - Steepbank River near Ft. McMurray
 UTM Location: 475293 E, 6317385 N

Site Visit Date: January 22, 2011



Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	1.50	0.00	0.00	0.000	0.000	0.000	1.0	1.50	2.70	1.20	0.08	0.000	0.000	0.09	0.000	0%
1	3.90	0.50	0.19	0.000			1.0	2.70	4.35	1.65	0.31	0.000	0.000	0.51	0.000	0%
2	4.80	0.52	0.19	0.019			0.9	4.35	5.15	0.80	0.33	0.019	0.017	0.26	0.005	1%
3	5.50	0.62	0.24	0.304			0.9	5.15	5.75	0.60	0.38	0.304	0.274	0.23	0.062	10%
4	6.00	0.63	0.27	0.327			0.9	5.75	6.35	0.60	0.36	0.327	0.294	0.22	0.064	10%
5	6.70	0.65	0.35	0.309			0.9	6.35	7.10	0.75	0.30	0.309	0.278	0.23	0.063	10%
6	7.50	0.72	0.35	0.342			0.9	7.10	7.75	0.65	0.37	0.342	0.308	0.24	0.074	12%
7	8.00	0.72	0.40	0.295			0.9	7.75	8.40	0.65	0.32	0.295	0.266	0.21	0.055	9%
8	8.80	0.81	0.40	0.134			0.9	8.40	9.00	0.60	0.41	0.134	0.121	0.25	0.030	5%
9	9.20	0.84	0.35	0.250			0.9	9.00	9.65	0.65	0.49	0.250	0.225	0.32	0.072	11%
10	10.10	0.81	0.35	0.292			0.9	9.65	10.55	0.90	0.46	0.292	0.263	0.41	0.109	17%
11	11.00	0.70	0.35	0.220			0.9	10.55	11.25	0.70	0.35	0.220	0.198	0.25	0.049	8%
12	11.50	0.62	0.30	0.153			0.9	11.25	11.90	0.65	0.32	0.153	0.138	0.21	0.029	5%
13	12.30	0.50	0.25	0.117			0.9	11.90	12.55	0.65	0.25	0.117	0.105	0.16	0.017	3%
14	12.80	0.42	0.29	0.088			0.9	12.55	13.15	0.60	0.13	0.088	0.079	0.08	0.006	1%
15	13.50	0.34	0.25	0.001			0.9	13.15	13.80	0.65	0.09	0.001	0.001	0.06	0.000	0%
16	14.10	0.38	0.23	0.000			1.0	13.80	15.05	1.25	0.15	0.000	0.000	0.19	0.000	0%
Right	16.00	0.00	0.00	0.000	0.000	0.000	1.0	15.05	16.00	0.95	0.04	0.000	0.000	0.04	0.000	0%
Total Flow															0.633	

Measurement Details:	
Start Time (MST):	11:00
End Time (MST):	12:20
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Clear, -16°C



Flow characteristics:		
Total Flow:	0.633	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	3.94	(m ²)
Wetted Width:	14.50	(m)
Hydraulic Depth:	0.272	(m)
Mean Velocity:	0.161	(m/s)
Froude Number:	0.098	

Datalogger Details:		
	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	WSC Brass Cap near cabin		98.672		98.672	-
Bench Mark 2:	Brass Cap away from shack	1.267	100.000	1.258	100.000	-
Top of Ice:		3.401	97.866	3.395	97.863	97.865
Water Level:		3.442	97.825	3.439	97.819	97.822
Transducer Reading:						
Other:						

Datalogger / Station Notes:
 WSC site

General Notes:

Field Personnel:	JO, DB	Trip Date:	22-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S38 - Steepbank River near Ft. McMurray
 UTM Location: 475293 E, 6317385 N

Site Visit Date: February 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	2.75	0.00	0.00	0.000	0.000	0.000	0.9	2.75	3.03	0.28	0.02	0.000	0.000	0.01	0.000	0%
1	3.30	0.50	0.41	0.001			0.9	3.03	3.55	0.53	0.09	0.001	0.001	0.05	0.000	0%
2	3.80	0.53	0.44	0.055			0.9	3.55	4.00	0.45	0.09	0.055	0.050	0.04	0.002	0%
3	4.20	0.60	0.45	0.011			0.9	4.00	4.43	0.43	0.15	0.011	0.010	0.06	0.001	0%
4	4.65	0.68	0.45	0.129			0.9	4.43	4.85	0.42	0.23	0.129	0.116	0.10	0.011	2%
5	5.05	0.77	0.44	0.140			0.9	4.85	5.25	0.40	0.33	0.140	0.126	0.13	0.017	3%
6	5.45	0.80	0.44	0.188			0.9	5.25	5.68	0.43	0.36	0.188	0.169	0.15	0.026	5%
7	5.90	0.83	0.45	0.273			0.9	5.68	6.10	0.42	0.38	0.273	0.246	0.16	0.040	7%
8	6.30	0.89	0.45	0.301			0.9	6.10	6.48	0.38	0.44	0.301	0.271	0.17	0.045	8%
9	6.65	0.89	0.45	0.315			0.9	6.48	6.85	0.38	0.44	0.315	0.284	0.17	0.047	8%
10	7.05	0.83	0.51	0.338			0.9	6.85	7.25	0.40	0.32	0.338	0.304	0.13	0.039	7%
11	7.45	0.88	0.47	0.284			0.9	7.25	7.63	0.38	0.41	0.284	0.256	0.15	0.039	7%
12	7.80	0.93	0.46	0.252			0.9	7.63	7.95	0.32	0.47	0.252	0.227	0.15	0.035	6%
13	8.10	0.97	0.45	0.279			0.9	7.95	8.28	0.32	0.52	0.279	0.251	0.17	0.042	7%
14	8.45	0.98	0.45	0.204			0.9	8.28	8.65	0.38	0.53	0.204	0.184	0.20	0.036	6%
15	8.85	0.96	0.42	0.242			0.9	8.65	9.05	0.40	0.54	0.242	0.218	0.22	0.047	8%
16	9.25	0.95	0.38	0.112			0.9	9.05	9.43	0.38	0.57	0.112	0.101	0.21	0.022	4%
17	9.60	0.88	0.40	0.216			0.9	9.43	9.85	0.42	0.48	0.216	0.194	0.20	0.040	7%
18	10.10	0.88	0.43	0.139			0.9	9.85	10.35	0.50	0.45	0.139	0.125	0.23	0.028	5%
19	10.60	0.77	0.42	0.122			0.9	10.35	10.83	0.48	0.35	0.122	0.110	0.17	0.018	3%
20	11.05	0.71	0.43	0.120			0.9	10.83	11.28	0.45	0.28	0.120	0.108	0.13	0.014	2%
21	11.50	0.68	0.35	0.079			0.9	11.28	11.70	0.42	0.33	0.079	0.071	0.14	0.010	2%
22	11.90	0.53	0.35	0.145			0.9	11.70	12.10	0.40	0.18	0.145	0.131	0.07	0.009	2%
23	12.30	0.49	0.32	0.048			0.9	12.10	12.65	0.55	0.17	0.048	0.043	0.09	0.004	1%
Right	13.00	0.00	0.00	0.000	0.000	0.000	1.0	12.65	13.00	0.35	0.04	0.012	0.012	0.01	0.000	0%
Total Flow															0.571	

Measurement Details:

Start Time (MST):	8:00
End Time (MST):	9:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear

Flow characteristics:

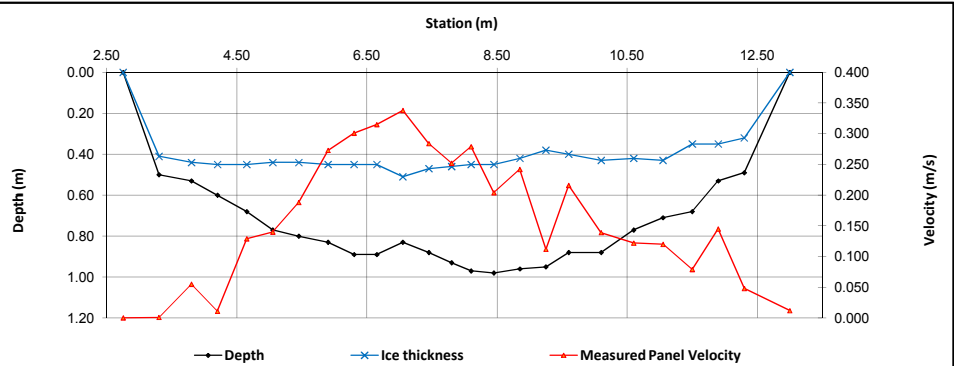
Total Flow:	0.571	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.31	(m ²)
Wetted Width:	10.25	(m)
Hydraulic Depth:	0.323	(m)
Mean Velocity:	0.173	(m/s)
Froude Number:	0.097	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	WSC Brass Cap near cabin		98.672		98.672	-
Bench Mark 2:	Brass Cap away from shack	1.243	100.000	1.229	100.000	-
Top of Ice:		3.410	97.833	3.398	97.831	97.832
Water Level:		3.369	97.874	3.355	97.874	97.874
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	SG, BL	Trip Date:	14-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S38 - Steepbank River near Ft. McMurray

UTM Location: 475293 E, 6317385 N

Site Visit Date: December 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
L	6.00	0.00	0.00	0.000	0.000	0.000	0.9	6.00	6.40	0.40	0.03	0.008	0.007	0.01	0.000	0%
1	6.80	0.40	0.28	0.030			0.9	6.40	7.20	0.80	0.12	0.030	0.027	0.10	0.003	0%
2	7.60	0.50	0.26	0.070			0.9	7.20	7.97	0.77	0.24	0.070	0.063	0.18	0.012	2%
3	8.33	0.54	0.27	0.100			0.9	7.97	8.57	0.60	0.27	0.100	0.090	0.16	0.015	2%
4	8.80	0.60	0.26	0.120			0.9	8.57	9.00	0.43	0.34	0.120	0.108	0.15	0.016	3%
5	9.20	0.60	0.24	0.170			0.9	9.00	9.45	0.45	0.36	0.170	0.153	0.16	0.025	4%
6	9.70	0.68	0.25	0.180			0.9	9.45	9.90	0.45	0.43	0.180	0.162	0.19	0.031	5%
7	10.10	0.70	0.25	0.200			0.9	9.90	10.35	0.45	0.45	0.200	0.180	0.20	0.036	6%
8	10.60	0.80	0.25	0.220			0.9	10.35	10.83	0.48	0.55	0.220	0.198	0.26	0.052	9%
9	11.05	0.81	0.25	0.170			0.9	10.83	11.30	0.48	0.56	0.170	0.153	0.27	0.041	7%
10	11.55	0.87	0.25	0.170			0.9	11.30	11.75	0.45	0.62	0.170	0.153	0.28	0.043	7%
11	11.95	0.90	0.25	0.150			0.9	11.75	12.13	0.38	0.65	0.150	0.135	0.24	0.033	6%
12	12.30	0.90	0.25	0.160			0.9	12.13	12.50	0.38	0.65	0.160	0.144	0.24	0.035	6%
13	12.70	0.98	0.25	0.160			0.9	12.50	12.90	0.40	0.73	0.160	0.144	0.29	0.042	7%
14	13.10	0.99	0.26	0.110			0.9	12.90	13.30	0.40	0.73	0.110	0.099	0.29	0.029	5%
15	13.50	1.01	0.26		0.090	0.150	1.0	13.30	13.70	0.40	0.75	0.120	0.120	0.30	0.036	6%
16	13.90	1.01	0.27	0.150			0.9	13.70	14.08	0.38	0.74	0.150	0.135	0.28	0.037	6%
17	14.25	1.03	0.27		0.130	0.100	1.0	14.08	14.45	0.38	0.76	0.115	0.115	0.29	0.033	6%
18	14.65	1.00	0.28	0.070			0.9	14.45	14.85	0.40	0.72	0.070	0.063	0.29	0.018	3%
19	15.05	0.98	0.28	0.050			0.9	14.85	15.48	0.63	0.70	0.050	0.045	0.44	0.020	3%
20	15.90	0.84	0.29	0.050			0.9	15.48	16.35	0.88	0.55	0.050	0.045	0.48	0.022	4%
21	16.80	0.77	0.30	0.030			0.9	16.35	17.20	0.85	0.47	0.030	0.027	0.40	0.011	2%
22	17.60	0.67	0.31	0.010			0.9	17.20	18.15	0.95	0.36	0.010	0.009	0.34	0.003	1%
23	18.70	0.55	0.30	0.000			1.0	18.15	19.10	0.95	0.25	0.000	0.000	0.24	0.000	0%
R	19.50	0.00	0.00	0.000	0.000	0.000	1.0	19.10	19.50	0.40	0.06	0.000	0.000	0.02	0.000	0%
Total Flow															0.591	

Measurement Details:

Start Time (MST):	14:25
End Time (MST):	15:30
Equipment:	MARSH
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Excellent
Weather:	Partly cloudy, -5

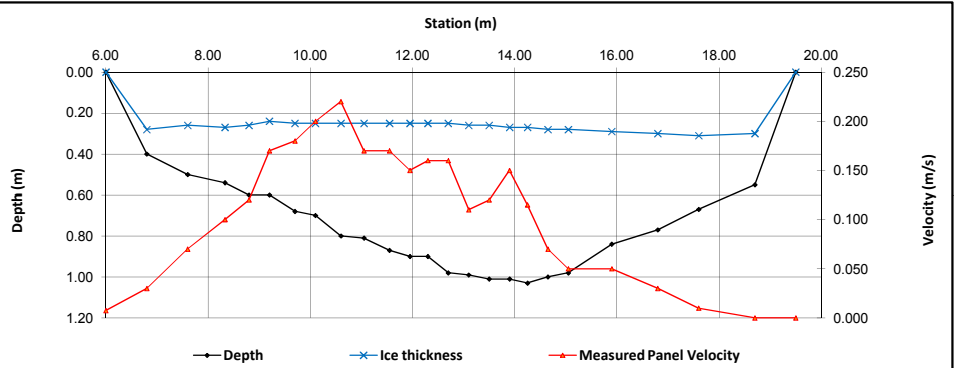
Flow characteristics:

Total Flow:	0.591	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	6.11	(m ²)
Wetted Width:	13.50	(m)
Hydraulic Depth:	0.453	(m)
Mean Velocity:	0.097	(m/s)
Froude Number:	0.046	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	WSC Brass Cap near cabin	1.518	98.672	1.478	98.672	-
Bench Mark 2:	Brass Cap away from shack	1.141	100.000	1.100	100.000	-
Top of Ice:		3.228	96.962	3.187	96.963	96.963
Water Level:		3.209	96.981	3.166	96.984	96.983
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	3-Dec-11
Data Entry Personnel:	DW	Date:	5-Dec-11
Data Check Personnel:	MY	Date:	19-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S39 - Beaver River above Syncrude WSC

UTM Location: 465542 E, 6311435 N

Site Visit Date: January 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	2.00	0.00	0.00	0.000	0.000	0.000	0.9	2.00	2.30	0.30	0.09	-0.001	0.000	0.03	0.000	0%
1	2.60	0.43	0.08	-0.002			0.9	2.30	2.80	0.50	0.35	-0.002	-0.002	0.18	0.000	0%
2	3.00	0.60	0.15	0.028			0.9	2.80	3.20	0.40	0.45	0.028	0.025	0.18	0.005	4%
3	3.40	0.66	0.09	0.035			0.9	3.20	3.60	0.40	0.57	0.035	0.032	0.23	0.007	7%
4	3.80	0.76	0.15	0.026			0.9	3.60	4.00	0.40	0.61	0.026	0.023	0.24	0.006	6%
5	4.20	0.90	0.15	0.041			0.9	4.00	4.45	0.45	0.75	0.041	0.037	0.34	0.012	12%
6	4.70	0.88	0.19	0.027			0.9	4.45	4.90	0.45	0.69	0.027	0.024	0.31	0.008	7%
7	5.10	0.96	0.19	0.033			0.9	4.90	5.40	0.50	0.77	0.033	0.030	0.39	0.011	11%
8	5.70	1.05	0.20		0.028	0.022	1.0	5.40	5.90	0.50	0.85	0.025	0.025	0.43	0.011	10%
9	6.10	1.10	0.17		0.019	0.014	1.0	5.90	6.30	0.40	0.93	0.017	0.017	0.37	0.006	6%
10	6.50	1.30	0.21		0.028	0.002	1.0	6.30	6.70	0.40	1.09	0.015	0.015	0.44	0.007	6%
11	6.90	1.30	0.20		0.001	0.012	1.0	6.70	7.10	0.40	1.10	0.007	0.007	0.44	0.003	3%
12	7.30	1.38	0.19		0.023	0.019	1.0	7.10	7.45	0.35	1.19	0.021	0.021	0.42	0.009	9%
13	7.60	1.40	0.15		0.020	0.008	1.0	7.45	7.80	0.35	1.25	0.014	0.014	0.44	0.006	6%
14	8.00	1.32	0.12		0.023	0.005	1.0	7.80	8.55	0.75	1.20	0.014	0.014	0.90	0.013	12%
Left	9.10	0.00	0.00	0.000	0.000	0.000	1.0	8.55	9.10	0.55	0.30	0.004	0.004	0.17	0.001	1%
Total Flow															0.103	

Measurement Details:

Start Time (MST):	15:00
End Time (MST):	16:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear, -26°C

Flow characteristics:

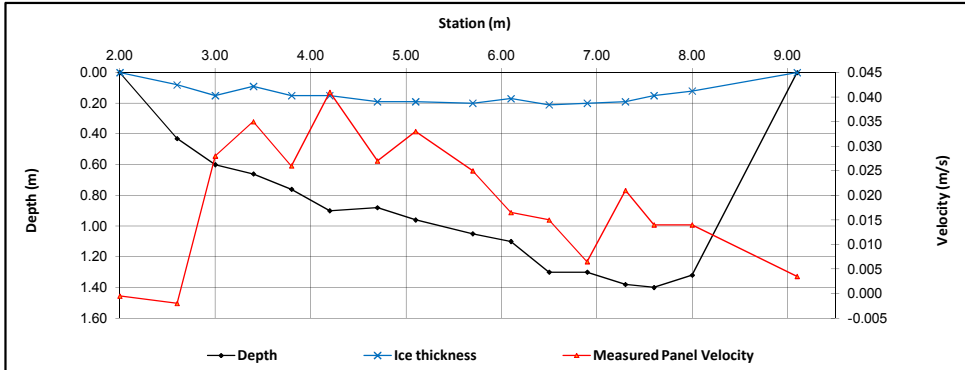
Total Flow:	0.103	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	5.48	(m ²)
Wetted Width:	7.10	(m)
Hydraulic Depth:	0.772	(m)
Mean Velocity:	0.019	(m/s)
Froude Number:	0.007	

Datalogger Details:

	Before	After
Transducer Reading:	-	-
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:

WSC Site



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Brass cap near cable way	2.201	29.696	2.150	29.696	-
Bench Mark 2:	Brass cap ~4m from cabin	1.432	30.469	1.377	30.469	-
Top of Ice:		3.735	28.162	3.681	28.165	28.164
Water Level:		3.833	28.064	3.784	28.062	28.063
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	13-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S39 - Beaver River above Syncrude WSC

UTM Location: 465542 E, 6311435 N

Site Visit Date: February 11, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	6.00	0.00	0.00	0.000	0.000	0.000	1.0	6.00	5.90	0.10	-0.08	0.000	0.000	-0.01	0.000	0%
1	5.80	0.40	0.70	0.000			1.0	5.90	5.75	0.15	-0.30	0.000	0.000	-0.05	0.000	0%
2	5.70	0.45	0.70	0.000			1.0	5.75	5.68	0.07	-0.25	0.000	0.000	-0.02	0.000	0%
3	5.65	0.45	0.70	-0.026			0.9	5.68	5.55	0.13	-0.25	-0.026	-0.023	-0.03	0.001	1%
4	5.45	0.45	0.95	0.025			0.9	5.55	5.40	0.15	-0.50	0.025	0.023	-0.08	-0.002	-3%
5	5.35	0.45	0.95	0.021			0.9	5.40	5.30	0.10	-0.50	0.021	0.019	-0.05	-0.001	-2%
6	5.25	0.45	0.95	0.023			0.9	5.30	5.15	0.15	-0.50	0.023	0.021	-0.07	-0.002	-3%
7	5.05	0.90	0.30	0.031			0.9	5.15	5.03	0.13	0.60	0.031	0.028	0.08	0.002	4%
8	5.00	0.95	0.30	0.041			0.9	5.03	4.95	0.08	0.65	0.041	0.037	0.05	0.002	3%
9	4.90	0.95	0.30	0.030			0.9	4.95	4.83	0.13	0.65	0.030	0.027	0.08	0.002	4%
10	4.75	1.00	0.35	0.035			0.9	4.83	4.73	0.10	0.65	0.035	0.032	0.07	0.002	4%
11	4.70	1.00	0.35	0.031			0.9	4.73	4.65	0.07	0.65	0.031	0.028	0.05	0.001	3%
12	4.60	1.05	0.35		0.022	0.031	1.0	4.65	4.50	0.15	0.70	0.027	0.027	0.11	0.003	5%
13	4.40	1.10	0.40	0.025			0.9	4.50	4.38	0.13	0.70	0.025	0.023	0.09	0.002	4%
14	4.35	1.10	0.40	0.023			0.9	4.38	4.30	0.08	0.70	0.023	0.021	0.05	0.001	2%
15	4.25	1.15	0.40		0.025	0.035	1.0	4.30	4.18	0.13	0.75	0.030	0.030	0.09	0.003	5%
16	4.10	1.20	0.40		0.012	0.034	1.0	4.18	4.05	0.13	0.80	0.023	0.023	0.10	0.002	4%
17	4.00	1.25	0.40	0.022	0.035	0.035	1.0	4.05	3.95	0.10	0.85	0.029	0.029	0.08	0.002	5%
18	3.90	1.25	0.40	0.022	0.035	0.035	1.0	3.95	3.78	0.18	0.85	0.029	0.029	0.15	0.004	8%
19	3.65	1.30	0.40	0.040	0.031	0.031	1.0	3.78	3.63	0.15	0.90	0.036	0.036	0.14	0.005	9%
20	3.60	1.30	0.40		0.017	0.034	1.0	3.63	3.55	0.08	0.90	0.026	0.026	0.07	0.002	3%
21	3.50	1.30	0.40	0.026	0.040	0.040	1.0	3.55	3.43	0.13	0.90	0.033	0.033	0.11	0.004	7%
22	3.35	1.25	0.35	0.028	0.042	0.042	1.0	3.43	3.30	0.13	0.90	0.035	0.035	0.11	0.004	7%
23	3.25	1.25	0.35	0.023	0.038	0.038	1.0	3.30	3.23	0.07	0.90	0.031	0.031	0.07	0.002	4%
24	3.20	1.25	0.35	0.023	0.033	0.033	1.0	3.23	3.05	0.18	0.90	0.028	0.028	0.16	0.004	8%
25	2.90	1.20	0.70	0.055			0.9	3.05	2.70	0.35	0.50	0.055	0.050	0.18	0.009	16%
RB	2.50	0.00	0.00	0.000	0.000	0.000	1.0	2.70	2.50	0.20	0.13	0.014	0.014	0.03	0.000	1%
Total Flow														0.053		

Measurement Details:

Start Time (MST):	16:50
End Time (MST):	17:54
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Light snow, -11°C

Flow characteristics:

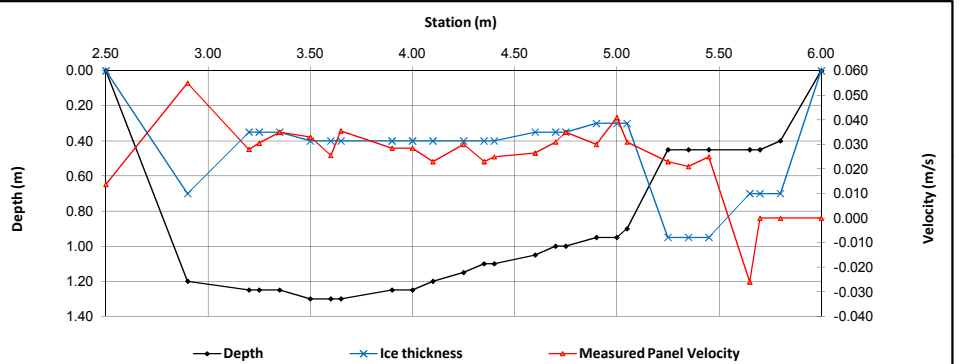
Total Flow:	0.053	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	1.54	(m ²)
Wetted Width:	3.20	(m)
Hydraulic Depth:	0.482	(m)
Mean Velocity:	0.035	(m/s)
Froude Number:	0.016	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC Site



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Brass cap near cable way	1.435	29.696	1.409	29.696	-
Bench Mark 2:	Brass cap ~4m from cabin	0.671	30.469	0.645	30.469	-
Top of Ice:		2.969	28.162	2.935	28.170	28.166
Water Level:		3.128	28.003	3.094	28.011	28.007
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	BL, GB	Trip Date:	11-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S39 - Beaver River above Syncrude WSC

UTM Location: 465542 E, 6311435 N

Site Visit Date: November 28, 2011



Flow Measurement:

Measured Data							Calculated Data										
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow	
L	5.30	0.00	0.00	0.000	0.000	0.000	1.0	5.30	5.50	0.20	0.29	-0.010	-0.010	0.06	-0.001	-1%	
1	5.70	1.35	0.20		-0.080		1.0	5.50	5.90	0.40	1.15	-0.040	-0.040	0.46	-0.018	-18%	
2	6.10	1.50	0.20	-0.028			0.9	5.90	6.28	0.38	1.30	-0.028	-0.025	0.49	-0.012	-12%	
3	6.45	1.64	0.20		0.013	-0.005	1.0	6.28	6.58	0.30	1.44	0.004	0.004	0.43	0.002	2%	
4	6.70	1.71	0.19		0.013	-0.001	1.0	6.58	6.90	0.33	1.52	0.006	0.006	0.49	0.003	3%	
5	7.10	1.72	0.19	-0.003			0.9	6.90	7.23	0.32	1.53	-0.003	-0.003	0.50	-0.001	-1%	
6	7.35	1.75	0.19	-0.054			0.9	7.23	7.53	0.30	1.56	-0.054	-0.049	0.47	-0.023	-22%	
7	7.70	1.70	0.15				1.0	7.53	7.85	0.32	1.55	0.000	0.000	0.50	0.000	0%	
8	8.00	1.65	0.15	0.055			0.9	7.85	8.18	0.33	1.50	0.055	0.050	0.49	0.024	23%	
9	8.35	1.50	0.17	0.180			0.9	8.18	8.53	0.35	1.33	0.180	0.162	0.47	0.075	72%	
10	8.70	1.20	0.15	0.176			0.9	8.53	8.90	0.38	1.05	0.176	0.158	0.39	0.062	59%	
11	9.10	1.00	0.15	-0.010			0.9	8.90	9.25	0.35	0.85	-0.010	-0.009	0.30	-0.003	-3%	
12	9.40	0.80	0.15				1.0	9.25	9.60	0.35	0.65	0.000	0.000	0.23	0.000	0%	
13	9.80	0.60	0.17	-0.030			0.9	9.60	10.00	0.40	0.43	-0.030	-0.027	0.17	-0.005	-4%	
14	10.20	0.40	0.16	0.005			0.9	10.00	10.95	0.95	0.24	0.005	0.005	0.23	0.001	1%	
RB	11.70	0.00	0.00	0.000	0.000	0.000	1.0	10.95	11.70	0.75	0.06	0.001	0.001	0.05	0.000	0%	
Total Flow															0.105		

Measurement Details:

Start Time (MST):	15:05
End Time (MST):	16:10
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Clear, Clam, -7

Flow characteristics:

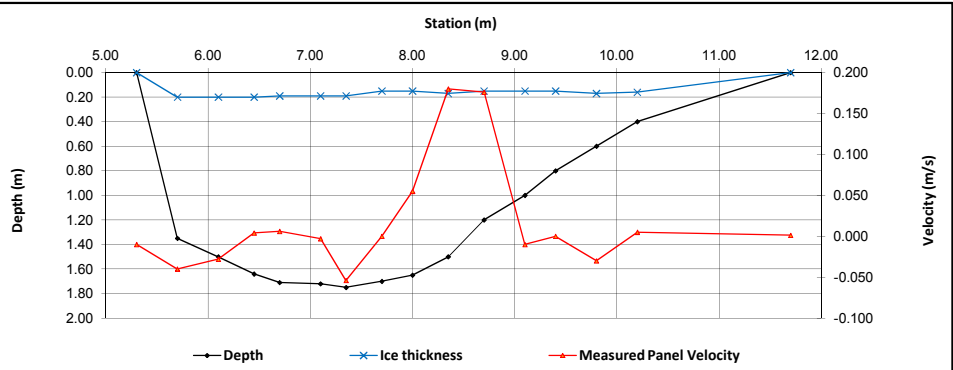
Total Flow:	0.105	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	5.72	(m ²)
Wetted Width:	6.40	(m)
Hydraulic Depth:	0.893	(m)
Mean Velocity:	0.018	(m/s)
Froude Number:	0.006	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC Site



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Brass cap near cable way	1.958	29.696	1.948	29.696	-
Bench Mark 2:	Brass cap ~4m from cabin	1.189	30.469	1.180	30.469	-
Top of Ice:		3.182	28.472	3.172	28.472	28.472
Water Level:		3.190	28.464	3.181	28.463	28.464
Transducer Reading:						
Other:						

General Notes:

River is fairly slushy.

Field Personnel:	SM, DB	Trip Date:	28-Nov-11
Data Entry Personnel:	DW	Date:	3-Jan-12
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge

UTM Location: 445023 E, 6314256 N

Site Visit Date: January 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	5.00	0.00	0.00	0.000	0.000	0.000	0.9	5.00	6.75	1.75	0.05	0.010	0.009	0.08	0.001	0%
1	8.50	0.62	0.44	0.041			0.9	6.75	8.65	1.90	0.18	0.041	0.037	0.34	0.013	2%
2	8.80	0.66	0.45	0.306			0.9	8.65	9.05	0.40	0.21	0.306	0.275	0.08	0.023	4%
3	9.30	0.71	0.45	-0.057			0.9	9.05	9.75	0.70	0.26	-0.057	-0.051	0.18	-0.009	-2%
4	10.20	0.68	0.45	0.315			0.9	9.75	10.50	0.75	0.23	0.315	0.284	0.17	0.049	9%
5	10.80	0.70	0.40	0.064			0.9	10.50	11.15	0.65	0.30	0.064	0.058	0.20	0.011	2%
6	11.50	0.69	0.45	0.100			0.9	11.15	11.70	0.55	0.24	0.100	0.090	0.13	0.012	2%
7	11.90	0.76	0.42	0.149			0.9	11.70	12.20	0.50	0.34	0.149	0.134	0.17	0.023	4%
8	12.50	0.87	0.43	0.106			0.9	12.20	12.70	0.50	0.44	0.106	0.095	0.22	0.021	4%
9	12.90	0.91	0.33	0.197			0.9	12.70	13.10	0.40	0.58	0.197	0.177	0.23	0.041	8%
10	13.30	0.91	0.43	0.183			0.9	13.10	13.65	0.55	0.48	0.183	0.165	0.26	0.043	8%
11	14.00	0.93	0.43	-0.047			0.9	13.65	14.40	0.75	0.50	-0.047	-0.042	0.38	-0.016	-3%
12	14.80	0.90	0.43	0.238			0.9	14.40	15.30	0.90	0.47	0.238	0.214	0.42	0.091	17%
13	15.80	0.90	0.43	-0.027			0.9	15.30	16.30	1.00	0.47	-0.027	-0.024	0.47	-0.011	-2%
14	16.80	0.90	0.39	0.050			0.9	16.30	17.25	0.95	0.51	0.050	0.045	0.48	0.022	4%
15	17.70	0.90	0.39	0.053			0.9	17.25	18.15	0.90	0.51	0.053	0.048	0.46	0.022	4%
16	18.60	0.95	0.43	0.248			0.9	18.15	19.15	1.00	0.52	0.248	0.223	0.52	0.116	21%
17	19.70	0.79	0.43	0.189			0.9	19.15	20.25	1.10	0.36	0.189	0.170	0.40	0.067	12%
18	20.80	0.86	0.42	0.044			0.9	20.25	21.30	1.05	0.44	0.044	0.040	0.46	0.018	3%
19	21.80	0.78	0.37	0.019			0.9	21.30	22.50	1.20	0.41	0.019	0.017	0.49	0.008	2%
20	23.20	0.58	0.35	-0.005			0.9	22.50	23.70	1.20	0.23	-0.005	-0.005	0.28	-0.001	0%
21	24.20	0.48	0.35	0.000			0.9	23.70	25.60	1.90	0.13	0.000	0.000	0.25	0.000	0%
Left	27.00	0.00	0.00	0.000	0.000	0.000	0.9	25.60	27.00	1.40	0.03	0.000	0.000	0.05	0.000	0%
Total Flow															0.543	

Measurement Details:

Start Time (MST):	11:50
End Time (MST):	14:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	-

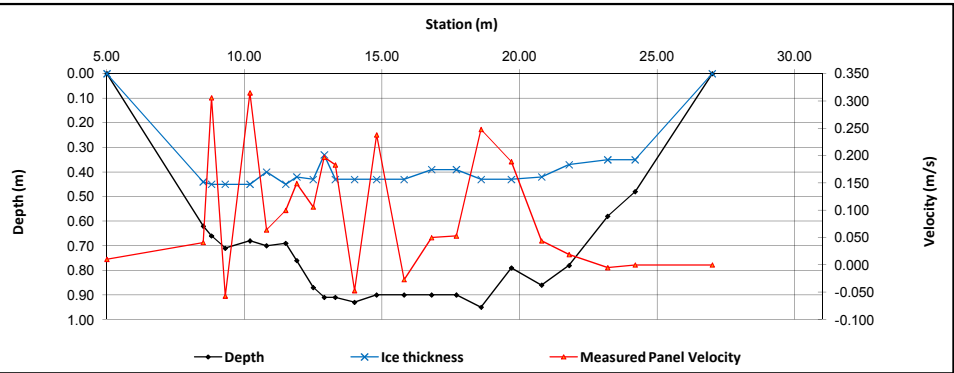
Flow characteristics:

Total Flow:	0.543	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	6.72	(m ²)
Wetted Width:	22.00	(m)
Hydraulic Depth:	0.306	(m)
Mean Velocity:	0.081	(m/s)
Froude Number:	0.047	

Datalogger Details:

	Before	After
Transducer Reading:		0.761
Battery (Main):	15.2	
Battery (Aux):	-	
Datalogger Clock:	11:55	
Laptop Clock:	11:22	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.169	100.000	1.170	100.000	-
Bench Mark 2:	T-post on second bench	3.267	97.893	3.265	97.893	-
Top of Ice:		4.852	96.317	4.851	96.319	96.318
Water Level:		4.871	96.298	4.870	96.300	96.299
Transducer Reading:		0.761	95.537	0.761	95.539	95.538
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	13-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge
 UTM Location: 445023 E, 6314256 N

Site Visit Date: February 11, 2011



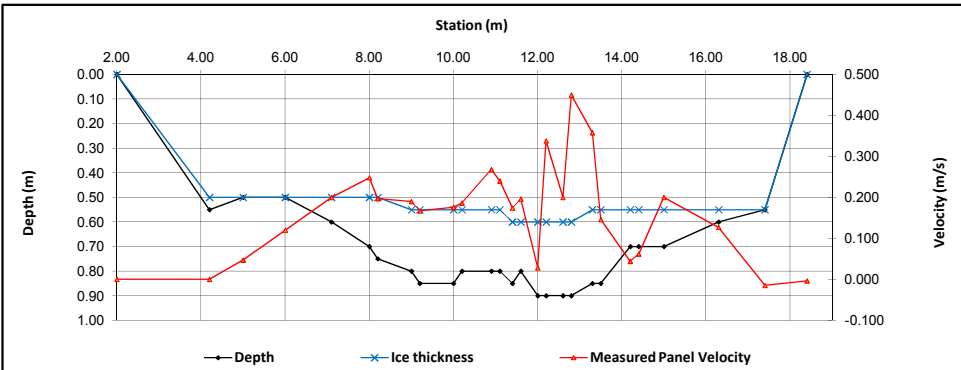
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	18.40	0.00	0.00	0.000	0.000	0.000	0.9	18.40	17.90	0.50	0.00	-0.004	-0.003	0.00	0.000	0%
1	17.40	0.55	0.55	-0.015			0.9	17.90	16.85	1.05	0.00	-0.015	-0.014	0.00	0.000	0%
2	16.30	0.60	0.55	0.127			0.9	16.85	15.65	1.20	0.05	0.127	0.114	0.06	0.007	2%
3	15.00	0.70	0.55	0.200			0.9	15.65	14.70	0.95	0.15	0.200	0.180	0.14	0.026	7%
4	14.40	0.70	0.55	0.062			0.9	14.70	14.30	0.40	0.15	0.062	0.056	0.06	0.003	1%
5	14.20	0.70	0.55	0.044			0.9	14.30	13.85	0.45	0.15	0.044	0.040	0.07	0.003	1%
6	13.50	0.85	0.55	0.146			0.9	13.85	13.40	0.45	0.30	0.146	0.131	0.14	0.018	5%
7	13.30	0.85	0.55	0.358			0.9	13.40	13.05	0.35	0.30	0.358	0.322	0.11	0.034	9%
8	12.80	0.90	0.60	0.450			0.9	13.05	12.70	0.35	0.30	0.450	0.405	0.11	0.043	11%
9	12.60	0.90	0.60	0.200			0.9	12.70	12.40	0.30	0.30	0.200	0.180	0.09	0.016	4%
10	12.20	0.90	0.60	0.338			0.9	12.40	12.10	0.30	0.30	0.338	0.304	0.09	0.027	7%
11	12.00	0.90	0.60	0.028			0.9	12.10	11.80	0.30	0.30	0.028	0.025	0.09	0.002	1%
12	11.60	0.80	0.60	0.196			0.9	11.80	11.50	0.30	0.20	0.196	0.176	0.06	0.011	3%
13	11.40	0.85	0.60	0.174			0.9	11.50	11.25	0.25	0.25	0.174	0.157	0.06	0.010	3%
14	11.10	0.80	0.55	0.240			0.9	11.25	11.00	0.25	0.25	0.240	0.216	0.06	0.014	3%
15	10.90	0.80	0.55	0.268			0.9	11.00	10.55	0.45	0.25	0.268	0.241	0.11	0.027	7%
16	10.20	0.80	0.55	0.186			0.9	10.55	10.10	0.45	0.25	0.186	0.167	0.11	0.019	5%
17	10.00	0.85	0.55	0.176			0.9	10.10	9.60	0.50	0.30	0.176	0.158	0.15	0.024	6%
18	9.20	0.85	0.55	0.167			0.9	9.60	9.10	0.50	0.30	0.167	0.150	0.15	0.023	6%
19	9.00	0.80	0.55	0.190			0.9	9.10	8.60	0.50	0.25	0.190	0.171	0.13	0.021	5%
20	8.20	0.75	0.50	0.197			0.9	8.60	8.10	0.50	0.25	0.197	0.177	0.13	0.022	6%
21	8.00	0.70	0.50	0.248			0.9	8.10	7.55	0.55	0.20	0.248	0.223	0.11	0.025	6%
22	7.10	0.60	0.50	0.200			0.9	7.55	6.55	1.00	0.10	0.200	0.180	0.10	0.018	5%
23	6.00	0.50	0.50	0.120			0.9	6.55	5.50	1.05	0.00	0.120	0.108	0.00	0.000	0%
24	5.00	0.50	0.50	0.047			0.9	5.50	4.60	0.90	0.00	0.047	0.042	0.00	0.000	0%
25	4.20	0.55	0.50	0.000			0.9	4.60	3.10	1.50	0.05	0.000	0.000	0.08	0.000	0%
Left	2.00	0.00	0.00	0.000	0.000	0.000	0.9	3.10	2.00	1.10	0.01	0.000	0.000	0.01	0.000	0%
Total Flow														0.391		

Measurement Details:	
Start Time (MST):	14:05
End Time (MST):	15:57
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Light snow

Flow characteristics:		
Total Flow:	0.391	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	2.20	(m ²)
Wetted Width:	14.80	(m)
Hydraulic Depth:	0.149	(m)
Mean Velocity:	0.177	(m/s)
Froude Number:	0.147	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	14.9	
Battery (Aux):	-	
Datalogger Clock:	14:10	
Laptop Clock:	14:07	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	Good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.530	100.000	1.515	100.000	-
Bench Mark 2:	T-post on second bench	3.611	97.893	3.601	97.893	-
Top of Ice:		5.229	96.301	5.215	96.300	96.301
Water Level:		5.233	96.297	5.219	96.296	96.297
Transducer Reading:		0.714	95.583	0.714	95.582	95.583
Other:						

General Notes:

Field Personnel:	BL, GB	Trip Date:	11-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge
 UTM Location: 445023 E, 6314256 N

Site Visit Date: March 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	30.00	0.00	0.00	0.000	0.000	0.000	0.9	30.00	28.15	1.85	0.01	0.016	0.014	0.01	0.000	0%
1	26.30	0.65	0.63	0.064			0.9	28.15	25.90	2.25	0.02	0.064	0.058	0.05	0.003	1%
2	25.50	0.77	0.60	0.082			0.9	25.90	25.00	0.90	0.17	0.082	0.074	0.15	0.011	3%
3	24.50	0.78	0.60	0.147			0.9	25.00	24.05	0.95	0.18	0.147	0.132	0.17	0.023	6%
4	23.60	0.87	0.67	0.151			0.9	24.05	23.20	0.85	0.20	0.151	0.136	0.17	0.023	6%
5	22.80	0.92	0.70	0.057			0.9	23.20	22.40	0.80	0.22	0.057	0.051	0.18	0.009	2%
6	22.00	0.90	0.70	0.076			0.9	22.40	21.50	0.90	0.20	0.076	0.068	0.18	0.012	3%
7	21.00	0.97	0.68	0.288			0.9	21.50	20.55	0.95	0.29	0.288	0.259	0.28	0.071	19%
8	20.10	0.97	0.65	0.484			0.9	20.55	19.60	0.95	0.32	0.484	0.436	0.30	0.132	36%
9	19.10	0.81	0.62	0.408			0.9	19.60	18.65	0.95	0.19	0.408	0.367	0.18	0.066	18%
10	18.20	0.80	0.68	0.161			0.9	18.65	17.75	0.90	0.12	0.161	0.145	0.11	0.016	4%
11	17.30	0.72	0.61	0.000			0.9	17.75	16.80	0.95	0.11	0.000	0.000	0.10	0.000	0%
12	16.30	0.00	0.00	0.000			0.9	16.80	15.60	1.20	0.03	0.000	0.000	0.03	0.000	0%
13	14.90	0.55	0.55	0.000			0.9	15.60	14.30	1.30	0.00	0.000	0.000	0.00	0.000	0%
14	13.70	0.00	0.00	0.000			0.9	14.30	13.15	1.15	0.00	0.000	0.000	0.00	0.000	0%
15	12.60	0.00	0.00	0.000			0.9	13.15	11.85	1.30	0.00	0.000	0.000	0.00	0.000	0%
16	11.10	0.57	0.53	-0.002			0.9	11.85	10.50	1.35	0.04	-0.002	-0.002	0.05	0.000	0%
Left	9.90	0.00	0.00	0.000	0.000	0.000	0.9	10.50	9.90	0.60	0.01	-0.001	0.000	0.01	0.000	0%
Total Flow															0.367	

Measurement Details:

Start Time (MST):	8:00
End Time (MST):	9:25
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Sunny, -11 °C

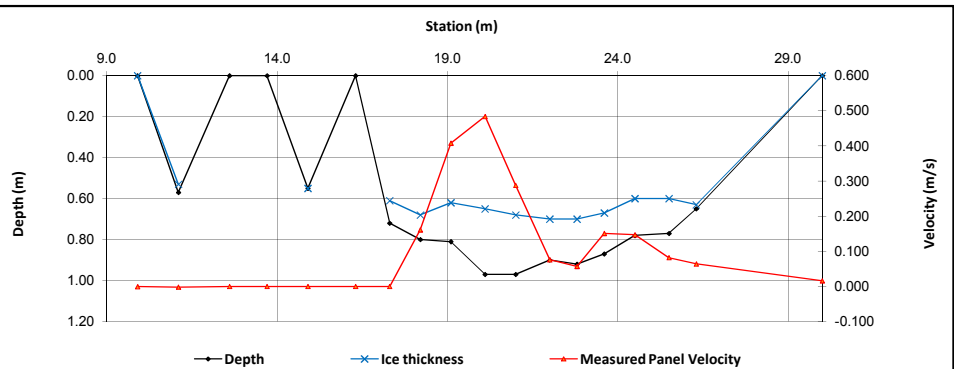
Flow characteristics:

Total Flow:	0.367	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	1.97	(m ²)
Wetted Width:	17.65	(m)
Hydraulic Depth:	0.112	(m)
Mean Velocity:	0.186	(m/s)
Froude Number:	0.178	

Datalogger Details:

	Before	After
Transducer Reading:		0.764
Battery (Main):	15.0	
Battery (Aux):	-	
Datalogger Clock:	8:24	
Laptop Clock:	8:21	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.303	100.000	1.271	100.000	-
Bench Mark 2:	T-post on second bench	3.375	97.893	3.343	97.893	-
Top of Ice:		5.011	96.292	4.974	96.297	96.295
Water Level:		4.985	96.318	4.954	96.317	96.318
Transducer Reading:		0.764	95.554	0.764	95.553	95.554
Other:						

General Notes:

Effective water depth very shallow. Signal to noise ratio very high, two velocity readings required at most holes. Holes drilled at offsets 16.3, 13.7, 12.6, and 9.90 were dry (no water).

Field Personnel:	DB, GB	Trip Date:	12-Mar-11
Data Entry Personnel:	CM	Date:	22-Mar-11
Data Check Personnel:	DB	Date:	27-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge
 UTM Location: 445023 E, 6314256 N

Site Visit Date: April 4, 2011



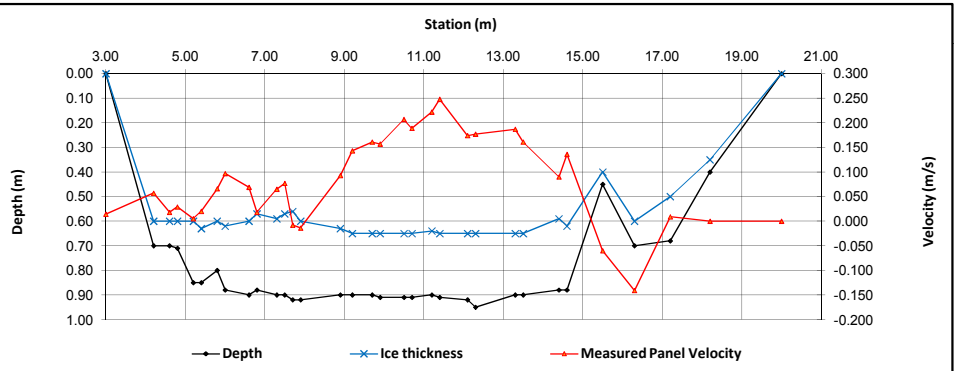
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	3.00	0.00	0.00	0.000	0.000	0.000	0.9	3.00	3.60	0.60	0.03	0.014	0.013	0.02	0.000	0%
1	4.20	0.70	0.60	0.057			0.9	3.60	4.40	0.80	0.10	0.057	0.051	0.08	0.004	1%
2	4.60	0.70	0.60	0.018			0.9	4.40	4.70	0.30	0.10	0.018	0.016	0.03	0.000	0%
3	4.80	0.71	0.60	0.029			0.9	4.70	5.00	0.30	0.11	0.029	0.026	0.03	0.001	0%
4	5.20	0.85	0.60	0.005			0.9	5.00	5.30	0.30	0.25	0.005	0.005	0.08	0.000	0%
5	5.40	0.85	0.63	0.020			0.9	5.30	5.60	0.30	0.22	0.020	0.018	0.07	0.001	0%
6	5.80	0.80	0.60	0.066			0.9	5.60	5.90	0.30	0.20	0.066	0.059	0.06	0.004	1%
7	6.00	0.88	0.62	0.097			0.9	5.90	6.30	0.40	0.26	0.097	0.087	0.10	0.009	3%
8	6.60	0.90	0.60	0.069			0.9	6.30	6.70	0.40	0.30	0.069	0.062	0.12	0.007	3%
9	6.80	0.88	0.57	0.018			0.9	6.70	7.05	0.35	0.31	0.018	0.016	0.11	0.002	1%
10	7.30	0.90	0.59	0.065			0.9	7.05	7.40	0.35	0.31	0.065	0.059	0.11	0.006	2%
11	7.50	0.90	0.57	0.077			0.9	7.40	7.60	0.20	0.33	0.077	0.069	0.07	0.005	2%
12	7.70	0.92	0.56	-0.008			0.9	7.60	7.80	0.20	0.36	-0.008	-0.007	0.07	-0.001	0%
13	7.90	0.92	0.60	-0.014			0.9	7.80	8.40	0.60	0.32	-0.014	-0.013	0.19	-0.002	-1%
14	8.90	0.90	0.63	0.093			0.9	8.40	9.05	0.65	0.27	0.093	0.084	0.18	0.015	5%
15	9.20	0.90	0.65	0.143			0.9	9.05	9.45	0.40	0.25	0.143	0.129	0.10	0.013	5%
16	9.70	0.90	0.65	0.161			0.9	9.45	9.80	0.35	0.25	0.161	0.145	0.09	0.013	4%
17	9.90	0.91	0.65	0.157			0.9	9.80	10.20	0.40	0.26	0.157	0.141	0.10	0.015	5%
18	10.50	0.91	0.65	0.207			0.9	10.20	10.60	0.40	0.26	0.207	0.186	0.10	0.019	7%
19	10.70	0.91	0.65	0.189			0.9	10.60	10.95	0.35	0.26	0.189	0.170	0.09	0.015	5%
20	11.20	0.90	0.64	0.222			0.9	10.95	11.30	0.35	0.26	0.222	0.200	0.09	0.018	6%
21	11.40	0.91	0.65	0.248			0.9	11.30	11.75	0.45	0.26	0.248	0.223	0.12	0.026	9%
22	12.10	0.92	0.65	0.174			0.9	11.75	12.20	0.45	0.27	0.174	0.157	0.12	0.019	7%
23	12.30	0.95	0.65	0.177			0.9	12.20	12.80	0.60	0.30	0.177	0.159	0.18	0.029	10%
24	13.30	0.90	0.65	0.187			0.9	12.80	13.40	0.60	0.25	0.187	0.168	0.15	0.025	9%
25	13.50	0.90	0.65	0.161			0.9	13.40	13.95	0.55	0.25	0.161	0.145	0.14	0.020	7%
26	14.40	0.88	0.59	0.090			0.9	13.95	14.50	0.55	0.29	0.090	0.081	0.16	0.013	5%
27	14.60	0.88	0.62	0.136			0.9	14.50	15.05	0.55	0.26	0.136	0.122	0.14	0.018	6%
28	15.50	0.45	0.40	-0.060			0.9	15.05	15.90	0.85	0.05	-0.060	-0.054	0.04	-0.002	-1%
29	16.30	0.70	0.60	-0.141			0.9	15.90	16.75	0.85	0.10	-0.141	-0.127	0.09	-0.011	-4%
30	17.20	0.68	0.50	0.009			0.9	16.75	17.70	0.95	0.18	0.009	0.008	0.17	0.001	0%
31	18.20	0.40	0.35	0.000			0.9	17.70	19.10	1.40	0.05	0.000	0.000	0.07	0.000	0%
Right	20.00	0.00	0.00	0.000	0.000	0.000	0.9	19.10	20.00	0.90	0.01	0.000	0.000	0.01	0.000	0%
Total Flow															0.283	

Measurement Details:	
Start Time (MST):	14:45
End Time (MST):	16:20
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Cloudy, 7°C

Flow characteristics:		
Total Flow:	0.283	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.27	(m ²)
Wetted Width:	17.00	(m)
Hydraulic Depth:	0.192	(m)
Mean Velocity:	0.086	(m/s)
Froude Number:	0.063	

Datalogger Details:		
Transducer Reading:	Before	After
		0.792
Battery (Main):	14.3	
Battery (Aux):	-	
Datalogger Clock:	14:08	
Laptop Clock:	14:05	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 Rain guage installed, before and after = 0mm



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.305	100.000	1.292	100.000	-
Bench Mark 2:	T-post on second bench	3.380	97.893	3.367	97.893	-
Top of Ice:		4.928	96.377	4.910	96.382	96.380
Water Level:		4.958	96.347	4.945	96.347	96.347
Transducer Reading:		0.792	95.555	0.792	95.555	95.555
Other:						

General Notes:

Data affected by slush

Field Personnel:	JO, BL	Trip Date:	4-Apr-11
Data Entry Personnel:	CM	Date:	6-Apr-11
Data Check Personnel:	DB	Date:	8-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge

UTM Location: 445023 E, 6314256 N

Site Visit Date: April 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	36.00	0.00		0.000	0.000	0.000	1.0	36.00	35.50	0.50	0.11	0.105	0.105	0.05	0.006	0%
1	35.00	0.42		0.421			1.0	35.50	34.25	1.25	0.42	0.421	0.421	0.53	0.221	3%
2	33.50	1.24			0.487	0.362	1.0	34.25	32.75	1.50	1.24	0.425	0.425	1.86	0.790	10%
3	32.00	1.24			0.175	0.160	1.0	32.75	31.25	1.50	1.24	0.168	0.168	1.86	0.312	4%
4	30.50	1.26			0.135	0.162	1.0	31.25	29.75	1.50	1.26	0.149	0.149	1.89	0.281	4%
5	29.00	1.18			0.044	0.094	1.0	29.75	28.25	1.50	1.18	0.069	0.069	1.77	0.122	2%
6	27.50	1.24			0.104	0.056	1.0	28.25	26.75	1.50	1.24	0.080	0.080	1.86	0.149	2%
7	26.00	1.38			0.099	0.086	1.0	26.75	25.25	1.50	1.38	0.093	0.093	2.07	0.191	2%
8	24.50	1.40			0.192	0.123	1.0	25.25	23.75	1.50	1.40	0.158	0.158	2.10	0.331	4%
9	23.00	0.78			0.571	0.541	1.0	23.75	22.25	1.50	0.78	0.556	0.556	1.17	0.651	8%
10	21.50	0.76			0.338	0.595	1.0	22.25	20.75	1.50	0.76	0.467	0.467	1.14	0.532	7%
11	20.00	0.68		0.442			1.0	20.75	19.25	1.50	0.68	0.442	0.442	1.02	0.451	6%
12	18.50	0.56		0.478			1.0	19.25	17.75	1.50	0.56	0.478	0.478	0.84	0.402	5%
13	17.00	0.54		0.437			1.0	17.75	16.25	1.50	0.54	0.437	0.437	0.81	0.354	5%
14	15.50	0.40		0.520			1.0	16.25	14.75	1.50	0.40	0.520	0.520	0.60	0.312	4%
15	14.00	0.40		0.642			1.0	14.75	13.25	1.50	0.40	0.642	0.642	0.60	0.385	5%
16	12.50	0.48		0.541			1.0	13.25	11.75	1.50	0.48	0.541	0.541	0.72	0.390	5%
17	11.00	0.42		0.731			1.0	11.75	10.25	1.50	0.42	0.731	0.731	0.63	0.461	6%
18	9.50	0.34		0.736			1.0	10.25	8.75	1.50	0.34	0.736	0.736	0.51	0.375	5%
19	8.00	0.36		0.349			1.0	8.75	7.25	1.50	0.36	0.349	0.349	0.54	0.188	2%
20	6.50	0.64		0.061			1.0	7.25	5.75	1.50	0.64	0.061	0.061	0.96	0.059	1%
21	5.00	0.58		0.538			1.0	5.75	4.25	1.50	0.58	0.538	0.538	0.87	0.468	6%
22	3.50	0.54		0.358			1.0	4.25	3.00	1.25	0.54	0.358	0.358	0.68	0.242	3%
23	2.50	0.14		0.002			1.0	3.00	2.25	0.75	0.14	0.002	0.002	0.11	0.000	0%
Left	2.00	0.00		0.000	0.000	0.000	1.0	2.25	2.00	0.25	0.04	0.001	0.001	0.01	0.000	0%
Total Flow															7.670	

Measurement Details:

Start Time (MST):	15:45
End Time (MST):	17:00
Equipment:	ADV
Method:	Fishcat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Partly cloudy, -5°C

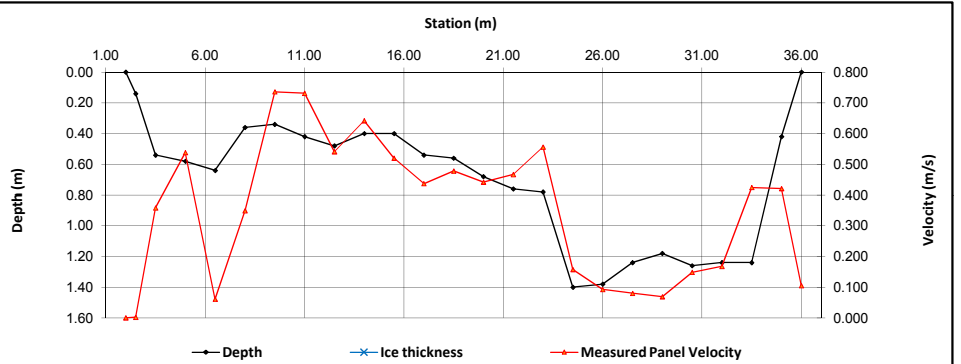
Flow characteristics:

Total Flow:	7.670	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	25.19	(m ²)
Wetted Width:	33.25	(m)
Hydraulic Depth:	0.757	(m)
Mean Velocity:	0.305	(m/s)
Froude Number:	0.112	

Datalogger Details:

	Before	After
Transducer Reading:		1.159
Battery (Main):	14.4	
Battery (Aux):	-	
Datalogger Clock:	15:11	
Laptop Clock:	15:08	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.345	100.000	1.315	100.000	-
Bench Mark 2:	T-post on second bench	3.300	97.893	3.388	97.893	-
Top of Ice:						
Water Level:		4.608	96.737	4.580	96.735	96.736
Transducer Reading:		1.159	95.578	1.159	95.576	95.577
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	18-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge
 UTM Location: 445023 E, 6314256 N

Site Visit Date: June 14, 2011



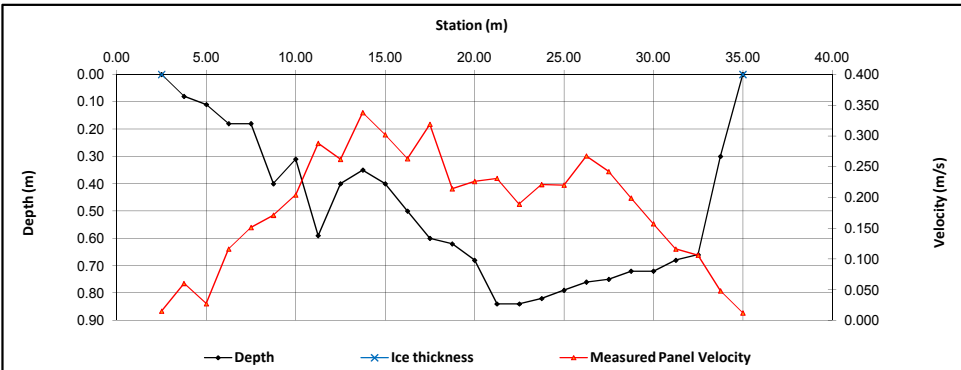
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
TR	35.00	0.00	0.00	0.000	0.000	0.000	1.0	35.00	34.38	0.63	0.08	0.012	0.012	0.05	0.001	0%
1	33.75	0.30		0.048			1.0	34.38	33.13	1.25	0.30	0.048	0.048	0.38	0.018	1%
2	32.50	0.66		0.106			1.0	33.13	31.88	1.25	0.66	0.106	0.106	0.83	0.087	2%
3	31.25	0.68		0.116			1.0	31.88	30.63	1.25	0.68	0.116	0.116	0.85	0.099	3%
4	30.00	0.72		0.157			1.0	30.63	29.38	1.25	0.72	0.157	0.157	0.90	0.141	4%
5	28.75	0.72		0.199			1.0	29.38	28.13	1.25	0.72	0.199	0.199	0.90	0.179	5%
6	27.50	0.75			0.188	0.296	1.0	28.13	26.88	1.25	0.75	0.242	0.242	0.94	0.227	6%
7	26.25	0.76			0.221	0.314	1.0	26.88	25.63	1.25	0.76	0.268	0.268	0.95	0.254	7%
8	25.00	0.79			0.179	0.261	1.0	25.63	24.38	1.25	0.79	0.220	0.220	0.99	0.217	6%
9	23.75	0.82			0.185	0.257	1.0	24.38	23.13	1.25	0.82	0.221	0.221	1.03	0.227	6%
10	22.50	0.84			0.202	0.176	1.0	23.13	21.88	1.25	0.84	0.189	0.189	1.05	0.198	6%
11	21.25	0.84			0.189	0.273	1.0	21.88	20.63	1.25	0.84	0.231	0.231	1.05	0.243	7%
12	20.00	0.68		0.226			1.0	20.63	19.38	1.25	0.68	0.226	0.226	0.85	0.192	5%
13	18.75	0.62		0.214			1.0	19.38	18.13	1.25	0.62	0.214	0.214	0.78	0.166	5%
14	17.50	0.60		0.319			1.0	18.13	16.88	1.25	0.60	0.319	0.319	0.75	0.239	7%
15	16.25	0.50		0.263			1.0	16.88	15.63	1.25	0.50	0.263	0.263	0.63	0.164	5%
16	15.00	0.40		0.302			1.0	15.63	14.38	1.25	0.40	0.302	0.302	0.50	0.151	4%
17	13.75	0.35		0.338			1.0	14.38	13.13	1.25	0.35	0.338	0.338	0.44	0.148	4%
18	12.50	0.40		0.262			1.0	13.13	11.88	1.25	0.40	0.262	0.262	0.50	0.131	4%
19	11.25	0.59		0.288			1.0	11.88	10.63	1.25	0.59	0.288	0.288	0.74	0.212	6%
20	10.00	0.31		0.204			1.0	10.63	9.38	1.25	0.31	0.204	0.204	0.39	0.079	2%
21	8.75	0.40		0.171			1.0	9.38	8.13	1.25	0.40	0.171	0.171	0.50	0.086	2%
22	7.50	0.18		0.151			1.0	8.13	6.88	1.25	0.18	0.151	0.151	0.23	0.034	1%
23	6.25	0.18		0.116			1.0	6.88	5.63	1.25	0.18	0.116	0.116	0.23	0.026	1%
24	5.00	0.11		0.027			1.0	5.63	4.38	1.25	0.11	0.027	0.027	0.14	0.004	0%
25	3.75	0.08		0.060			1.0	4.38	3.13	1.25	0.08	0.060	0.060	0.10	0.006	0%
TL	2.50	0.00	0.00	0.000	0.000	0.000	1.0	3.13	2.50	0.63	0.08	0.015	0.015	0.05	0.001	0%
Total Flow														3.530		

Measurement Details:	
Start Time (MST):	11:30
End Time (MST):	13:30:00 PM
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Smoke, 21 deg C

Flow characteristics:		
Total Flow:	3.530	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	16.70	(m ²)
Wetted Width:	31.25	(m)
Hydraulic Depth:	0.534	(m)
Mean Velocity:	0.211	(m/s)
Froude Number:	0.092	

Datalogger Details:	Before	After
Transducer Reading:		0.698
Battery (Main):	13.9	
Battery (Aux):	-	
Datalogger Clock:	11:06	
Laptop Clock:	11:03	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	19.0	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 OS Updated to v 22 @ 12:15



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.175	100.000	1.166	100.000	-
Bench Mark 2:	T-post on second bench		97.893		97.893	-
Top of Ice:						
Water Level:		4.918	96.257	4.912	96.254	96.256
Transducer Reading:		0.698	95.559	0.698	95.556	95.558
Other:	T-post next to pipe	1.301		1.292		

General Notes:

Field Personnel:	JO, SM	Trip Date:	14-Jun-11
Data Entry Personnel:	JO	Date:	24-Jun-11
Data Check Personnel:	SG & DB	Date:	9/1/2011 & 27-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge

UTM Location: 445023 E, 6314256 N

Site Visit Date: August 11, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	37.00	0.00	0.00	0.000	0.000	0.000	1.0	37.00	36.00	1.00	0.13	0.108	0.108	0.13	0.013	0%
1	35.00	0.50		0.431			1.0	36.00	34.25	1.75	0.50	0.431	0.431	0.88	0.377	2%
2	33.50	0.52		0.510			1.0	34.25	32.75	1.50	0.52	0.510	0.510	0.78	0.398	3%
3	32.00	0.60		0.539			1.0	32.75	31.25	1.50	0.60	0.539	0.539	0.90	0.485	3%
4	30.50	0.72		0.582			1.0	31.25	29.75	1.50	0.72	0.582	0.582	1.08	0.629	4%
5	29.00	0.74		0.704			1.0	29.75	28.25	1.50	0.74	0.704	0.704	1.11	0.781	5%
6	27.50	0.82			0.464	0.584	1.0	28.25	26.75	1.50	0.82	0.524	0.524	1.23	0.645	4%
7	26.00	0.82			0.419	0.510	1.0	26.75	25.25	1.50	0.82	0.465	0.465	1.23	0.571	4%
8	24.50	0.78			0.683	0.688	1.0	25.25	23.75	1.50	0.78	0.686	0.686	1.17	0.802	5%
9	23.00	0.80			0.488	0.746	1.0	23.75	22.25	1.50	0.80	0.617	0.617	1.20	0.740	5%
10	21.50	0.85			0.648	0.607	1.0	22.25	20.75	1.50	0.85	0.628	0.628	1.28	0.800	5%
11	20.00	0.90			0.565	0.629	1.0	20.75	19.25	1.50	0.90	0.597	0.597	1.35	0.806	5%
12	18.50	1.08			0.747	0.699	1.0	19.25	17.75	1.50	1.08	0.723	0.723	1.62	1.171	8%
13	17.00	1.00			0.703	0.708	1.0	17.75	16.25	1.50	1.00	0.706	0.706	1.50	1.058	7%
14	15.50	1.24			0.614	0.686	1.0	16.25	14.75	1.50	1.24	0.650	0.650	1.86	1.209	8%
15	14.00	1.25			0.501	0.667	1.0	14.75	13.25	1.50	1.25	0.584	0.584	1.88	1.095	7%
16	12.50	1.30			0.525	0.571	1.0	13.25	11.75	1.50	1.30	0.548	0.548	1.95	1.069	7%
17	11.00	1.16			0.363	0.464	1.0	11.75	10.25	1.50	1.16	0.414	0.414	1.74	0.719	5%
18	9.50	1.16			0.293	0.495	1.0	10.25	8.50	1.75	1.16	0.394	0.394	2.03	0.800	5%
19	7.50	1.17			0.245	0.347	1.0	8.50	6.50	2.00	1.17	0.296	0.296	2.34	0.693	5%
20	5.50	0.68		0.186			1.0	6.50	4.75	1.75	0.68	0.186	0.186	1.19	0.221	1%
RB	4.00	0.00	0.00	0.000	0.000	0.000	1.0	4.75	4.00	0.75	0.17	0.047	0.047	0.13	0.006	0%
Total Flow														15.089		

Measurement Details:

Start Time (MST):	15:40
End Time (MST):	17:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

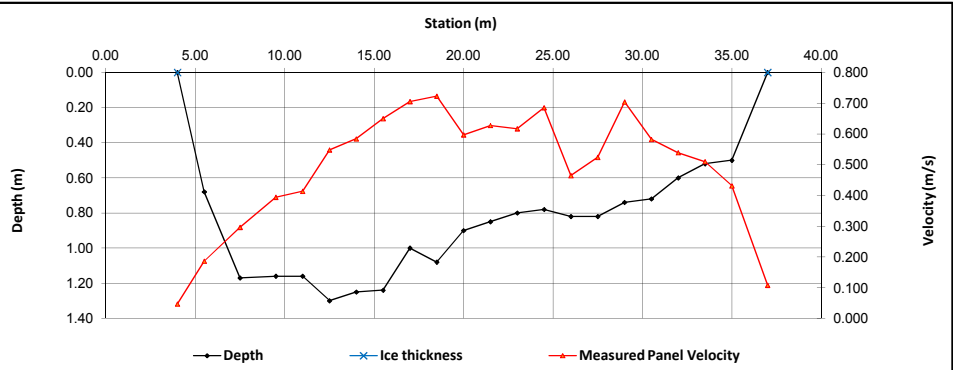
Flow characteristics:

Total Flow:	15.089	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	28.56	(m ²)
Wetted Width:	31.25	(m)
Hydraulic Depth:	0.914	(m)
Mean Velocity:	0.528	(m/s)
Froude Number:	0.177	

Datalogger Details:

	Before	After
Transducer Reading:		1.081
Battery (Main):	13.9	
Battery (Aux):	-	
Datalogger Clock:	15:45	
Laptop Clock:	15:47	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	20.5	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.072	100.000	1.056	100.000	-
Bench Mark 2:	T-post on second bench	3.142	97.893	3.128	97.893	-
Top of Ice:						
Water Level:		4.432	96.640	4.415	96.641	96.641
Transducer Reading:		1.081	95.559	1.081	95.560	95.560
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	11-Aug-11
Data Entry Personnel:	JP	Date:	29-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge

UTM Location: 445023 E, 6314256 N

Site Visit Date: September 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	2.00	0.00	0.00	0.000	0.000	0.000	1.0	2.00	2.50	0.50	0.04	0.010	0.010	0.02	0.000	0%
1	3.00	0.14		0.041			1.0	2.50	3.75	1.25	0.14	0.041	0.041	0.18	0.007	0%
2	4.50	0.10		0.090			1.0	3.75	5.25	1.50	0.10	0.090	0.090	0.15	0.014	0%
3	6.00	0.18		0.097			1.0	5.25	6.75	1.50	0.18	0.097	0.097	0.27	0.026	1%
4	7.50	0.28		0.197			1.0	6.75	8.25	1.50	0.28	0.197	0.197	0.42	0.083	3%
5	9.00	0.32		0.130			1.0	8.25	9.75	1.50	0.32	0.130	0.130	0.48	0.062	2%
6	10.50	0.46		0.298			1.0	9.75	11.25	1.50	0.46	0.298	0.298	0.69	0.206	7%
7	12.00	0.44		0.067			1.0	11.25	12.75	1.50	0.44	0.067	0.067	0.66	0.044	2%
8	13.50	0.40		0.163			1.0	12.75	14.25	1.50	0.40	0.163	0.163	0.60	0.098	3%
9	15.00	0.39		0.299			1.0	14.25	15.75	1.50	0.39	0.299	0.299	0.59	0.175	6%
10	16.50	0.53		0.115			1.0	15.75	17.25	1.50	0.53	0.115	0.115	0.80	0.091	3%
11	18.00	0.62		0.177			1.0	17.25	18.75	1.50	0.62	0.177	0.177	0.93	0.165	6%
12	19.50	0.65		0.229			1.0	18.75	20.25	1.50	0.65	0.229	0.229	0.98	0.223	8%
13	21.00	0.74		0.185			1.0	20.25	21.75	1.50	0.74	0.185	0.185	1.11	0.205	7%
14	22.50	0.84			0.174	0.230	1.0	21.75	22.88	1.13	0.84	0.202	0.202	0.95	0.191	7%
15	23.25	0.81			0.195	0.151	1.0	22.88	23.63	0.75	0.81	0.173	0.173	0.61	0.105	4%
16	24.00	0.83			0.229	0.211	1.0	23.63	24.38	0.75	0.83	0.220	0.220	0.62	0.137	5%
17	24.75	0.84			0.235	0.222	1.0	24.38	25.13	0.75	0.84	0.229	0.229	0.63	0.144	5%
18	25.50	0.82			-0.024	0.213	1.0	25.13	25.88	0.75	0.82	0.095	0.095	0.62	0.058	2%
19	26.25	0.82			0.033	0.281	1.0	25.88	26.63	0.75	0.82	0.157	0.157	0.62	0.097	3%
20	27.00	0.80			0.145	0.258	1.0	26.63	27.38	0.75	0.80	0.202	0.202	0.60	0.121	4%
21	27.75	0.74		0.192			1.0	27.38	28.13	0.75	0.74	0.192	0.192	0.56	0.107	4%
22	28.50	0.78			0.187	0.208	1.0	28.13	29.25	1.13	0.78	0.198	0.198	0.88	0.173	6%
23	30.00	0.62		0.164			1.0	29.25	30.75	1.50	0.62	0.164	0.164	0.93	0.153	5%
24	31.50	0.58		0.144			1.0	30.75	32.25	1.50	0.58	0.144	0.144	0.87	0.125	4%
25	33.00	0.36		0.002			1.0	32.25	33.50	1.25	0.36	0.002	0.002	0.45	0.001	0%
RB	34.00	0.00	0.00	0.000	0.000	0.000	1.0	30.50	34.00	3.50	0.20	0.001	0.001	0.70	0.000	0%
Total Flow														2.811		

Measurement Details:

Start Time (MST):	14:30
End Time (MST):	15:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 10°C

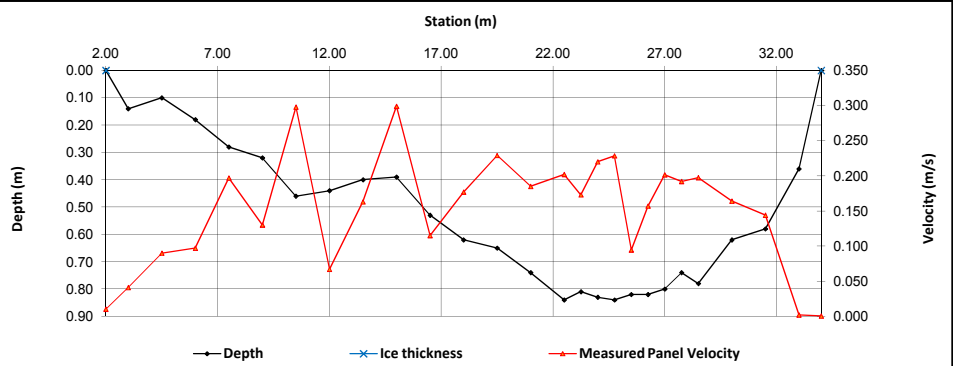
Flow characteristics:

Total Flow:	2.811	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	16.88	(m ²)
Wetted Width:	32.00	(m)
Hydraulic Depth:	0.527	(m)
Mean Velocity:	0.167	(m/s)
Froude Number:	0.073	

Datalogger Details:

	Before	After
Transducer Reading:	0.688	0.693
Battery (Main):	14.5	14.2
Battery (Aux):	-	-
Datalogger Clock:	14:19	14:57
Laptop Clock:	14:20	14:59
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	12.0	12.2
Memory Used:	-	-
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):	changed	PLS

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	0.955	100.000	0.938	100.000	-
Bench Mark 2:	T-post on second bench	3.023	97.893	3.006	97.893	-
Top of Ice:						
Water Level:		4.713	96.242	4.695	96.243	96.243
Transducer Reading:		0.688	95.554	0.688	95.555	95.555
Other:	T-post next to pipe	1.081		1.063		

General Notes:

Field Personnel:	DB, SM	Trip Date:	13-Sep-11
Data Entry Personnel:	TK	Date:	23-Sep-11
Data Check Personnel:	DB	Date:	27-Sep-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge

UTM Location: 445023 E, 6314256 N

Site Visit Date: November 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
R	2.75	0.00	0.00	0.000	0.000	0.000	1.0	2.75	3.38	0.63	0.06	0.006	0.006	0.04	0.000	0%
1	4.00	0.25		0.022			1.0	3.38	4.75	1.38	0.25	0.022	0.022	0.34	0.008	0%
2	5.50	0.47		0.088			1.0	4.75	6.25	1.50	0.47	0.088	0.088	0.71	0.062	3%
3	7.00	0.58		0.074			1.0	6.25	7.75	1.50	0.58	0.074	0.074	0.87	0.064	3%
4	8.50	0.71		0.164			1.0	7.75	9.25	1.50	0.71	0.164	0.164	1.07	0.175	9%
5	10.00	0.72		0.172			1.0	9.25	10.75	1.50	0.72	0.172	0.172	1.08	0.186	9%
6	11.50	0.76			0.114	0.180	1.0	10.75	11.88	1.13	0.76	0.147	0.147	0.86	0.126	6%
7	12.25	0.76			0.188	0.190	1.0	11.88	12.63	0.75	0.76	0.189	0.189	0.57	0.108	5%
8	13.00	0.76			0.169	0.175	1.0	12.63	13.38	0.75	0.76	0.172	0.172	0.57	0.098	5%
9	13.75	0.76			0.146	0.148	1.0	13.38	14.13	0.75	0.76	0.147	0.147	0.57	0.084	4%
10	14.50	0.77			0.125	0.138	1.0	14.13	14.88	0.75	0.77	0.132	0.132	0.58	0.076	4%
11	15.25	0.76			0.193	0.210	1.0	14.88	15.63	0.75	0.76	0.202	0.202	0.57	0.115	6%
12	16.00	0.64		0.223			1.0	15.63	16.75	1.13	0.64	0.223	0.223	0.72	0.161	8%
13	17.50	0.60		0.224			1.0	16.75	18.25	1.50	0.60	0.224	0.224	0.90	0.202	10%
14	19.00	0.54		0.202			1.0	18.25	19.75	1.50	0.54	0.202	0.202	0.81	0.164	8%
15	20.50	0.44		0.087			1.0	19.75	21.25	1.50	0.44	0.087	0.087	0.66	0.057	3%
16	22.00	0.34		0.167			1.0	21.25	22.75	1.50	0.34	0.167	0.167	0.51	0.085	4%
17	23.50	0.37		0.100			1.0	22.75	24.25	1.50	0.37	0.100	0.100	0.56	0.056	3%
18	25.00	0.35		0.121			1.0	24.25	25.75	1.50	0.35	0.121	0.121	0.53	0.064	3%
19	26.50	0.38		0.177			1.0	25.75	27.25	1.50	0.38	0.177	0.177	0.57	0.101	5%
20	28.00	0.26		0.062			1.0	27.25	28.75	1.50	0.26	0.062	0.062	0.39	0.024	1%
21	29.50	0.19		0.055			1.0	28.75	32.38	3.63	0.19	0.055	0.055	0.69	0.038	2%
L	35.25	0.00	0.00	0.000	0.000	0.000	1.0	32.38	35.25	2.88	0.05	0.014	0.014	0.14	0.002	0%

Total Flow 2.053

Measurement Details:

Start Time (MST):	14:05
End Time (MST):	15:15
Equipment:	ADV
Method:	Wading
River Condition:	low, open
Quality/Error (see reverse):	Good
Weather:	Overcast, Breezy, 0°C

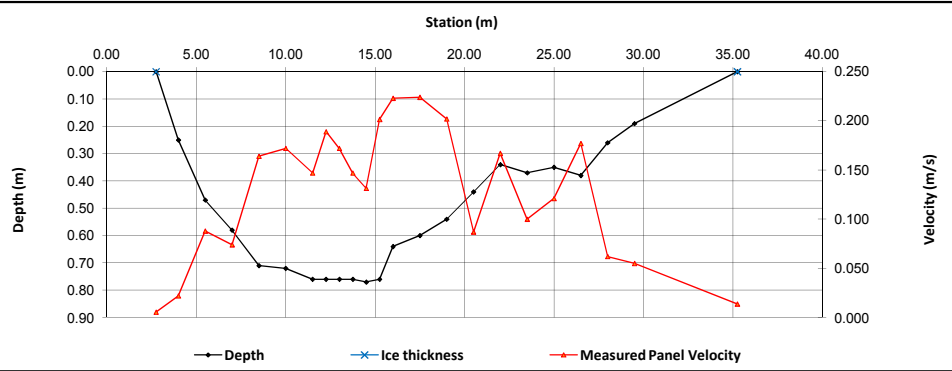
Flow characteristics:

Total Flow:	2.053	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	14.28	(m ²)
Wetted Width:	32.50	(m)
Hydraulic Depth:	0.439	(m)
Mean Velocity:	0.144	(m/s)
Froude Number:	0.069	

Datalogger Details:

	Before	After
Transducer Reading:		0.625
Battery (Main):	14.6	
Battery (Aux):	-	
Rainfall Before (mm)	0	
Rainfall After (mm)	0	
Datalogger Clock:	14:17	
Laptop Clock:	14:18	
Air Temperature °C:	-	
Air Pressure:	0.20	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.215	100.000	1.204	100.000	-
Bench Mark 2:	T-post on second bench	3.285	97.893	3.274	97.893	-
Top of Ice:						
Water Level:		5.042	96.173	5.030	96.174	96.174
Transducer Reading:		0.625	95.548	0.625	95.549	95.549
Other:						

General Notes:

BM1: 0.48m
BM2: 0.31m

Field Personnel:	GB, SM	Trip Date:	3-Nov-11
Data Entry Personnel:	DW	Date:	16-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S40 - MacKay River at Petro-Canada Bridge

UTM Location: 445023 E, 6314256 N

Site Visit Date: November 28, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
R	3.50	0.00		0.000	0.000	0.000	0.9	3.50	4.50	1.00	0.03	0.001	0.001	0.03	0.000	0%
1	5.50	0.32	0.22	0.005			0.9	4.50	6.05	1.55	0.10	0.005	0.005	0.16	0.001	0%
2	6.60	0.45	0.23	0.058			0.9	6.05	7.10	1.05	0.22	0.058	0.052	0.23	0.012	1%
3	7.60	0.58	0.24	0.148			0.9	7.10	8.10	1.00	0.34	0.148	0.133	0.34	0.045	3%
4	8.60	0.77	0.24	0.129			0.9	8.10	9.10	1.00	0.53	0.129	0.116	0.53	0.062	4%
5	9.60	0.78	0.23	0.216			0.9	9.10	10.20	1.10	0.55	0.216	0.194	0.61	0.118	8%
6	10.80	0.79	0.23	0.209			0.9	10.20	11.40	1.20	0.56	0.209	0.188	0.67	0.126	8%
7	12.00	0.85	0.24	0.230			0.9	11.40	12.55	1.15	0.61	0.230	0.207	0.70	0.145	9%
8	13.10	0.82	0.23	0.018			0.9	12.55	13.65	1.10	0.59	0.018	0.016	0.65	0.011	1%
9	14.20	0.82	0.23	0.450			0.9	13.65	14.70	1.05	0.59	0.450	0.405	0.62	0.251	16%
10	15.20	0.87	0.22	0.209			0.9	14.70	15.65	0.95	0.65	0.209	0.188	0.62	0.116	7%
11	16.10	0.88	0.22	0.407			0.9	15.65	16.60	0.95	0.66	0.407	0.366	0.63	0.230	15%
12	17.10	0.78	0.22	0.111			0.9	16.60	17.55	0.95	0.66	0.111	0.100	0.53	0.053	3%
13	18.00	0.70	0.21	0.128			0.9	17.55	18.50	0.95	0.49	0.128	0.115	0.47	0.054	3%
14	19.00	0.67	0.23	0.219			0.9	18.50	19.45	0.95	0.44	0.219	0.197	0.42	0.082	5%
15	19.90	0.76	0.23	0.363			0.9	19.45	20.35	0.90	0.53	0.363	0.327	0.48	0.156	10%
16	20.80	0.71	0.23	0.073			0.9	20.35	21.15	0.80	0.48	0.073	0.066	0.38	0.025	2%
17	21.50	0.62	0.23	0.044			0.9	21.15	22.00	0.85	0.39	0.044	0.040	0.33	0.013	1%
18	22.50	0.51	0.23	0.206			0.9	22.00	22.95	0.95	0.28	0.206	0.185	0.27	0.049	3%
19	23.40	0.37	0.23	0.094			0.9	22.95	23.75	0.80	0.14	0.094	0.085	0.11	0.009	1%
20	24.10	0.35	0.22	0.039			0.9	23.75	24.55	0.80	0.13	0.039	0.035	0.10	0.004	0%
21	25.00	0.31	0.22	0.002			0.9	24.55	25.95	1.40	0.09	0.002	0.002	0.13	0.000	0%
22	26.90	0.30	0.27	0.047			0.9	25.95	27.45	1.50	0.03	0.047	0.042	0.05	0.002	0%
L	28.00	0.00		0.000	0.000	0.000	1.0	27.45	28.00	0.55	0.01	0.012	0.012	0.00	0.000	0%
Total Flow															1.564	

Measurement Details:

Start Time (MST):	12:40
End Time (MST):	14:10
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Overcast, Breezy, 0°C

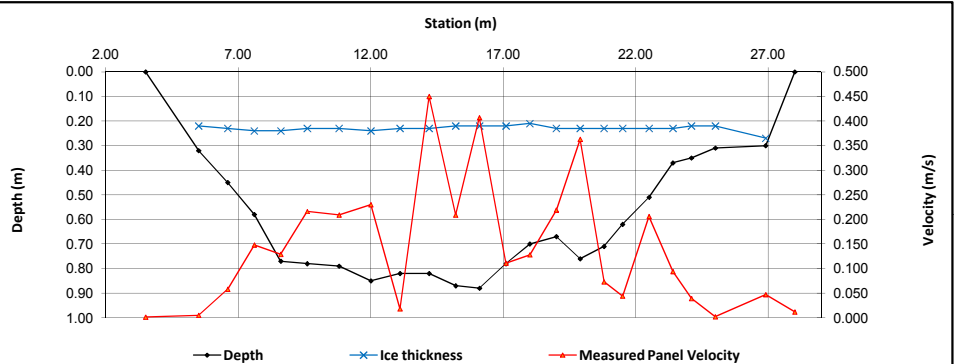
Flow characteristics:

Total Flow:	1.564	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	9.04	(m ²)
Wetted Width:	24.50	(m)
Hydraulic Depth:	0.369	(m)
Mean Velocity:	0.173	(m/s)
Froude Number:	0.091	

Datalogger Details:

	Before	After
Transducer Reading:		0.673
Battery (Main):	14.9	
Battery (Aux):	-	
Rainfall Before (mm)	0	
Rainfall After (mm)	0	
Datalogger Clock:	12:43	
Laptop Clock:	12:46	
Air Temperature °C:	-	
Air Pressure:	0.10	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, w/flag, behind logger	1.012	100.000	0.997	100.000	-
Bench Mark 2:	T-post on second bench	3.086	97.893	3.069	97.893	-
Top of Ice:		4.768	96.244	4.753	96.244	96.244
Water Level:		4.783	96.229	4.769	96.228	96.229
Transducer Reading:		0.673	95.556	0.673	95.555	95.556
Other:						

General Notes:

Field Personnel:	SM, DB	Trip Date:	28-Nov-11
Data Entry Personnel:	SG	Date:	16-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S42 - Clearwater River above Christina River

UTM Location: 504427 E, 6279666 N

Site Visit Date: January 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
Left		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	13:00
End Time (MST):	13:13
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Partly cloudy, -15°C

Flow characteristics:

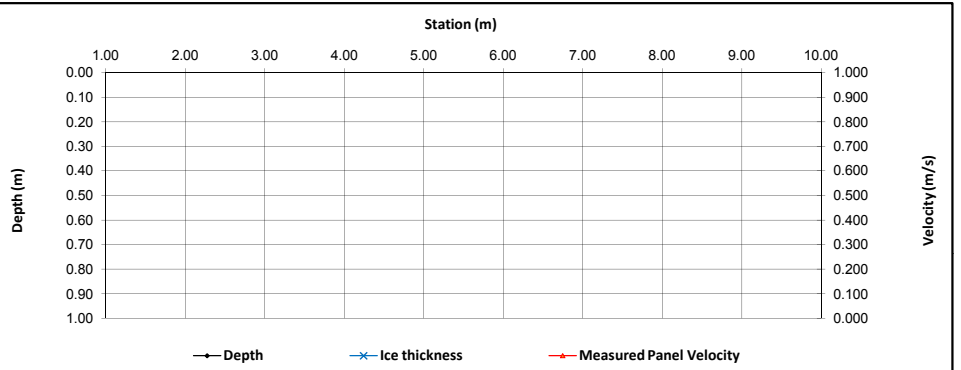
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Brass Cap on Right Bank	2.860	25.299	2.851	25.299	-
Bench Mark 2:	T-post	1.419	26.735	1.405	26.735	-
Top of Ice:		4.758	23.401	4.747	23.403	23.402
Water Level:		4.747	23.412	4.735	23.415	23.414
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	22-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S42 - Clearwater River above Christina River

UTM Location: 504427 E, 6279666 N

Site Visit Date: February 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	1.38	1.37	0.36	0.063	0.063	0.50	0.032	0%
1	2.75	1.83	0.38		0.231	0.275	1.0	1.38	3.88	2.50	1.45	0.253	0.253	3.62	0.917	2%
2	5.00	2.11	0.45		0.237	0.297	1.0	3.88	6.13	2.25	1.66	0.267	0.267	3.74	0.997	2%
3	7.25	2.02	0.46		0.313	0.365	1.0	6.13	8.30	2.18	1.56	0.339	0.339	3.39	1.150	3%
4	9.35	2.00	0.43		0.335	0.405	1.0	8.30	10.33	2.03	1.57	0.370	0.370	3.18	1.176	3%
5	11.30	1.97	0.44		0.310	0.433	1.0	10.33	12.25	1.93	1.53	0.372	0.372	2.95	1.094	3%
6	13.20	1.87	0.45		0.412	0.469	1.0	12.25	14.08	1.83	1.42	0.441	0.441	2.59	1.142	3%
7	14.95	1.79	0.44		0.507	0.527	1.0	14.08	15.93	1.85	1.35	0.517	0.517	2.50	1.291	3%
8	16.90	1.68	0.36		0.532	0.546	1.0	15.93	17.78	1.85	1.32	0.539	0.539	2.44	1.316	3%
9	18.65	1.69	0.35		0.534	0.544	1.0	17.78	19.58	1.80	1.34	0.539	0.539	2.41	1.300	3%
10	20.50	1.67	0.43		0.440	0.529	1.0	19.58	21.38	1.80	1.24	0.485	0.485	2.23	1.081	2%
11	22.25	1.67	0.33		0.479	0.483	1.0	21.38	23.13	1.75	1.34	0.481	0.481	2.35	1.128	3%
12	24.00	1.96	0.35		0.409	0.514	1.0	23.13	25.08	1.95	1.61	0.462	0.462	3.14	1.449	3%
13	26.15	1.98	0.36		0.314	0.505	1.0	25.08	27.10	2.03	1.62	0.410	0.410	3.28	1.343	3%
14	28.05	2.00	0.44		0.328	0.437	1.0	27.10	28.90	1.80	1.56	0.383	0.383	2.81	1.074	2%
15	29.75	2.02	0.43		0.197	0.466	1.0	28.90	30.75	1.85	1.59	0.332	0.332	2.94	0.975	2%
16	31.75	1.86	0.42		0.381	0.570	1.0	30.75	32.60	1.85	1.44	0.476	0.476	2.66	1.267	3%
17	33.45	1.82	0.38		0.395	0.531	1.0	32.60	34.40	1.80	1.44	0.463	0.463	2.59	1.200	3%
18	35.35	1.80	0.43		0.451	0.549	1.0	34.40	36.28	1.88	1.37	0.500	0.500	2.57	1.284	3%
19	37.20	1.82	0.33		0.413	0.511	1.0	36.28	39.50	3.22	1.49	0.462	0.462	4.81	2.220	5%
20	41.80	1.98	0.40		0.459	0.451	1.0	39.50	42.65	3.15	1.58	0.455	0.455	4.98	2.265	5%
21	43.50	1.93	0.57		0.440	0.473	1.0	42.65	44.50	1.85	1.36	0.457	0.457	2.52	1.149	3%
22	45.50	1.92	0.44		0.366	0.474	1.0	44.50	47.55	3.05	1.48	0.420	0.420	4.51	1.896	4%
23	49.60	1.88	0.43		0.378	0.516	1.0	47.55	50.45	2.90	1.45	0.447	0.447	4.21	1.880	4%
24	51.30	2.09	0.35		0.367	0.499	1.0	50.45	53.20	2.75	1.74	0.433	0.433	4.78	2.072	5%
25	55.10	1.90	0.48		0.319	0.441	1.0	53.20	56.20	3.00	1.42	0.380	0.380	4.26	1.619	4%
26	57.30	1.98	0.53		0.320	0.450	1.0	56.20	59.80	3.60	1.45	0.385	0.385	5.22	2.010	5%
27	62.30	2.01	0.44		0.273	0.394	1.0	59.80	63.70	3.90	1.57	0.334	0.334	6.12	2.042	5%
28	65.10	1.91	0.53		0.256	0.389	1.0	63.70	69.23	5.53	1.38	0.323	0.323	7.62	2.459	6%
29	73.35	1.52	0.58		0.265	0.347	1.0	69.23	77.73	8.50	0.94	0.306	0.306	7.99	2.445	6%
30	82.10	0.58	0.46	0.006			0.9	77.73	82.35	4.63	0.12	0.006	0.005	0.56	0.003	0%
Left	82.60	0.00	0.00	0.000	0.000	0.000	1.0	82.35	82.60	0.25	0.03	0.002	0.002	0.01	0.000	0%
														Total Flow	43.276	

Measurement Details:

Start Time (MST):	15:15
End Time (MST):	16:45
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear

Flow characteristics:

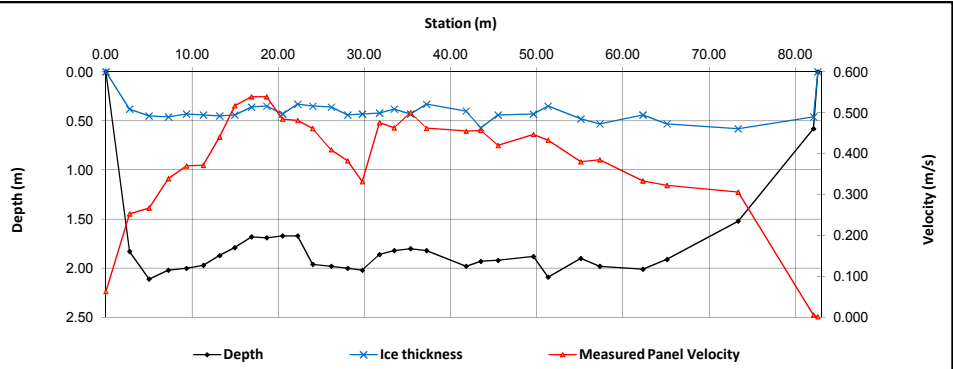
Total Flow:	43.276	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	109.47	(m ²)
Wetted Width:	82.60	(m)
Hydraulic Depth:	1.325	(m)
Mean Velocity:	0.395	(m/s)
Froude Number:	0.110	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	-
Laptop Clock:	-	-
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	-
Memory Used:	-	-
Dessicant:	-	-
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Brass Cap on Right Bank	2.451	25.299	2.468	25.299	-
Bench Mark 2:	T-post	1.003	26.735	1.002	26.735	-
Top of Ice:		4.312	23.438	4.312	23.455	23.447
Water Level:		4.278	23.472	4.276	23.491	23.482
Transducer Reading:						
Other:						

General Notes:

Field Personnel:	BL, SG	Trip Date:	12-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S42 - Clearwater River above Christina River

UTM Location: 504427 E, 6279666 N

Site Visit Date: December 4, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
				(m/s)	(m/s)	(m/s)	(m)				(m)	(m/s)	(m/s)			
Right		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
21							1.0				0.00	0.000	0.000	0.00	0.000	
22							1.0				0.00	0.000	0.000	0.00	0.000	
23							1.0				0.00	0.000	0.000	0.00	0.000	
24							1.0				0.00	0.000	0.000	0.00	0.000	
25							1.0				0.00	0.000	0.000	0.00	0.000	
26							1.0				0.00	0.000	0.000	0.00	0.000	
27							1.0				0.00	0.000	0.000	0.00	0.000	
28							1.0				0.00	0.000	0.000	0.00	0.000	
29							1.0				0.00	0.000	0.000	0.00	0.000	
30							1.0				0.00	0.000	0.000	0.00	0.000	
Left		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	12:50
End Time (MST):	13:10
Equipment:	-
Method:	-
River Condition:	Ice
Quality/Error (see reverse):	-
Weather:	Clear

Flow characteristics:

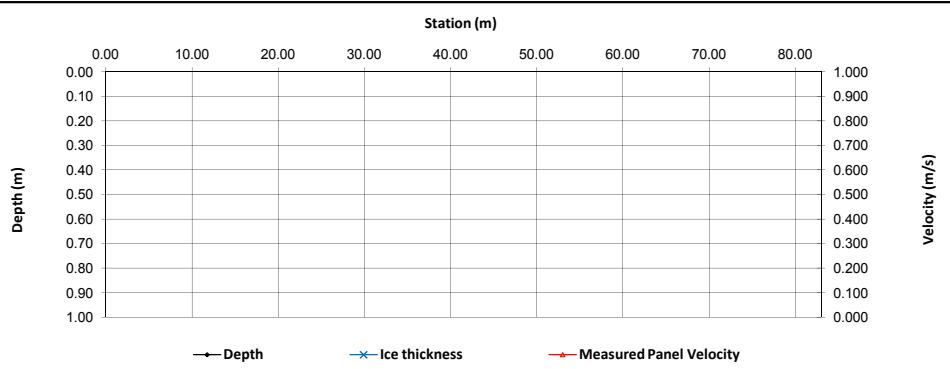
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	#DIV/0!	(m)
Mean Velocity:	#DIV/0!	(m/s)
Froude Number:	#DIV/0!	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

WSC site



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Brass Cap on Right Bank		25.299		25.299	-
Bench Mark 2:	T-post		26.735		26.735	-
Top of Ice:			25.299		25.299	25.299
Water Level:			25.299		25.299	25.299
Transducer Reading:						
Other:						

General Notes:

Ice conditions tested by considered unsafe to cross river. Thin spot in middle of cross section at less than 5 cm of ice.

Field Personnel:	SM, SG	Trip Date:	4-Dec-11
Data Entry Personnel:	SG	Date:	16-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: January 14, 2011



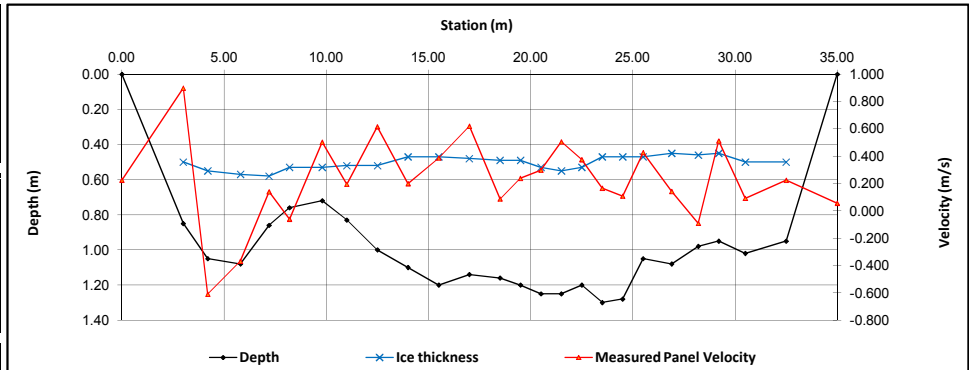
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	35.00	0.00		0.000	0.000	0.000	0.9	35.00	33.75	1.25	0.11	0.056	0.050	0.14	0.007	0%
1	32.50	0.95	0.50	0.224			0.9	33.75	31.50	2.25	0.45	0.224	0.202	1.01	0.204	5%
2	30.50	1.02	0.50	0.092			0.9	31.50	29.85	1.65	0.52	0.092	0.083	0.86	0.071	2%
3	29.20	0.95	0.45	0.512			0.9	29.85	28.70	1.15	0.50	0.512	0.461	0.58	0.265	7%
4	28.20	0.98	0.46	-0.091			0.9	28.70	27.55	1.15	0.52	-0.091	-0.082	0.60	-0.049	-1%
5	26.90	1.08	0.45	0.142			0.9	27.55	26.20	1.35	0.63	0.142	0.128	0.85	0.109	3%
6	25.50	1.05	0.47	0.427			0.9	26.20	25.00	1.20	0.58	0.427	0.384	0.70	0.267	7%
7	24.50	1.28	0.47		-0.069	0.285	1.0	25.00	24.00	1.00	0.81	0.108	0.108	0.81	0.087	2%
8	23.50	1.30	0.47		0.073	0.258	1.0	24.00	23.00	1.00	0.83	0.166	0.166	0.83	0.137	4%
9	22.50	1.20	0.53	0.375			0.9	23.00	22.00	1.00	0.67	0.375	0.338	0.67	0.226	6%
10	21.50	1.25	0.55	0.505			0.9	22.00	21.00	1.00	0.70	0.505	0.455	0.70	0.318	8%
11	20.50	1.25	0.53	0.298			0.9	21.00	20.00	1.00	0.72	0.298	0.268	0.72	0.193	5%
12	19.50	1.20	0.49	0.238			0.9	20.00	19.00	1.00	0.71	0.238	0.214	0.71	0.152	4%
13	18.50	1.16	0.49	0.087			0.9	19.00	17.75	1.25	0.67	0.087	0.078	0.84	0.066	2%
14	17.00	1.14	0.48	0.620			0.9	17.75	16.25	1.50	0.66	0.620	0.558	0.99	0.552	15%
15	15.50	1.20	0.47	0.387			0.9	16.25	14.75	1.50	0.73	0.387	0.348	1.10	0.381	10%
16	14.00	1.10	0.47	0.199			0.9	14.75	13.25	1.50	0.63	0.199	0.179	0.95	0.169	4%
17	12.50	1.00	0.52	0.616			0.9	13.25	11.75	1.50	0.48	0.616	0.554	0.72	0.399	11%
18	11.00	0.83	0.52	0.195			0.9	11.75	10.40	1.35	0.31	0.195	0.176	0.42	0.073	2%
19	9.80	0.72	0.53	0.503			0.9	10.40	9.00	1.40	0.19	0.503	0.453	0.27	0.120	3%
20	8.20	0.76	0.53	-0.061			0.9	9.00	7.70	1.30	0.23	-0.061	-0.055	0.30	-0.016	0%
21	7.20	0.86	0.58	0.140			0.9	7.70	6.50	1.20	0.28	0.140	0.126	0.34	0.042	1%
22	5.80	1.08	0.57	-0.369			0.9	6.50	5.00	1.50	0.51	-0.369	-0.332	0.77	-0.254	-7%
23	4.20	1.05	0.55	-0.610			0.9	5.00	3.60	1.40	0.50	-0.610	-0.549	0.70	-0.394	-10%
24	3.00	0.85	0.50	0.899			0.9	3.60	1.50	2.10	0.35	0.899	0.809	0.73	0.595	16%
Left	0.00	0.00		0.000	0.000	0.000	1.0	1.50	0.00	1.50	0.09	0.225	0.225	0.13	0.029	1%
Total Flow															3.762	

Measurement Details:	
Start Time (MST):	10:10
End Time (MST):	11:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Overcast, -30°C

Flow characteristics:		
Total Flow:	3.762	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	17.41	(m ²)
Wetted Width:	32.25	(m)
Hydraulic Depth:	0.540	(m)
Mean Velocity:	0.216	(m/s)
Froude Number:	0.094	

Datalogger Details:		
	Before	After
Transducer Reading:		0.914
Battery (Main):	15.7	
Battery (Aux):	-	
Datalogger Clock:	10:13	
Laptop Clock:	10:11	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	0.935	100.270	0.931	100.270	-
Bench Mark 2:	Nail in log w/ flagging	1.309	100.000	1.309	100.000	-
Top of Ice:		1.850	99.355	1.850	99.351	99.353
Water Level:		1.868	99.337	1.869	99.332	99.335
Transducer Reading:		0.914	98.423	0.914	98.418	98.421
Other:						

General Notes:
 First ice layer (top) 0.25m, total ice 0.60m.

Field Personnel:	DB, JO	Trip Date:	14-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: February 12, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	2.00	0.00		0.000	0.000	0.000	0.9	2.00	2.60	0.60	0.08	0.004	0.004	0.05	0.000	0%
1	3.20	0.79	0.47	0.016			0.9	2.60	3.93	1.33	0.32	0.016	0.014	0.42	0.006	0%
2	4.65	1.11	0.56	0.051			0.9	3.93	5.40	1.48	0.55	0.051	0.046	0.81	0.037	1%
3	6.15	1.09	0.57	0.039			0.9	5.40	7.08	1.68	0.52	0.039	0.035	0.87	0.031	1%
4	8.00	1.11	0.57	0.242			0.9	7.08	8.83	1.75	0.54	0.242	0.218	0.95	0.206	5%
5	9.65	1.30	0.51		0.228	0.373	1.0	8.83	10.40	1.58	0.79	0.301	0.301	1.24	0.374	8%
6	11.15	1.50	0.54		0.197	0.323	1.0	10.40	12.05	1.65	0.96	0.260	0.260	1.58	0.412	9%
7	12.95	1.61	0.59		0.116	0.249	1.0	12.05	13.88	1.83	1.02	0.183	0.183	1.86	0.340	7%
8	14.80	1.46	0.58		0.167	0.205	1.0	13.88	15.88	2.00	0.88	0.186	0.186	1.76	0.327	7%
9	16.95	1.48	0.56		0.213	0.255	1.0	15.88	18.13	2.25	0.92	0.234	0.234	2.07	0.484	11%
10	19.30	1.39	0.58		0.287	0.304	1.0	18.13	20.25	2.13	0.81	0.296	0.296	1.72	0.509	11%
11	21.20	1.15	0.58	0.309			0.9	20.25	22.10	1.85	0.57	0.309	0.278	1.05	0.293	6%
12	23.00	1.18	0.55	0.365			0.9	22.10	23.60	1.50	0.63	0.365	0.329	0.95	0.310	7%
13	24.20	1.18	0.55	0.293			0.9	23.60	24.80	1.20	0.63	0.293	0.264	0.76	0.199	4%
14	25.40	1.20	0.57	0.262			0.9	24.80	26.05	1.25	0.63	0.262	0.236	0.79	0.186	4%
15	26.70	1.09	0.57	0.334			0.9	26.05	27.40	1.35	0.52	0.334	0.301	0.70	0.211	5%
16	28.10	1.08	0.60	0.261			0.9	27.40	28.85	1.45	0.48	0.261	0.235	0.70	0.163	4%
17	29.60	1.01	0.59	0.202			0.9	28.85	30.30	1.45	0.42	0.202	0.182	0.61	0.111	2%
18	31.00	0.98	0.63	0.183			0.9	30.30	31.65	1.35	0.35	0.183	0.165	0.47	0.078	2%
19	32.30	0.90	0.65	0.035			0.9	31.65	32.80	1.15	0.25	0.035	0.032	0.29	0.009	0%
20	33.30	0.97	0.65	0.081			0.9	32.80	34.30	1.50	0.32	0.081	0.073	0.48	0.035	1%
21	35.30	1.20	0.63	0.166			0.9	34.30	35.85	1.55	0.57	0.166	0.149	0.88	0.132	3%
22	36.40	0.93	0.49	0.197			0.9	35.85	37.00	1.15	0.44	0.197	0.177	0.51	0.090	2%
Left	37.60	0.00		0.000	0.000	0.000	1.0	37.00	37.60	0.60	0.11	0.049	0.049	0.07	0.003	0%
Total Flow															4.547	

Measurement Details:

Start Time (MST):	8:55
End Time (MST):	9:50
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Light Snow

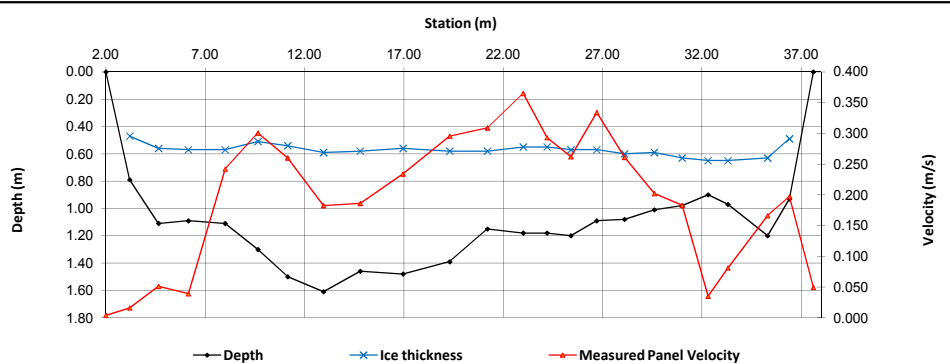
Flow characteristics:

Total Flow:	4.547	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	21.59	(m ²)
Wetted Width:	35.60	(m)
Hydraulic Depth:	0.606	(m)
Mean Velocity:	0.211	(m/s)
Froude Number:	0.086	

Datalogger Details:

	Before	After
Transducer Reading:		0.939
Battery (Main):	13.1	
Battery (Aux):	-	
Datalogger Clock:	9:01	
Laptop Clock:	8:59	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.488	100.270	1.474	100.270	-
Bench Mark 2:	Nail in log w/ flagging	1.860	100.000	1.843	100.000	-
Top of Ice:		2.329	99.429	2.311	99.433	99.431
Water Level:		2.398	99.360	2.380	99.364	99.362
Transducer Reading:		0.939	98.421	0.939	98.425	98.423
Other:						

General Notes:

Field Personnel:	BL, SG	Trip Date:	12-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: March 9, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Right	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	2.35	2.35	0.23	0.070	0.070	0.53	0.037	1%
1	4.70	1.50	0.60		0.223	0.340	1.0	2.35	5.10	2.75	0.90	0.282	0.282	2.47	0.697	17%
2	5.50	1.55	0.60		0.211	0.296	1.0	5.10	6.15	1.05	0.95	0.254	0.254	1.00	0.253	6%
3	6.80	1.68	0.60		0.158	0.164	1.0	6.15	7.55	1.40	1.08	0.161	0.161	1.51	0.243	6%
4	8.30	1.60	0.65		0.159	0.203	1.0	7.55	9.45	1.90	0.95	0.181	0.181	1.81	0.327	8%
5	10.60	1.40	0.62	0.334			0.9	9.45	11.80	2.35	0.78	0.334	0.301	1.83	0.551	14%
6	13.00	1.32	0.63	0.415			0.9	11.80	14.10	2.30	0.69	0.415	0.374	1.59	0.593	15%
7	15.20	1.15	0.62	0.456			0.9	14.10	16.05	1.95	0.53	0.456	0.410	1.03	0.424	10%
8	16.90	0.99	0.55	0.482			0.9	16.05	17.45	1.40	0.44	0.482	0.434	0.62	0.267	7%
9	18.00	0.95	0.57	0.428			0.9	17.45	18.60	1.15	0.38	0.428	0.385	0.44	0.168	4%
10	19.20	0.90	0.64	0.396			0.9	18.60	19.85	1.25	0.26	0.396	0.356	0.33	0.116	3%
11	20.50	0.97	0.57	0.344			0.9	19.85	21.15	1.30	0.40	0.344	0.310	0.52	0.161	4%
12	21.80	0.90	0.63	0.315			0.9	21.15	22.25	1.10	0.27	0.315	0.284	0.30	0.084	2%
13	22.70	0.90	0.63	0.290			0.9	22.25	23.10	0.85	0.27	0.290	0.261	0.23	0.060	1%
14	23.50	0.90	0.59	0.235			0.9	23.10	24.00	0.90	0.31	0.235	0.212	0.28	0.059	1%
15	24.50	0.90	0.65	0.100			0.9	24.00	24.85	0.85	0.25	0.100	0.090	0.21	0.019	0%
16	25.20	0.80	0.65	-0.010			0.9	24.85	25.70	0.85	0.15	-0.010	-0.009	0.13	-0.001	0%
17	26.20	0.95	0.73	0.093			0.9	25.70	26.80	1.10	0.22	0.093	0.084	0.24	0.020	0%
18	27.40	0.69	0.62	0.000			0.9	26.80	28.20	1.40	0.07	0.000	0.000	0.10	0.000	0%
Left	29.00	0.00	0.00	0.000	0.000	0.000	1.0	28.20	29.00	0.80	0.02	0.000	0.000	0.01	0.000	0%
Total Flow															4.079	

Measurement Details:

Start Time (MST):	14:10
End Time (MST):	15:00
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Light snow

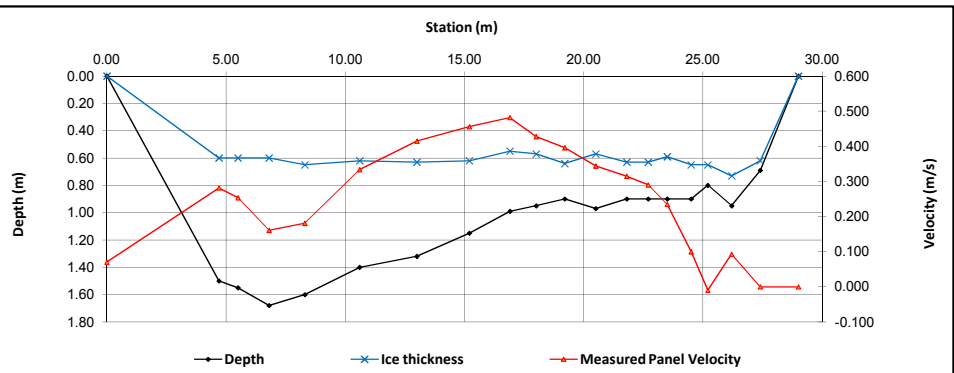
Flow characteristics:

Total Flow:	4.079	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	15.17	(m ²)
Wetted Width:	29.00	(m)
Hydraulic Depth:	0.523	(m)
Mean Velocity:	0.269	(m/s)
Froude Number:	0.119	

Datalogger Details:

	Before	After
Transducer Reading:		0.936
Battery (Main):	15.1	
Battery (Aux):	-	
Datalogger Clock:	14:16	
Laptop Clock:	14:13	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.579	100.270	1.572	100.270	-
Bench Mark 2:	Nail in log w/ flagging	1.948	100.000	1.943	100.000	-
Top of Ice:		2.462	99.387	2.457	99.385	99.386
Water Level:		2.490	99.359	2.483	99.359	99.359
Transducer Reading:		0.936	98.423	0.936	98.423	98.423
Other:						

General Notes:

Field Personnel:	JO, BL	Trip Date:	9-Mar-11
Data Entry Personnel:	CM	Date:	22-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: April 1, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:

Start Time (MST):	9:30
End Time (MST):	10:15
Equipment:	ADV
Method:	Ice
River Condition:	Partially frozen
Quality/Error (see reverse):	-
Weather:	Clear, 5°C

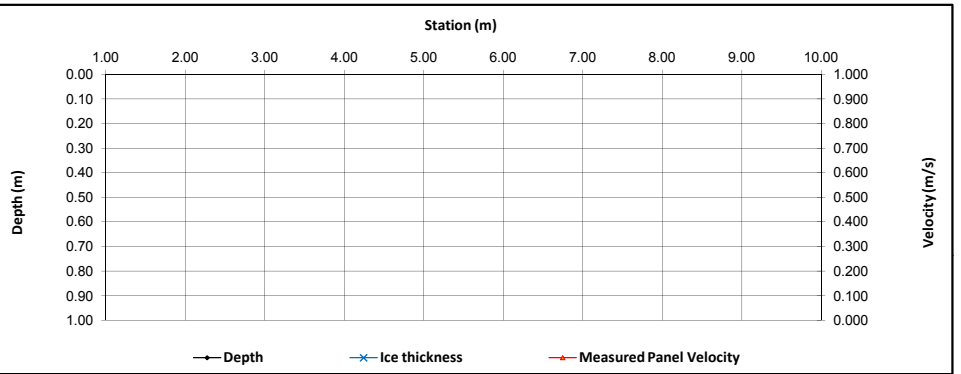
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.995
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	8:46	
Laptop Clock:	8:43	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.541	100.270	1.532	100.270	-
Bench Mark 2:	Nail in log w/ flagging	1.908	100.000	1.901	100.000	-
Top of Ice:		2.398	99.413	2.387	99.415	99.414
Water Level:		2.401	99.410	2.390	99.412	99.411
Transducer Reading:		0.995	98.415	0.995	98.417	98.416
Other:						

General Notes:

No flow measurements taken due to open leads on TL of river. River ice cover deemed unsafe.

Field Personnel:	JO, SG	Trip Date:	1-Apr-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: April 22, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	7:30
End Time (MST):	8:30
Equipment:	-
Method:	-
River Condition:	Partially Open
Quality/Error (see reverse):	-
Weather:	-

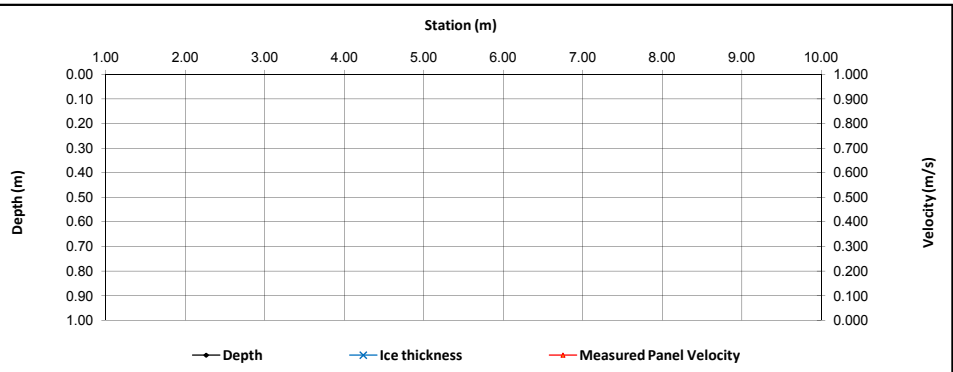
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		1.051
Battery (Main):	14.9	
Battery (Aux):	-	
Datalogger Clock:	8:04	
Laptop Clock:	8:01	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.122	100.270	1.112	100.270	-
Bench Mark 2:	Nail in log w/ flagging	1.485	100.000	1.475	100.000	-
Top of Ice:						
Water Level:		1.932	99.460	1.924	99.458	99.459
Transducer Reading:		1.051	98.409	1.051	98.407	98.408
Other:						

General Notes:

No flow measurements taken due to frozen ice conditions.

Field Personnel:	DB, SG	Trip Date:	22-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag

UTM Location: 531528 E, 6354782 N

Site Visit Date: August 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	36.00	0.00	0.00	0.000	0.000	0.000	1.0	36.00	35.00	1.00	0.16	0.048	0.048	0.16	0.008	0%
1	34.00	0.64		0.192			1.0	35.00	33.00	2.00	0.64	0.192	0.192	1.28	0.246	4%
2	32.00	0.70		0.170			1.0	33.00	31.00	2.00	0.70	0.170	0.170	1.40	0.238	4%
3	30.00	0.76			0.150	0.266	1.0	31.00	29.00	2.00	0.76	0.208	0.208	1.52	0.316	6%
4	28.00	0.98			0.181	0.259	1.0	29.00	27.25	1.75	0.98	0.220	0.220	1.72	0.377	7%
5	26.50	1.16			0.156	0.184	1.0	27.25	25.75	1.50	1.16	0.170	0.170	1.74	0.296	5%
6	25.00	1.14			0.140	0.192	1.0	25.75	24.25	1.50	1.14	0.166	0.166	1.71	0.284	5%
7	23.50	1.12			0.189	0.231	1.0	24.25	22.75	1.50	1.12	0.210	0.210	1.68	0.353	6%
8	22.00	1.00			0.255	0.271	1.0	22.75	21.00	1.75	1.00	0.263	0.263	1.75	0.460	8%
9	20.00	0.84			0.294	0.347	1.0	21.00	19.00	2.00	0.84	0.321	0.321	1.68	0.538	10%
10	18.00	0.82			0.230	0.295	1.0	19.00	17.00	2.00	0.82	0.263	0.263	1.64	0.431	8%
11	16.00	0.54		0.280			1.0	17.00	15.00	2.00	0.54	0.280	0.280	1.08	0.302	6%
12	14.00	0.58		0.302			1.0	15.00	13.00	2.00	0.58	0.302	0.302	1.16	0.350	6%
13	12.00	0.52		0.333			1.0	13.00	11.00	2.00	0.52	0.333	0.333	1.04	0.346	6%
14	10.00	0.52		0.330			1.0	11.00	9.00	2.00	0.52	0.330	0.330	1.04	0.343	6%
15	8.00	0.50		0.242			1.0	9.00	7.00	2.00	0.50	0.242	0.242	1.00	0.242	4%
16	6.00	0.50		0.216			1.0	7.00	5.00	2.00	0.50	0.216	0.216	1.00	0.216	4%
17	4.00	0.55		0.125			1.0	5.00	3.00	2.00	0.55	0.125	0.125	1.10	0.138	3%
18	2.00	0.25		0.021			1.0	3.00	1.60	1.40	0.25	0.021	0.021	0.35	0.007	0%
LB	1.20	0.00	0.00	0.000	0.000	0.000	1.0	1.60	1.20	0.40	0.06	0.005	0.005	0.03	0.000	0%
Total Flow														5.492		

Measurement Details:

Start Time (MST):	12:50
End Time (MST):	14:15
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny

Flow characteristics:

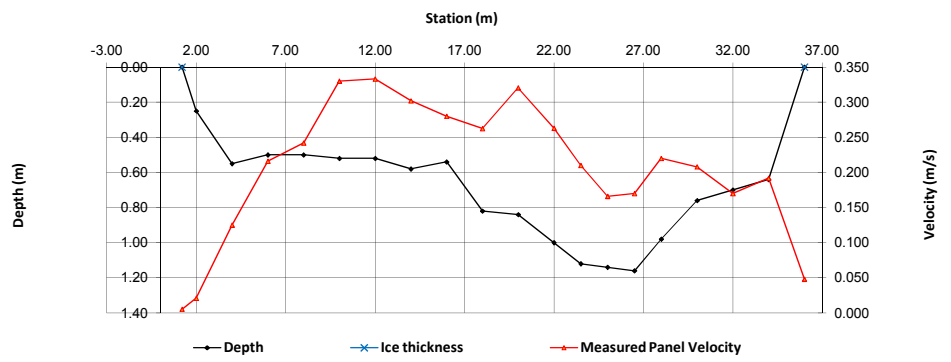
Total Flow:	5.492	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	24.07	(m ²)
Wetted Width:	33.40	(m)
Hydraulic Depth:	0.721	(m)
Mean Velocity:	0.228	(m/s)
Froude Number:	0.086	

Datalogger Details:

	Before	After
Transducer Reading:	0.557	0.671
Battery (Main):	14.4	14.3
Battery (Aux):	-	-
Datalogger Clock:	12:59	14:12
Laptop Clock:	12:58	14:11
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	18.2	19.0
Memory Used:	-	-
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Ignore PPT avg 13:30 - 14:15 on Aug 13th



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.284	100.270	1.278	100.270	-
Bench Mark 2:	NEW pipe w/flagging to E of station	1.439	100.000	1.431	100.000	-
Top of Ice:						
Water Level:		2.528	99.026	2.520	99.028	99.027
Transducer Reading:		0.671	98.355	0.671	98.357	98.356
Other:						

General Notes:

Rain gauge: screws loose on rain gauge. Tightened. Needs new mesh. Gauge fell in July sometime.

Field Personnel:	DB, SM	Trip Date:	13-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: September 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	2.00	0.00	0.00	0.000	0.000	0.000	1.0	2.00	2.50	0.50	0.07	0.018	0.018	0.04	0.001	0%
1	3.00	0.28		0.070			1.0	2.50	3.75	1.25	0.28	0.070	0.070	0.35	0.025	1%
2	4.50	0.43		0.125			1.0	3.75	5.25	1.50	0.43	0.125	0.125	0.65	0.081	2%
3	6.00	0.39		0.179			1.0	5.25	6.75	1.50	0.39	0.179	0.179	0.59	0.105	3%
4	7.50	0.39		0.193			1.0	6.75	8.25	1.50	0.39	0.193	0.193	0.59	0.113	3%
5	9.00	0.42		0.248			1.0	8.25	9.75	1.50	0.42	0.248	0.248	0.63	0.156	4%
6	10.50	0.43		0.280			1.0	9.75	11.25	1.50	0.43	0.280	0.280	0.65	0.181	4%
7	12.00	0.47		0.303			1.0	11.25	12.75	1.50	0.47	0.303	0.303	0.71	0.214	5%
8	13.50	0.46		0.302			1.0	12.75	14.25	1.50	0.46	0.302	0.302	0.69	0.208	5%
9	15.00	0.42		0.304			1.0	14.25	15.75	1.50	0.42	0.304	0.304	0.63	0.192	5%
10	16.50	0.53		0.254			1.0	15.75	17.25	1.50	0.53	0.254	0.254	0.80	0.202	5%
11	18.00	0.73		0.234			1.0	17.25	18.75	1.50	0.73	0.234	0.234	1.10	0.256	6%
12	19.50	0.86			0.180	0.260	1.0	18.75	20.25	1.50	0.86	0.220	0.220	1.29	0.284	7%
13	21.00	0.88			0.185	0.264	1.0	20.25	21.75	1.50	0.88	0.225	0.225	1.32	0.296	7%
14	22.50	0.96			0.186	0.219	1.0	21.75	23.25	1.50	0.96	0.203	0.203	1.44	0.292	7%
15	24.00	1.08			0.182	0.188	1.0	23.25	24.75	1.50	1.08	0.185	0.185	1.62	0.300	7%
16	25.50	1.08			0.123	0.175	1.0	24.75	26.25	1.50	1.08	0.149	0.149	1.62	0.241	6%
17	27.00	1.10			0.112	0.190	1.0	26.25	27.75	1.50	1.10	0.151	0.151	1.65	0.249	6%
18	28.50	0.90			0.115	0.168	1.0	27.75	29.25	1.50	0.90	0.142	0.142	1.35	0.191	5%
19	30.00	0.72		0.171			1.0	29.25	30.75	1.50	0.72	0.171	0.171	1.08	0.185	5%
20	31.50	0.65		0.155			1.0	30.75	32.25	1.50	0.65	0.155	0.155	0.98	0.151	4%
21	33.00	0.60		0.091			1.0	32.25	33.75	1.50	0.60	0.091	0.091	0.90	0.082	2%
22	34.50	0.63		0.023			1.0	33.75	35.15	1.40	0.63	0.023	0.023	0.88	0.020	1%
RB	35.80	0.00	0.00	0.000	0.000	0.000	1.0	33.65	35.80	2.15	0.16	0.006	0.006	0.35	0.002	0%
Total Flow															4.025	

Measurement Details:

Start Time (MST):	7:40
End Time (MST):	8:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, ~5°C

Flow characteristics:

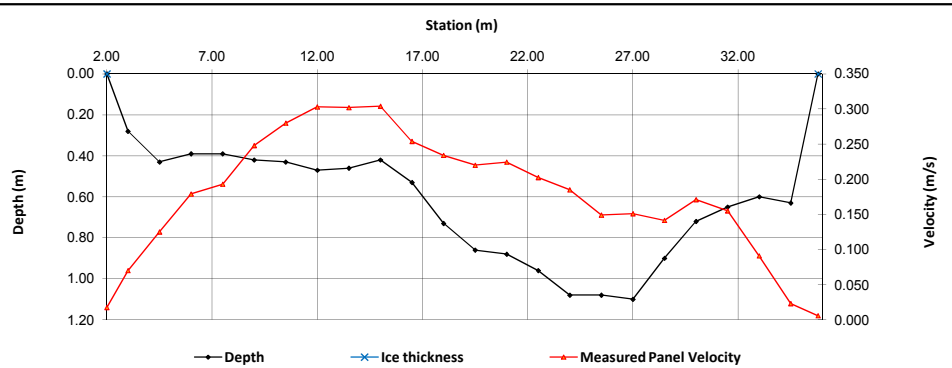
Total Flow:	4.025	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	21.87	(m ²)
Wetted Width:	33.80	(m)
Hydraulic Depth:	0.647	(m)
Mean Velocity:	0.184	(m/s)
Froude Number:	0.073	

Datalogger Details:

	Before	After
Transducer Reading:		0.596
Battery (Main):	14.9	
Battery (Aux):	-	
Datalogger Clock:	7:50	
Laptop Clock:	7:49	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	9.4	
Memory Used:	-	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Rain gauge checked



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.158	100.270	1.170	100.270	-
Bench Mark 2:	New pipe w/flagging to E of station within 10cm of station	1.315	100.000	1.325	100.000	-
Top of Ice:						
Water Level:		2.472	98.956	2.483	98.957	98.957
Transducer Reading:		0.596	98.360	0.596	98.361	98.361
Other:						

General Notes:

GPS at 3m2. Bring hacksaw to get rid of failed BM2

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	tk	Date:	23-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: October 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	4.00	0.00	0.00	0.000	0.000	0.000	1.0	4.00	4.50	0.50	0.19	0.020	0.020	0.10	0.002	0%
1	5.00	0.76		0.081			1.0	4.50	5.75	1.25	0.76	0.081	0.081	0.95	0.077	2%
2	6.50	0.40		0.112			1.0	5.75	7.25	1.50	0.40	0.112	0.112	0.60	0.067	2%
3	8.00	0.42		0.208			1.0	7.25	8.75	1.50	0.42	0.208	0.208	0.63	0.131	3%
4	9.50	0.44		0.195			1.0	8.75	10.25	1.50	0.44	0.195	0.195	0.66	0.129	3%
5	11.00	0.33		0.207			1.0	10.25	11.75	1.50	0.33	0.207	0.207	0.50	0.102	3%
6	12.50	0.31		0.311			1.0	11.75	13.25	1.50	0.31	0.311	0.311	0.47	0.145	4%
7	14.00	0.45		0.268			1.0	13.25	14.75	1.50	0.45	0.268	0.268	0.68	0.181	5%
8	15.50	0.46		0.249			1.0	14.75	16.25	1.50	0.46	0.249	0.249	0.69	0.172	4%
9	17.00	0.45		0.218			1.0	16.25	17.75	1.50	0.45	0.218	0.218	0.68	0.147	4%
10	18.50	0.58		0.215			1.0	17.75	19.25	1.50	0.58	0.215	0.215	0.87	0.187	5%
11	20.00	0.75			0.221	0.291	1.0	19.25	20.75	1.50	0.75	0.256	0.256	1.13	0.288	7%
12	21.50	0.77			0.241	0.324	1.0	20.75	22.25	1.50	0.77	0.283	0.283	1.16	0.326	8%
13	23.00	0.82			0.161	0.220	1.0	22.25	23.75	1.50	0.82	0.191	0.191	1.23	0.234	6%
14	24.50	0.92			0.163	0.305	1.0	23.75	25.25	1.50	0.92	0.234	0.234	1.38	0.323	8%
15	26.00	1.05			0.117	0.219	1.0	25.25	26.75	1.50	1.05	0.168	0.168	1.58	0.265	7%
16	27.50	1.04			0.106	0.227	1.0	26.75	28.25	1.50	1.04	0.167	0.167	1.56	0.260	7%
17	29.00	1.07			0.100	0.228	1.0	28.25	29.75	1.50	1.07	0.164	0.164	1.61	0.263	7%
18	30.50	0.86			0.022	0.179	1.0	29.75	31.25	1.50	0.86	0.101	0.101	1.29	0.130	3%
19	32.00	0.69		0.167			1.0	31.25	32.75	1.50	0.69	0.167	0.167	1.04	0.173	4%
20	33.50	0.64		0.234			1.0	32.75	34.25	1.50	0.64	0.234	0.234	0.96	0.225	6%
21	35.00	0.63		0.043			1.0	34.25	35.75	1.50	0.63	0.043	0.043	0.95	0.041	1%
22	36.50	0.60		-0.002			1.0	35.75	37.00	1.25	0.60	-0.002	-0.002	0.75	-0.002	0%
RB	37.50	0.00	0.00	0.000	0.000	0.000	1.0	37.00	37.50	0.50	0.15	-0.001	-0.001	0.08	0.000	0%
Total Flow															3.865	

Measurement Details:

Start Time (MST):	9:15
End Time (MST):	10:40
Equipment:	ADV
Method:	Wading
River Condition:	Low, Open
Quality/Error (see reverse):	Excellent
Weather:	Clear, -5 C

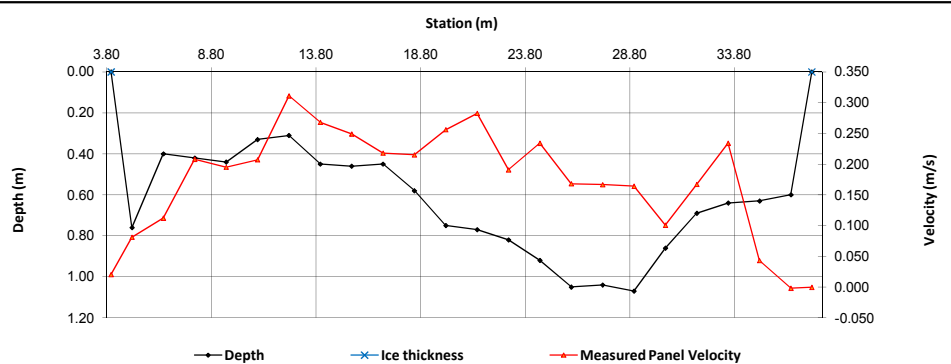
Flow characteristics:

Total Flow:	3.865	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	21.49	(m ²)
Wetted Width:	33.50	(m)
Hydraulic Depth:	0.641	(m)
Mean Velocity:	0.180	(m/s)
Froude Number:	0.072	

Datalogger Details:

	Before	After
Transducer Reading:		0.565
Battery (Main):	13.2	
Battery (Aux):	-	
Datalogger Clock:	8:23	
Laptop Clock:	8:21	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.4	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	0.835	100.270	0.825	100.270	-
Bench Mark 2:	New pipe w flagging to E of station	0.373	100.000	0.360	100.000	-
Top of Ice:						
Water Level:		2.147	98.958	2.137	98.958	98.958
Transducer Reading:		0.565	98.393	0.565	98.393	98.393
Other:						

General Notes:

Inverted precip funnel and covered it with a bag
 Rainfall before: 0mm
 Rainfall after: 0mm

Field Personnel:	DW, SM	Trip Date:	27-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S43 - Firebag River Upstream of Suncor Firebag
 UTM Location: 531528 E, 6354782 N

Site Visit Date: December 4, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	2.00	0.00		0.000	0.000	0.000	0.9	2.00	2.65	0.65	0.13	0.033	0.029	0.08	0.002	0%
1	3.30	0.82	0.30	0.130			0.9	2.65	4.05	1.40	0.52	0.130	0.117	0.73	0.085	2%
2	4.80	0.95	0.35	0.130			0.9	4.05	5.60	1.55	0.60	0.130	0.117	0.93	0.109	3%
3	6.40	0.90	0.35	0.230			0.9	5.60	7.25	1.65	0.55	0.230	0.207	0.91	0.188	5%
4	8.10	1.10	0.35		0.240	0.280	1.0	7.25	9.05	1.80	0.75	0.260	0.260	1.35	0.351	8%
5	10.00	1.40	0.40		0.110	0.200	1.0	9.05	11.05	2.00	1.00	0.155	0.155	2.00	0.310	8%
6	12.10	1.40	0.40		0.210	0.220	1.0	11.05	12.90	1.85	1.00	0.215	0.215	1.85	0.398	10%
7	13.70	1.30	0.37		0.270	0.320	1.0	12.90	14.60	1.70	0.93	0.295	0.295	1.58	0.466	11%
8	15.50	1.15	0.37		0.350	0.320	1.0	14.60	16.50	1.90	0.78	0.335	0.335	1.48	0.496	12%
9	17.50	1.10	0.37	0.190			0.9	16.50	18.70	2.20	0.73	0.190	0.171	1.61	0.275	7%
10	19.90	0.91	0.37	0.290			0.9	18.70	20.70	2.00	0.54	0.290	0.261	1.08	0.282	7%
11	21.50	0.70	0.35	0.360			0.9	20.70	22.20	1.50	0.35	0.360	0.324	0.53	0.170	4%
12	22.90	0.70	0.35	0.390			0.9	22.20	23.50	1.30	0.35	0.390	0.351	0.46	0.160	4%
13	24.10	0.70	0.33	0.390			0.9	23.50	24.80	1.30	0.37	0.390	0.351	0.48	0.169	4%
14	25.50	0.75	0.43	0.370			0.9	24.80	26.15	1.35	0.32	0.370	0.333	0.43	0.144	3%
15	26.80	0.75	0.42	0.360			0.9	26.15	27.60	1.45	0.33	0.360	0.324	0.48	0.155	4%
16	28.40	0.70	0.40	0.270			0.9	27.60	29.00	1.40	0.30	0.270	0.243	0.42	0.102	2%
17	29.60	0.62	0.40	0.230			0.9	29.00	30.30	1.30	0.22	0.230	0.207	0.29	0.059	1%
18	31.00	0.85	0.40	0.130			0.9	30.30	31.55	1.25	0.45	0.130	0.117	0.56	0.066	2%
19	32.10	0.95	0.35	0.090			0.9	31.55	32.65	1.10	0.60	0.090	0.081	0.66	0.053	1%
20	33.20	0.85	0.35	0.100			0.9	32.65	33.85	1.20	0.50	0.100	0.090	0.60	0.054	1%
21	34.50	0.59	0.31	0.100			0.9	33.85	35.30	1.45	0.28	0.100	0.090	0.41	0.037	1%
RB	36.10	0.00		0.000	0.000	0.000	1.0	35.30	36.10	0.80	0.07	0.025	0.025	0.06	0.001	0%
Total Flow															4.132	

Measurement Details:

Start Time (MST):	9:00
End Time (MST):	9:45
Equipment:	Marsh
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear, -5 C

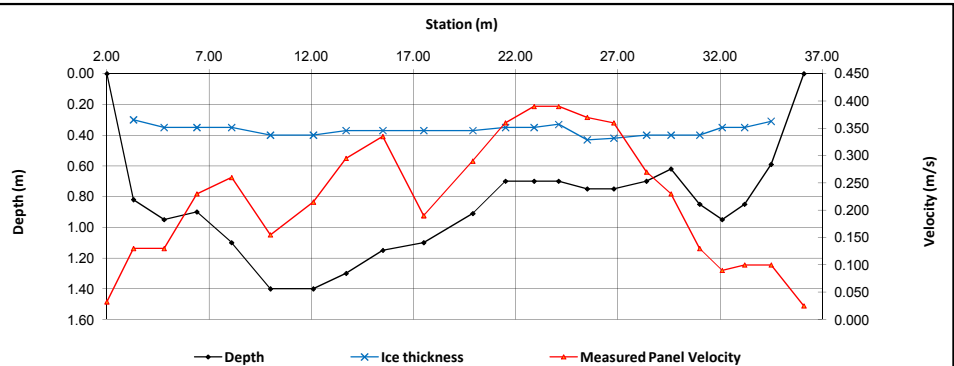
Flow characteristics:

Total Flow:	4.132	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	18.96	(m ²)
Wetted Width:	34.10	(m)
Hydraulic Depth:	0.556	(m)
Mean Velocity:	0.218	(m/s)
Froude Number:	0.093	

Datalogger Details:

	Before	After
Transducer Reading:		0.779
Battery (Main):	12.8	
Battery (Aux):	-	
Datalogger Clock:	9:04	
Laptop Clock:	9:03	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.3	
Memory Used:	-	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Pipe with flagging	1.057	100.270	1.046	100.270	-
Bench Mark 2:	New pipe w flagging to E of station	1.214	100.000	1.204	100.000	-
Top of Ice:		2.181	99.146	2.171	99.145	99.146
Water Level:		2.181	99.146	2.171	99.145	99.146
Transducer Reading:		0.779	98.367	0.779	98.366	98.367
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	4-Dec-11
Data Entry Personnel:	SG	Date:	16-Dec-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S44 - Pierre River near Ft. MacKay

UTM Location: 460775 E, 6369400 N

Site Visit Date: April 24, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0.70	0.00		0.000	0.000	0.000	1.0	0.70	0.80	0.10	0.05	0.000	0.000	0.00	0.000	0%
1	0.90	0.18		-0.001			1.0	0.80	1.00	0.20	0.18	-0.001	-0.001	0.04	0.000	0%
2	1.10	0.20		0.240			1.0	1.00	1.20	0.20	0.20	0.240	0.240	0.04	0.010	5%
3	1.30	0.22		0.278			1.0	1.20	1.40	0.20	0.22	0.278	0.278	0.04	0.012	6%
4	1.50	0.23		0.310			1.0	1.40	1.60	0.20	0.23	0.310	0.310	0.05	0.014	7%
5	1.70	0.23		0.337			1.0	1.60	1.80	0.20	0.23	0.337	0.337	0.05	0.016	7%
6	1.90	0.24		0.381			1.0	1.80	2.00	0.20	0.24	0.381	0.381	0.05	0.018	9%
7	2.10	0.23		0.339			1.0	2.00	2.20	0.20	0.23	0.339	0.339	0.05	0.016	8%
8	2.30	0.20		0.401			1.0	2.20	2.40	0.20	0.20	0.401	0.401	0.04	0.016	8%
9	2.50	0.20		0.325			1.0	2.40	2.60	0.20	0.20	0.325	0.325	0.04	0.013	6%
10	2.70	0.20		0.342			1.0	2.60	2.75	0.15	0.20	0.342	0.342	0.03	0.010	5%
11	2.80	0.19		0.288			1.0	2.75	2.95	0.20	0.19	0.288	0.288	0.04	0.011	5%
12	3.10	0.19		0.352			1.0	2.95	3.20	0.25	0.19	0.352	0.352	0.05	0.017	8%
13	3.30	0.19		0.360			1.0	3.20	3.40	0.20	0.19	0.360	0.360	0.04	0.014	7%
14	3.50	0.16		0.273			1.0	3.40	3.60	0.20	0.16	0.273	0.273	0.03	0.009	4%
15	3.70	0.17		0.263			1.0	3.60	3.80	0.20	0.17	0.263	0.263	0.03	0.009	4%
16	3.90	0.16		0.189			1.0	3.80	4.00	0.20	0.16	0.189	0.189	0.03	0.006	3%
17	4.10	0.14		0.238			1.0	4.00	4.20	0.20	0.14	0.238	0.238	0.03	0.007	3%
18	4.30	0.13		0.164			1.0	4.20	4.40	0.20	0.13	0.164	0.164	0.03	0.004	2%
19	4.50	0.14		0.118			1.0	4.40	4.60	0.20	0.14	0.118	0.118	0.03	0.003	2%
20	4.70	0.12		0.143			1.0	4.60	4.80	0.20	0.12	0.143	0.143	0.02	0.003	2%
21	4.90	0.09		0.003			1.0	4.80	5.00	0.20	0.09	0.003	0.003	0.02	0.000	0%
Right	5.10	0.00		0.000	0.000	0.000	1.0	5.00	5.10	0.10	0.02	0.001	0.001	0.00	0.000	0%
Total Flow															0.208	

Measurement Details:

Start Time (MST):	11:30
End Time (MST):	12:30
Equipment:	ADV
Method:	Wading
River Condition:	Ice
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 0°C

Flow characteristics:

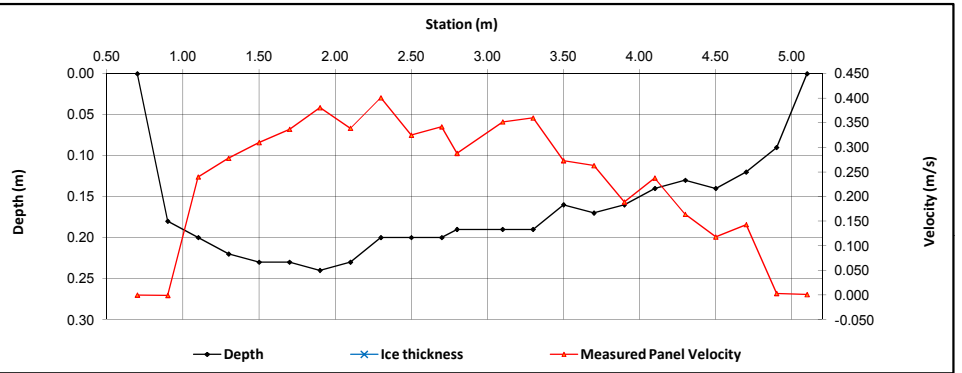
Total Flow:	0.208	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.77	(m ²)
Wetted Width:	4.40	(m)
Hydraulic Depth:	0.175	(m)
Mean Velocity:	0.270	(m/s)
Froude Number:	0.207	

Datalogger Details:

	Before	After
Transducer Reading:		0.085
Battery (Main):	4.8	
Battery (Aux):	14.7	
Datalogger Clock:	11:46	
Laptop Clock:	11:47	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	0%	
Dessicant:	New	
Logger# (if Δ):	2081	
PT# (if Δ):	101356	

Datalogger / Station Notes:

m=0.854231, b=-0.060309



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in logger tree root	0.837	100.000	0.805	100.000	-
Bench Mark 2:	3/4" pipe	0.957	99.878	0.928	99.878	-
Top of Ice:						
Water Level:		3.037	97.800	3.003	97.802	97.801
Transducer Reading:		0.085	97.715	0.085	97.717	97.716
Other:						

General Notes:

Field Personnel:	DB, SG	Trip Date:	24-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S44 - Pierre River near Ft. MacKay

UTM Location: 460775 E, 6369400 N

Site Visit Date: July 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	9:30
End Time (MST):	10:20
Equipment:	-
Method:	-
River Condition:	Open
Quality/Error (see reverse):	-
Weather:	-

Flow characteristics:

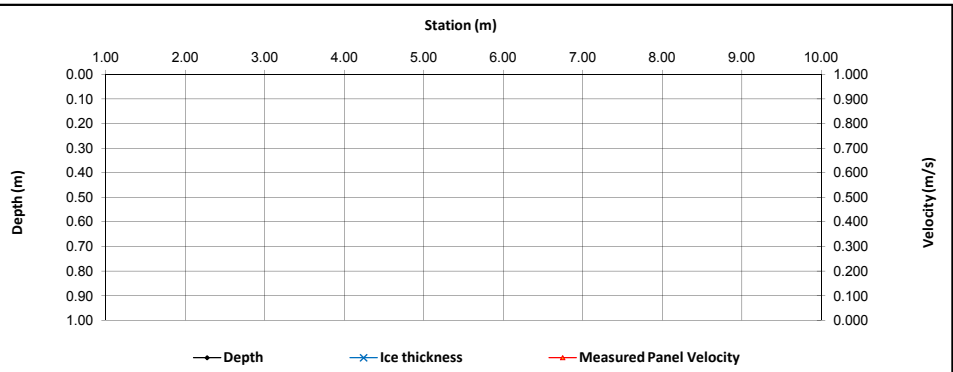
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	-	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:	0.477	0.483
Battery (Main):	5.4	13.1
Battery (Aux):	13.2	
Datalogger Clock:	9:18	10:13
Laptop Clock:	9:31	10:13
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	3%	0%
Dessicant:	-	
Logger# (if Δ):	DD400	CR800
PT# (if Δ):		18202

Datalogger / Station Notes:

Optimum hardware changed to Campbell Scientific hardware.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Nail in logger tree root		100.000		100.000	-
Bench Mark 2:	3/4" pipe		99.878		99.878	-
Top of Ice:						
Water Level:			100.000		100.000	100.000
Transducer Reading:		0.477	99.523	0.477	99.523	99.523
Other:						

General Notes:

Purpose of trip was to check station function after fires, and to upgrade station to Campbell Scientific hardware.

Field Personnel:	DB, SM	Trip Date:	27-Jul-11
Data Entry Personnel:	JP	Date:	5-Aug-11
Data Check Personnel:	DB	Date:	25-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S44 - Pierre River near Ft. MacKay

UTM Location: 460775 E, 6369400 N

Site Visit Date: 14-August, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	1.30	0.00	0.00	0.000	0.000	0.000	1.0	1.30	1.40	0.10	0.08	0.057	0.057	0.01	0.000	0%
1	1.50	0.30		0.229			1.0	1.40	1.58	0.18	0.30	0.229	0.229	0.05	0.012	4%
2	1.65	0.32		0.190			1.0	1.58	1.73	0.15	0.32	0.190	0.190	0.05	0.009	3%
3	1.80	0.32		0.418			1.0	1.73	1.88	0.15	0.32	0.418	0.418	0.05	0.020	6%
4	1.95	0.34		0.428			1.0	1.88	2.03	0.15	0.34	0.428	0.428	0.05	0.022	7%
5	2.10	0.38		0.122			1.0	2.03	2.18	0.15	0.38	0.122	0.122	0.06	0.007	2%
6	2.25	0.42		0.520			1.0	2.18	2.33	0.15	0.42	0.520	0.520	0.06	0.033	10%
7	2.40	0.44		0.703			1.0	2.33	2.48	0.15	0.44	0.703	0.703	0.07	0.046	14%
8	2.55	0.43		0.533			1.0	2.48	2.63	0.15	0.43	0.533	0.533	0.06	0.034	11%
9	2.70	0.36		0.401			1.0	2.63	2.78	0.15	0.36	0.401	0.401	0.05	0.022	7%
10	2.85	0.30		0.513			1.0	2.78	2.93	0.15	0.30	0.513	0.513	0.04	0.023	7%
11	3.00	0.26		0.440			1.0	2.93	3.08	0.15	0.26	0.440	0.440	0.04	0.017	5%
12	3.15	0.25		0.430			1.0	3.08	3.23	0.15	0.25	0.430	0.430	0.04	0.016	5%
13	3.30	0.20		0.437			1.0	3.23	3.38	0.15	0.20	0.437	0.437	0.03	0.013	4%
14	3.45	0.19		0.348			1.0	3.38	3.53	0.15	0.19	0.348	0.348	0.03	0.010	3%
15	3.60	0.19		0.308			1.0	3.53	3.68	0.15	0.19	0.308	0.308	0.03	0.009	3%
16	3.75	0.14		0.330			1.0	3.68	3.83	0.15	0.14	0.330	0.330	0.02	0.007	2%
17	3.90	0.16		0.268			1.0	3.83	4.00	0.18	0.16	0.268	0.268	0.03	0.008	2%
18	4.10	0.16		0.201			1.0	4.00	4.20	0.20	0.16	0.201	0.201	0.03	0.006	2%
19	4.30	0.15		0.161			1.0	4.20	4.40	0.20	0.15	0.161	0.161	0.03	0.005	2%
20	4.50	0.15		0.043			1.0	4.40	4.70	0.30	0.15	0.043	0.043	0.05	0.002	1%
RB	4.90	0.00	0.00	0.000	0.000	0.000	1.0	4.70	4.90	0.20	0.04	0.011	0.011	0.01	0.000	0%
Total Flow															0.321	

Measurement Details:

Start Time (MST):	14:45
End Time (MST):	15:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast

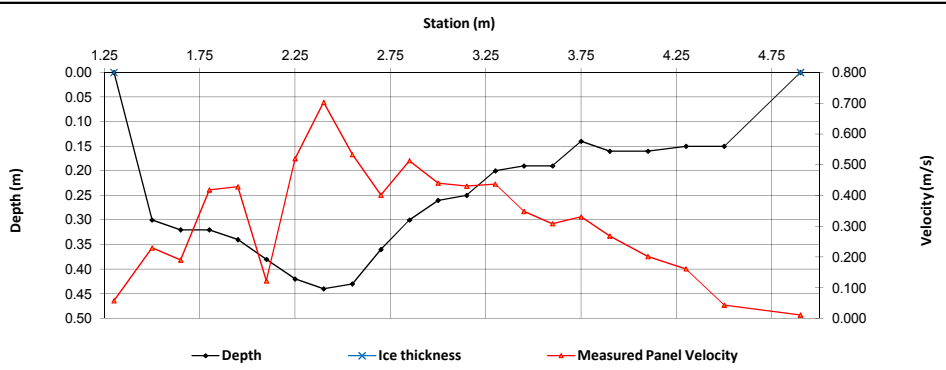
Flow characteristics:

Total Flow:	0.321	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.88	(m ²)
Wetted Width:	3.60	(m)
Hydraulic Depth:	0.245	(m)
Mean Velocity:	0.364	(m/s)
Froude Number:	0.235	

Datalogger Details:

	Before	After
Transducer Reading:		0.423
Battery (Main):	13.9	
Battery (Aux):	-	
Datalogger Clock:	14:42	
Laptop Clock:	14:48	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	17.6	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in logger tree root (not well positioned)	0.670	100.000	0.662	100.000	-
Bench Mark 2:	3/4" pipe	0.791	99.878	0.782	99.878	-
Top of Ice:						
Water Level:		2.947	97.723	2.940	97.722	97.723
Transducer Reading:		0.423	97.300	0.423	97.299	97.300
Other:						

General Notes:

TSS at 3.0mm

Field Personnel:	DB KW	Trip Date:	14-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S44 - Pierre River near Ft. MacKay
 UTM Location: 460775 E, 6369400 N

Site Visit Date: September 16, 2011



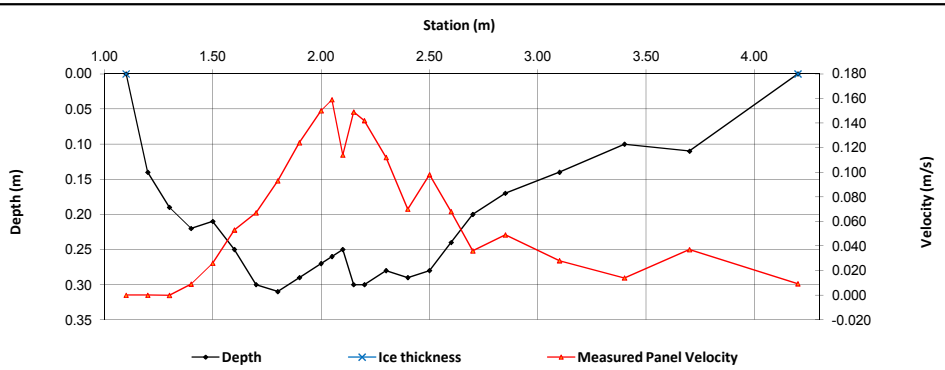
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	1.10	0.00	0.00	0.000	0.000	0.000	1.0	1.10	1.15	0.05	0.04	0.000	0.000	0.00	0.000	0%
1	1.20	0.14		0.000			1.0	1.15	1.25	0.10	0.14	0.000	0.000	0.01	0.000	0%
2	1.30	0.19		0.000			1.0	1.25	1.35	0.10	0.19	0.000	0.000	0.02	0.000	0%
3	1.40	0.22		0.009			1.0	1.35	1.45	0.10	0.22	0.009	0.009	0.02	0.000	1%
4	1.50	0.21		0.026			1.0	1.45	1.55	0.10	0.21	0.026	0.026	0.02	0.001	1%
5	1.60	0.25		0.053			1.0	1.55	1.65	0.10	0.25	0.053	0.053	0.03	0.001	4%
6	1.70	0.30		0.067			1.0	1.65	1.75	0.10	0.30	0.067	0.067	0.03	0.002	5%
7	1.80	0.31		0.093			1.0	1.75	1.85	0.10	0.31	0.093	0.093	0.03	0.003	8%
8	1.90	0.29		0.124			1.0	1.85	1.95	0.10	0.29	0.124	0.124	0.03	0.004	10%
9	2.00	0.27		0.150			1.0	1.95	2.03	0.08	0.27	0.150	0.150	0.02	0.003	8%
10	2.05	0.26		0.159			1.0	2.03	2.08	0.05	0.26	0.159	0.159	0.01	0.002	5%
11	2.10	0.25		0.114			1.0	2.08	2.13	0.05	0.25	0.114	0.114	0.01	0.001	4%
12	2.15	0.30		0.149			1.0	2.13	2.18	0.05	0.30	0.149	0.149	0.01	0.002	6%
13	2.20	0.30		0.142			1.0	2.18	2.25	0.08	0.30	0.142	0.142	0.02	0.003	8%
14	2.30	0.28		0.112			1.0	2.25	2.35	0.10	0.28	0.112	0.112	0.03	0.003	8%
15	2.40	0.29		0.070			1.0	2.35	2.45	0.10	0.29	0.070	0.070	0.03	0.002	5%
16	2.50	0.28		0.098			1.0	2.45	2.55	0.10	0.28	0.098	0.098	0.03	0.003	7%
17	2.60	0.24		0.068			1.0	2.55	2.65	0.10	0.24	0.068	0.068	0.02	0.002	4%
18	2.70	0.20		0.036			1.0	2.65	2.78	0.13	0.20	0.036	0.036	0.03	0.001	2%
19	2.85	0.17		0.049			1.0	2.78	2.98	0.20	0.17	0.049	0.049	0.03	0.002	4%
20	3.10	0.14		0.028			1.0	2.98	3.25	0.28	0.14	0.028	0.028	0.04	0.001	3%
21	3.40	0.10		0.014			1.0	3.25	3.55	0.30	0.10	0.014	0.014	0.03	0.000	1%
22	3.70	0.11		0.037			1.0	3.55	3.95	0.40	0.11	0.037	0.037	0.04	0.002	4%
RB	4.20	0.00	0.00	0.000	0.000	0.000	1.0	3.95	4.20	0.25	0.03	0.009	0.009	0.01	0.000	0%
Total Flow															0.038	

Measurement Details:	
Start Time (MST):	12:20
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Overcast, 10°C

Flow characteristics:		
Total Flow:	0.038	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.56	(m ²)
Wetted Width:	3.10	(m)
Hydraulic Depth:	0.182	(m)
Mean Velocity:	0.067	(m/s)
Froude Number:	0.050	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	13.0	
Battery (Aux):	-	
Datalogger Clock:	12:22	
Laptop Clock:	12:22	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	8.4	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	Nail in logger tree root	0.884	100.000	0.880	100.000	-
Bench Mark 2:	3/4" pipe	1.002	99.878	0.988	99.878	-
Top of Ice:						
Water Level:		3.254	97.626	3.242	97.624	97.625
Transducer Reading:		0.331	97.295	0.331	97.293	97.294
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	CM	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S44 - Pierre River near Ft. MacKay

UTM Location: 460775 E, 6369400 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.20	0.00	0.00	0.000	0.000	0.000	1.0	0.20	0.30	0.10	0.01	0.000	0.000	0.00	0.000	0%
1	0.40	0.04		-0.001			1.0	0.30	0.50	0.20	0.04	-0.001	-0.001	0.01	0.000	0%
2	0.60	0.10		0.053			1.0	0.50	0.70	0.20	0.10	0.053	0.053	0.02	0.001	1%
3	0.80	0.11		0.023			1.0	0.70	0.90	0.20	0.11	0.023	0.023	0.02	0.001	1%
4	1.00	0.08		0.145			1.0	0.90	1.10	0.20	0.08	0.145	0.145	0.02	0.002	3%
5	1.20	0.08		0.124			1.0	1.10	1.30	0.20	0.08	0.124	0.124	0.02	0.002	2%
6	1.40	0.10		0.162			1.0	1.30	1.50	0.20	0.10	0.162	0.162	0.02	0.003	4%
7	1.60	0.10		0.166			1.0	1.50	1.70	0.20	0.10	0.166	0.166	0.02	0.003	4%
8	1.80	0.10		0.202			1.0	1.70	1.85	0.15	0.10	0.202	0.202	0.02	0.003	4%
9	1.90	0.14		0.193			1.0	1.85	1.95	0.10	0.14	0.193	0.193	0.01	0.003	3%
10	2.00	0.20		0.214			1.0	1.95	2.05	0.10	0.20	0.214	0.214	0.02	0.004	5%
11	2.10	0.26		0.199			1.0	2.05	2.15	0.10	0.26	0.199	0.199	0.03	0.005	6%
12	2.20	0.28		0.227			1.0	2.15	2.25	0.10	0.28	0.227	0.227	0.03	0.006	7%
13	2.30	0.28		0.253			1.0	2.25	2.35	0.10	0.28	0.253	0.253	0.03	0.007	8%
14	2.40	0.30		0.241			1.0	2.35	2.45	0.10	0.30	0.241	0.241	0.03	0.007	8%
15	2.50	0.30		0.233			1.0	2.45	2.55	0.10	0.30	0.233	0.233	0.03	0.007	8%
16	2.60	0.30		0.261			1.0	2.55	2.65	0.10	0.30	0.261	0.261	0.03	0.008	9%
17	2.70	0.33		0.217			1.0	2.65	2.75	0.10	0.33	0.217	0.217	0.03	0.007	8%
18	2.80	0.30		0.162			1.0	2.75	2.85	0.10	0.30	0.162	0.162	0.03	0.005	6%
19	2.90	0.26		0.113			1.0	2.85	2.95	0.10	0.26	0.113	0.113	0.03	0.003	3%
20	3.00	0.24		0.111			1.0	2.95	3.10	0.15	0.24	0.111	0.111	0.04	0.004	5%
21	3.20	0.20		0.080			1.0	3.10	3.35	0.25	0.20	0.080	0.080	0.05	0.004	5%
LB	3.50	0.00	0.00	0.000	0.000	0.000	1.0	3.25	3.50	0.25	0.06	0.020	0.020	0.02	0.000	0%
Total Flow														0.086		

Measurement Details:

Start Time (MST):	12:35
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Clear, 4 C

Flow characteristics:

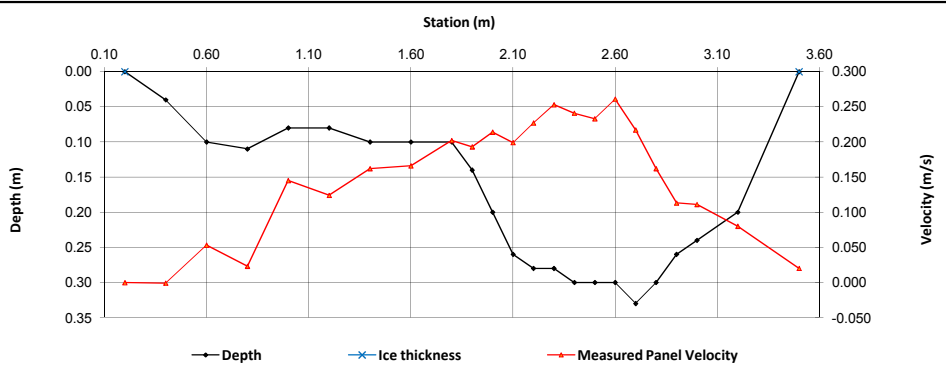
Total Flow:	0.086	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	0.53	(m ²)
Wetted Width:	3.30	(m)
Hydraulic Depth:	0.162	(m)
Mean Velocity:	0.162	(m/s)
Froude Number:	0.128	

Datalogger Details:

	Before	After
Transducer Reading:		0.357
Battery (Main):	13.2	
Battery (Aux):	-	
Datalogger Clock:	12:44	
Laptop Clock:	12:44	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.1	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

CR800, PLS and Batt removed



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	Nail in logger tree root		100.000		100.000	-
Bench Mark 2:	3/4" pipe	0.814	99.878	0.800	99.878	-
Top of Ice:						
Water Level:		3.046	97.646	3.030	97.648	97.647
Transducer Reading:		0.357	97.289	0.357	97.291	97.290
Other:						

General Notes:

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	24-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: January 18, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	6.00	0.00		0.000	0.000	0.000	0.9	6.00	7.50	1.50	0.14	0.069	0.062	0.21	0.013	1%
1	9.00	0.92	0.35	0.276			0.9	7.50	9.60	2.10	0.57	0.276	0.248	1.20	0.297	19%
2	10.20	0.88	0.35	0.306			0.9	9.60	10.40	0.80	0.53	0.306	0.275	0.42	0.117	7%
3	10.60	0.84	0.42	0.180			0.9	10.40	10.80	0.40	0.42	0.180	0.162	0.17	0.027	2%
4	11.00	0.82	0.45	0.077			0.9	10.80	11.30	0.50	0.37	0.077	0.069	0.19	0.013	1%
5	11.60	0.75	0.45	0.023			0.9	11.30	12.05	0.75	0.30	0.023	0.021	0.23	0.005	0%
6	12.50	0.89	0.45	0.061			0.9	12.05	12.85	0.80	0.44	0.061	0.055	0.35	0.019	1%
7	13.20	0.92	0.45	0.112			0.9	12.85	13.50	0.65	0.47	0.112	0.101	0.31	0.031	2%
8	13.80	0.92	0.42	0.249			0.9	13.50	14.05	0.55	0.50	0.249	0.224	0.28	0.062	4%
9	14.30	0.88	0.43	0.191			0.9	14.05	14.75	0.70	0.45	0.191	0.172	0.32	0.054	3%
10	15.20	0.79	0.41	0.266			0.9	14.75	15.50	0.75	0.38	0.266	0.239	0.29	0.068	4%
11	15.80	0.75	0.41	0.230			0.9	15.50	16.00	0.50	0.34	0.230	0.207	0.17	0.035	2%
12	16.20	0.78	0.37	0.286			0.9	16.00	16.60	0.60	0.41	0.286	0.257	0.25	0.063	4%
13	17.00	0.77	0.36	0.309			0.9	16.60	17.30	0.70	0.41	0.309	0.278	0.29	0.080	5%
14	17.60	0.80	0.33	0.213			0.9	17.30	18.05	0.75	0.47	0.213	0.192	0.35	0.068	4%
15	18.50	0.82	0.33	0.366			0.9	18.05	18.85	0.80	0.49	0.366	0.329	0.39	0.129	8%
16	19.20	0.82	0.33	0.226			0.9	18.85	19.65	0.80	0.49	0.226	0.203	0.39	0.080	5%
17	20.10	0.82	0.38	0.341			0.9	19.65	20.50	0.85	0.44	0.341	0.307	0.37	0.115	7%
18	20.90	0.79	0.48	0.248			0.9	20.50	21.35	0.85	0.31	0.248	0.223	0.26	0.059	4%
19	21.80	0.88	0.45	0.387			0.9	21.35	22.90	1.55	0.43	0.387	0.348	0.67	0.232	15%
Left	24.00	0.00		0.000	0.000	0.000	1.0	22.90	24.00	1.10	0.11	0.097	0.097	0.12	0.011	1%
Total Flow														1.578		

Measurement Details:

Start Time (MST):	14:00
End Time (MST):	15:15
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Poor
Weather:	Clear, -30°C

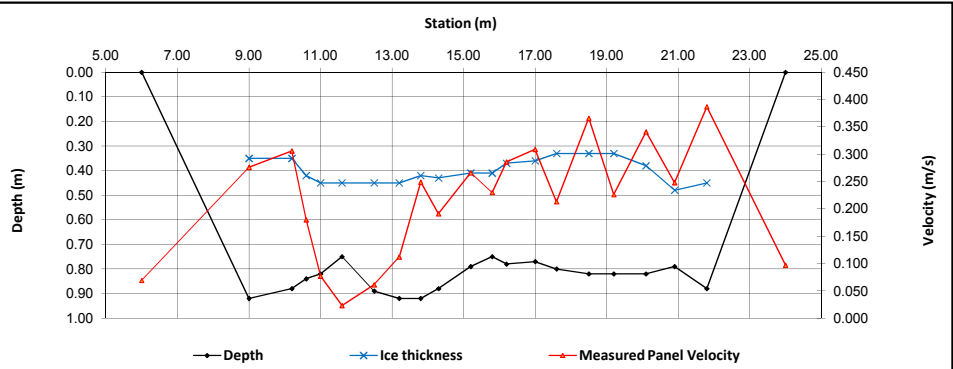
Flow characteristics:

Total Flow:	1.578	(m ³ /s)
Perceived Measurement Quality:	Poor	
Cross Section Area:	7.21	(m ²)
Wetted Width:	18.00	(m)
Hydraulic Depth:	0.400	(m)
Mean Velocity:	0.219	(m/s)
Froude Number:	0.111	

Datalogger Details:

	Before	After
Transducer Reading:		0.876
Battery (Main):	15.3	
Battery (Aux):	-	
Datalogger Clock:	14:15	
Laptop Clock:	14:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.0	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe	0.805	100.000	0.798	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.755	101.161	0.749	101.161	-
Top of Ice:		2.898	97.907	2.890	97.908	97.908
Water Level:		2.942	97.863	2.935	97.863	97.863
Transducer Reading:		0.876	96.987	0.876	96.987	96.987
Other:						

General Notes:

Field Personnel:	DB, JO	Trip Date:	18-Jan-11
Data Entry Personnel:	CM	Date:	25-Mar-11
Data Check Personnel:	DB	Date:	5-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: February 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0.00	0.00	0.00	0.000	0.000	0.000	0.9	0.00	1.10	1.10	0.05	0.001	0.001	0.05	0.000	0%
1	2.20	0.53	0.35	0.005			0.9	1.10	2.65	1.55	0.18	0.005	0.005	0.28	0.001	0%
2	3.10	0.53	0.36	0.024			0.9	2.65	3.55	0.90	0.17	0.024	0.022	0.15	0.003	0%
3	4.00	0.60	0.36	0.033			0.9	3.55	4.43	0.88	0.24	0.033	0.030	0.21	0.006	0%
4	4.85	0.61	0.34	0.080			0.9	4.43	5.30	0.88	0.27	0.080	0.072	0.24	0.017	1%
5	5.75	0.67	0.36	0.123			0.9	5.30	6.38	1.08	0.31	0.123	0.111	0.33	0.037	2%
6	7.00	0.86	0.41	0.175			0.9	6.38	7.50	1.13	0.45	0.175	0.158	0.51	0.080	5%
7	8.00	0.96	0.42	0.205			0.9	7.50	8.58	1.08	0.54	0.205	0.185	0.58	0.107	6%
8	9.15	1.00	0.40	0.183			0.9	8.58	9.65	1.08	0.60	0.183	0.165	0.65	0.106	6%
9	10.15	1.06	0.39	0.217			0.9	9.65	10.60	0.95	0.67	0.217	0.195	0.64	0.124	7%
10	11.05	1.19	0.43	0.241			0.9	10.60	11.48	0.88	0.76	0.241	0.217	0.67	0.144	9%
11	11.90	1.26	0.42		0.241	0.277	1.0	11.48	12.40	0.92	0.84	0.259	0.259	0.78	0.201	12%
12	12.90	1.38	0.41		0.191	0.263	1.0	12.40	13.33	0.92	0.97	0.227	0.227	0.90	0.204	12%
13	13.75	1.49	0.40		0.199	0.206	1.0	13.33	14.18	0.85	1.09	0.203	0.203	0.93	0.188	11%
14	14.60	1.69	0.40		0.158	0.170	1.0	14.18	15.10	0.92	1.29	0.164	0.164	1.19	0.196	12%
15	15.60	1.71	0.42		0.105	0.109	1.0	15.10	16.10	1.00	1.29	0.107	0.107	1.29	0.138	8%
16	16.60	1.38	0.36		0.071	0.075	1.0	16.10	17.08	0.98	1.02	0.073	0.073	0.99	0.073	4%
17	17.55	1.21	0.42		0.048	0.052	1.0	17.08	18.00	0.92	0.79	0.050	0.050	0.73	0.037	2%
18	18.45	1.05	0.45	0.027			0.9	18.00	18.93	0.92	0.60	0.027	0.024	0.55	0.013	1%
19	19.40	0.87	0.40	0.009			0.9	18.93	20.20	1.28	0.47	0.009	0.008	0.60	0.005	0%
20	21.00	0.52	0.43	0.001			0.9	20.20	21.50	1.30	0.09	0.001	0.001	0.12	0.000	0%
Right	22.00	0.00	0.00	0.000	0.000	0.000	1.0	21.50	22.00	0.50	0.02	0.000	0.000	0.01	0.000	0%
Total Flow															1.680	

Measurement Details:

Start Time (MST):	14:30
End Time (MST):	15:56
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear

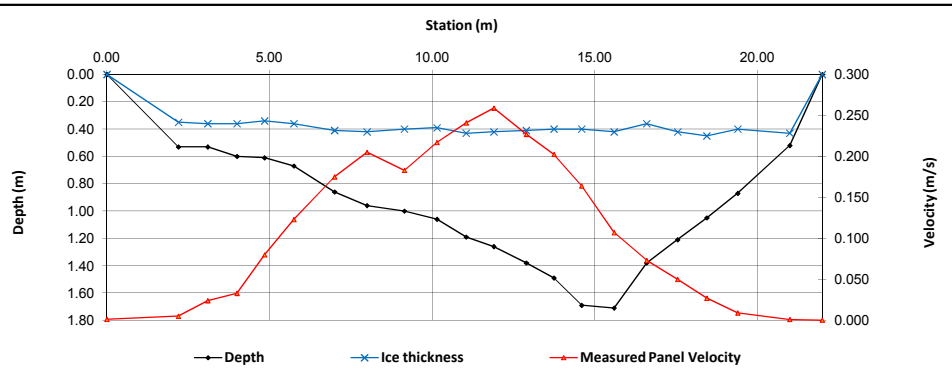
Flow characteristics:

Total Flow:	1.680	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	12.39	(m ²)
Wetted Width:	22.00	(m)
Hydraulic Depth:	0.563	(m)
Mean Velocity:	0.136	(m/s)
Froude Number:	0.058	

Datalogger Details:

	Before	After
Transducer Reading:		0.807
Battery (Main):	14.9	
Battery (Aux):	-	
Datalogger Clock:	14:57	
Laptop Clock:	14:57	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.0	
Memory Used:	-	
Dessicant:	Good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe	1.009	100.000	0.963	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.964	101.161	0.918	101.161	-
Top of Ice:		3.017	97.992	2.969	97.994	97.993
Water Level:		3.222	97.787	3.173	97.790	97.789
Transducer Reading:		0.807	96.980	0.807	96.983	96.982
Other:						

General Notes:

Field Personnel:	SG, BL	Trip Date:	13-Feb-11
Data Entry Personnel:	CM	Date:	24-Mar-11
Data Check Personnel:	DB	Date:	4-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: March 8, 2011



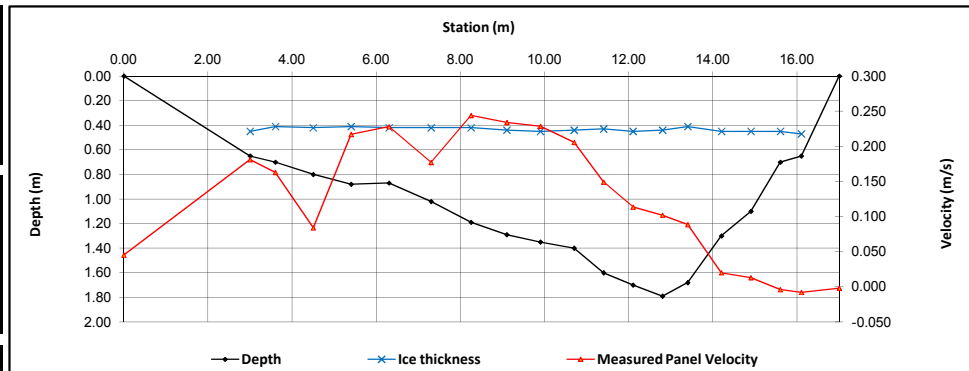
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.00	0.00		0.000	0.000	0.000	0.9	0.00	1.50	1.50	0.05	0.045	0.041	0.07	0.003	0%
1	3.00	0.65	0.45	0.181			0.9	1.50	3.30	1.80	0.20	0.181	0.163	0.36	0.059	4%
2	3.60	0.70	0.41	0.163			0.9	3.30	4.05	0.75	0.29	0.163	0.147	0.22	0.032	2%
3	4.50	0.80	0.42	0.084			0.9	4.05	4.95	0.90	0.38	0.084	0.076	0.34	0.026	2%
4	5.40	0.88	0.41	0.217			0.9	4.95	5.85	0.90	0.47	0.217	0.195	0.42	0.083	6%
5	6.30	0.87	0.42	0.228			0.9	5.85	6.80	0.95	0.45	0.228	0.205	0.43	0.088	6%
6	7.30	1.02	0.42	0.177			0.9	6.80	7.78	0.98	0.60	0.177	0.159	0.59	0.093	7%
7	8.25	1.19	0.42	0.244			0.9	7.78	8.68	0.90	0.77	0.244	0.220	0.69	0.152	11%
8	9.10	1.29	0.44		0.231	0.237	1.0	8.68	9.50	0.82	0.85	0.234	0.234	0.70	0.164	12%
9	9.90	1.35	0.45		0.190	0.267	1.0	9.50	10.30	0.80	0.90	0.229	0.229	0.72	0.165	12%
10	10.70	1.40	0.44		0.226	0.185	1.0	10.30	11.05	0.75	0.96	0.206	0.206	0.72	0.148	10%
11	11.40	1.60	0.43		0.152	0.146	1.0	11.05	11.75	0.70	1.17	0.149	0.149	0.82	0.122	9%
12	12.10	1.70	0.45		0.101	0.126	1.0	12.45	12.45	0.70	1.25	0.114	0.114	0.87	0.099	7%
13	12.80	1.79	0.44		0.078	0.126	1.0	12.45	13.10	0.65	1.35	0.102	0.102	0.88	0.090	6%
14	13.40	1.68	0.41		0.092	0.085	1.0	13.10	13.80	0.70	1.27	0.089	0.089	0.89	0.079	6%
15	14.20	1.30	0.45		0.034	0.006	1.0	13.80	14.55	0.75	0.85	0.020	0.020	0.64	0.013	1%
16	14.90	1.10	0.45	0.013			0.9	14.55	15.25	0.70	0.65	0.013	0.012	0.46	0.005	0%
17	15.60	0.70	0.45	-0.004			0.9	15.25	15.85	0.60	0.25	-0.004	-0.004	0.15	-0.001	0%
18	16.10	0.65	0.47	-0.008			0.9	15.85	16.55	0.70	0.18	-0.008	-0.007	0.13	-0.001	0%
Right	17.00	0.00		0.000	0.000	0.000	1.0	16.55	17.00	0.45	0.05	-0.002	-0.002	0.02	0.000	0%
Total Flow															1.418	

Measurement Details:	
Start Time (MST):	15:19
End Time (MST):	16:40
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Clear

Flow characteristics:		
Total Flow:	1.418	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	10.11	(m ²)
Wetted Width:	17.00	(m)
Hydraulic Depth:	0.595	(m)
Mean Velocity:	0.140	(m/s)
Froude Number:	0.058	

Datalogger Details:		
Transducer Reading:	Before	After
Battery (Main):	14.8	
Battery (Aux):	-	
Datalogger Clock:	15:24	
Laptop Clock:	15:23	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.0	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe					
Bench Mark 2:	Nail in stump on ledge					
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:
Survey aborted as stadia rod frozen.

Field Personnel:	JO, BL	Trip Date:	8-Mar-11
Data Entry Personnel:	CM	Date:	22-Mar-11
Data Check Personnel:	DB	Date:	6-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: March 31, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	5.00	0.00	0.00	0.000	0.000	0.000	0.9	5.00	5.60	0.60	0.04	0.035	0.031	0.03	0.001	0%
1	6.20	0.91	0.74	0.139			0.9	5.60	6.80	1.20	0.17	0.139	0.125	0.20	0.026	1%
2	7.40	1.06	0.75	0.179			0.9	6.80	8.05	1.25	0.31	0.179	0.161	0.39	0.062	4%
3	8.70	1.15	0.73	0.202			0.9	8.05	9.20	1.15	0.42	0.202	0.182	0.48	0.088	5%
4	9.70	1.23	0.75	0.220			0.9	9.20	10.15	0.95	0.48	0.220	0.198	0.46	0.090	5%
5	10.60	1.40	0.74	0.271			0.9	10.15	11.30	1.15	0.66	0.271	0.244	0.76	0.185	10%
6	12.00	1.42	0.74	0.312			0.9	11.30	12.50	1.20	0.68	0.312	0.281	0.82	0.229	13%
7	13.00	1.62	0.73		0.328	0.322	1.0	12.50	13.60	1.10	0.89	0.325	0.325	0.98	0.318	18%
8	14.20	1.82	0.74		0.179	0.329	1.0	13.60	14.90	1.30	1.08	0.254	0.254	1.40	0.357	20%
9	15.60	1.47	0.71		0.150	0.294	1.0	14.90	16.20	1.30	0.76	0.222	0.222	0.99	0.219	12%
10	16.80	1.21	0.68	0.078			0.9	16.20	17.30	1.10	0.53	0.078	0.070	0.58	0.041	2%
11	17.80	0.88	0.64	0.172			0.9	17.30	18.35	1.05	0.24	0.172	0.155	0.25	0.039	2%
12	18.90	0.92	0.58	0.167			0.9	18.35	19.40	1.05	0.34	0.167	0.150	0.36	0.054	3%
13	19.90	0.88	0.57	0.168			0.9	19.40	20.35	0.95	0.31	0.168	0.151	0.29	0.045	3%
14	20.80	0.92	0.59	0.054			0.9	20.35	21.40	1.05	0.33	0.054	0.049	0.35	0.017	1%
Right	22.00	0.00	0.00	0.000	0.000	0.000	1.0	21.40	22.00	0.60	0.06	0.014	0.014	0.05	0.001	0%
Total Flow															1.771	

Measurement Details:

Start Time (MST):	13:45
End Time (MST):	14:45
Equipment:	ADV
Method:	Ice
River Condition:	Ice
Quality/Error (see reverse):	Fair
Weather:	Partly cloudy, 6°C

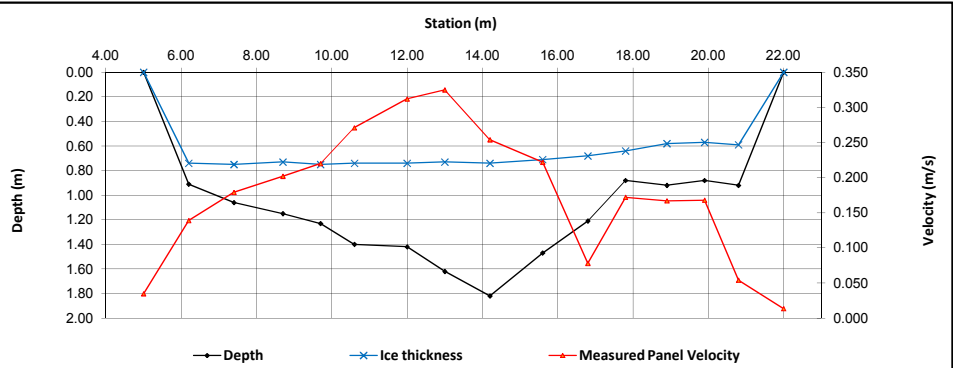
Flow characteristics:

Total Flow:	1.771	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	8.38	(m ²)
Wetted Width:	17.00	(m)
Hydraulic Depth:	0.493	(m)
Mean Velocity:	0.211	(m/s)
Froude Number:	0.096	

Datalogger Details:

	Before	After
Transducer Reading:		1.033
Battery (Main):	14.4	
Battery (Aux):	-	
Datalogger Clock:	12:45	
Laptop Clock:	12:45	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.0	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe	0.854	100.000	0.831	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.805	101.161	0.780	101.161	-
Top of Ice:		2.999	97.855	2.970	97.861	97.858
Water Level:		2.830	98.024	2.807	98.024	98.024
Transducer Reading:		1.033	96.991	1.033	96.991	96.991
Other:						

General Notes:

Field Personnel:	JO, SG	Trip Date:	31-Mar-11
Data Entry Personnel:	CM	Date:	7-Apr-11
Data Check Personnel:	DB	Date:	11-Apr-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: April 24, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	34.00	0.00		0.000	0.000	0.000	1.0	34.00	33.50	0.50	0.14	0.071	0.071	0.07	0.005	0%
1	33.00	0.54		0.285			1.0	33.50	32.50	1.00	0.54	0.285	0.285	0.54	0.154	5%
2	32.00	0.64		0.226			1.0	32.50	31.50	1.00	0.64	0.226	0.226	0.64	0.145	4%
3	31.00	0.66		0.116			1.0	31.50	30.50	1.00	0.66	0.116	0.116	0.66	0.077	2%
4	30.00	0.58		0.189			1.0	30.50	29.50	1.00	0.58	0.189	0.189	0.58	0.110	3%
5	29.00	0.51		0.330			1.0	29.50	28.50	1.00	0.51	0.330	0.330	0.51	0.168	5%
6	28.00	0.50		0.216			1.0	28.50	27.50	1.00	0.50	0.216	0.216	0.50	0.108	3%
7	27.00	0.32		0.357			1.0	27.50	26.50	1.00	0.32	0.357	0.357	0.32	0.114	4%
8	26.00	0.47		0.303			1.0	26.50	25.50	1.00	0.47	0.303	0.303	0.47	0.142	4%
9	25.00	0.49		0.323			1.0	25.50	24.50	1.00	0.49	0.323	0.323	0.49	0.158	5%
10	24.00	0.49		0.247			1.0	24.50	23.50	1.00	0.49	0.247	0.247	0.49	0.121	4%
11	23.00	0.50		0.132			1.0	23.50	22.50	1.00	0.50	0.132	0.132	0.50	0.066	2%
12	22.00	0.61		0.165			1.0	22.50	21.25	1.25	0.61	0.165	0.165	0.76	0.126	4%
13	20.50	0.60		0.091			1.0	21.25	19.25	2.00	0.60	0.091	0.091	1.20	0.109	3%
14	18.00	0.53		0.091			1.0	19.25	17.00	2.25	0.53	0.091	0.091	1.19	0.109	3%
15	16.00	0.55		0.025			1.0	17.00	15.00	2.00	0.55	0.025	0.025	1.10	0.028	1%
16	14.00	0.42		0.248			1.0	15.00	13.50	1.50	0.42	0.248	0.248	0.63	0.156	5%
17	13.00	0.38		0.273			1.0	13.50	12.25	1.25	0.38	0.273	0.273	0.48	0.130	4%
18	11.50	0.38		0.136			1.0	12.25	10.75	1.50	0.38	0.136	0.136	0.57	0.078	2%
19	10.00	0.42		0.170			1.0	10.75	9.25	1.50	0.42	0.170	0.170	0.63	0.107	3%
20	8.50	0.37		0.133			1.0	9.25	7.75	1.50	0.37	0.133	0.133	0.56	0.074	2%
21	7.00	0.33		0.229			1.0	7.75	6.25	1.50	0.33	0.229	0.229	0.50	0.113	3%
22	5.50	0.33		0.356			1.0	6.25	4.75	1.50	0.33	0.356	0.356	0.50	0.176	5%
23	4.00	0.40		0.378			1.0	4.75	3.50	1.25	0.40	0.378	0.378	0.50	0.189	6%
24	3.00	0.40		0.488			1.0	3.50	2.50	1.00	0.40	0.488	0.488	0.40	0.195	6%
25	2.00	0.43		0.408			1.0	2.50	1.50	1.00	0.43	0.408	0.408	0.43	0.175	5%
26	1.00	0.48		0.255			1.0	1.50	0.50	1.00	0.48	0.255	0.255	0.48	0.122	4%
Right	0.00	0.00		0.000	0.000	0.000	1.0	0.50	0.00	0.50	0.12	0.064	0.064	0.06	0.004	0%
Total Flow															3.259	

Measurement Details:

Start Time (MST):	13:50
End Time (MST):	15:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	-

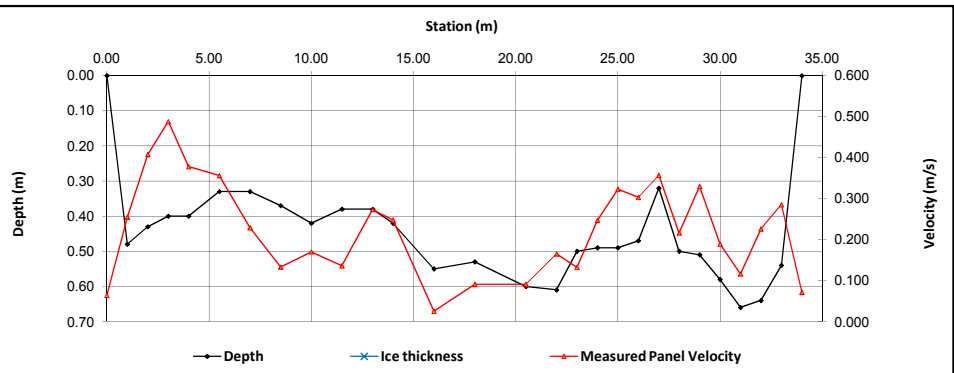
Flow characteristics:

Total Flow:	3.259	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	15.74	(m ²)
Wetted Width:	33.00	(m)
Hydraulic Depth:	0.477	(m)
Mean Velocity:	0.207	(m/s)
Froude Number:	0.096	

Datalogger Details:

	Before	After
Transducer Reading:		0.817
Battery (Main):	14.6	
Battery (Aux):	-	
Datalogger Clock:	13:56	
Laptop Clock:	13:57	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe	0.564	100.000	0.559	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.515	101.161	0.509	101.161	-
Top of Ice:						
Water Level:		2.747	97.817	2.740	97.819	97.818
Transducer Reading:		0.817	97.000	0.817	97.002	97.001
Other:						

General Notes:

Partial Ice in Channel

Field Personnel:	DB, SG	Trip Date:	24-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Eells River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: July-26,2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	9:00
End Time (MST):	10:00
Equipment:	-
Method:	-
River Condition:	Open
Quality/Error (see reverse):	-
Weather:	Partly Cloudy

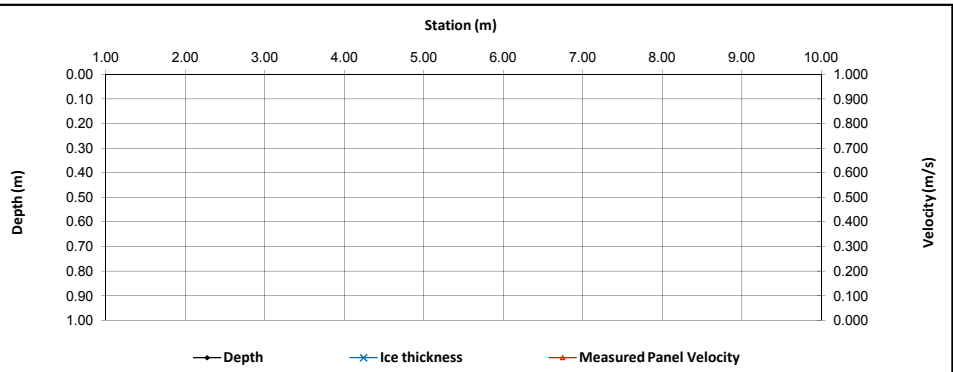
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:	0.97	1.00
Battery (Main):	14.3	14.2
Battery (Aux):	-	-
Datalogger Clock:	8:00	8:45
Laptop Clock:	8:01	8:46
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	18.4	18.7
Memory Used:	-	-
Dessicant:	-	Changed
Logger# (if Δ):	-	-
PT# (if Δ):	-	-

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe					
Bench Mark 2:	Nail in stump on ledge					
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:

This trip was only made to check on station status after recent fires, and to change PLS transducer now due for biannual calibration.

Field Personnel:	DB SM	Trip Date:	26-Jul-11
Data Entry Personnel:	DB	Date:	8-Aug-11
Data Check Personnel:	JP	Date:	26-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Ells River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: August 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
RB	26.20	0.00	0.00	0.000	0.000	0.000	1.0	26.20	25.85	0.35	0.18	0.093	0.093	0.06	0.006	0%
1	25.50	0.70		0.373			1.0	25.85	25.00	0.85	0.70	0.373	0.373	0.60	0.222	3%
2	24.50	0.73		0.583			1.0	25.00	24.00	1.00	0.73	0.583	0.583	0.73	0.426	5%
3	23.50	0.69		0.698			1.0	24.00	23.00	1.00	0.69	0.698	0.698	0.69	0.482	6%
4	22.50	0.74		0.696			1.0	23.00	22.00	1.00	0.74	0.696	0.696	0.74	0.515	6%
5	21.50	0.85			0.499	0.772	1.0	22.00	21.00	1.00	0.85	0.636	0.636	0.85	0.540	6%
6	20.50	0.76			0.416	0.814	1.0	21.00	20.00	1.00	0.76	0.615	0.615	0.76	0.467	6%
7	19.50	0.72		0.597			1.0	20.00	19.00	1.00	0.72	0.597	0.597	0.72	0.430	5%
8	18.50	0.64		0.610			1.0	19.00	18.00	1.00	0.64	0.610	0.610	0.64	0.390	5%
9	17.50	0.61		0.709			1.0	18.00	16.75	1.25	0.61	0.709	0.709	0.76	0.541	6%
10	16.00	0.50		0.609			1.0	16.75	15.25	1.50	0.50	0.609	0.609	0.75	0.457	5%
11	14.50	0.40		0.736			1.0	15.25	13.75	1.50	0.40	0.736	0.736	0.60	0.442	5%
12	13.00	0.50		0.752			1.0	13.75	12.25	1.50	0.50	0.752	0.752	0.75	0.564	7%
13	11.50	0.48		0.746			1.0	12.25	10.75	1.50	0.48	0.746	0.746	0.72	0.537	6%
14	10.00	0.43		0.851			1.0	10.75	9.25	1.50	0.43	0.851	0.851	0.65	0.549	7%
15	8.50	0.38		0.898			1.0	9.25	8.00	1.25	0.38	0.898	0.898	0.48	0.427	5%
16	7.50	0.34		0.839			1.0	8.00	7.00	1.00	0.34	0.839	0.839	0.34	0.285	3%
17	6.50	0.40		0.868			1.0	7.00	6.00	1.00	0.40	0.868	0.868	0.40	0.347	4%
18	5.50	0.48		0.532			1.0	6.00	4.75	1.25	0.48	0.532	0.532	0.60	0.319	4%
19	4.00	0.53		0.233			1.0	4.75	3.25	1.50	0.53	0.233	0.233	0.80	0.185	2%
20	2.50	0.54		0.252			1.0	3.25	1.85	1.40	0.54	0.252	0.252	0.76	0.191	2%
21	1.20	0.32		0.193			1.0	1.85	0.10	1.75	0.32	0.193	0.193	0.56	0.108	1%
LB	-1.00	0.00	0.00	0.000	0.000	0.000	1.0	0.10	-1.00	1.10	0.08	0.048	0.048	0.09	0.004	0%

Total Flow 8.433

Measurement Details:

Start Time (MST):	7:07
End Time (MST):	8:23
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, Rain

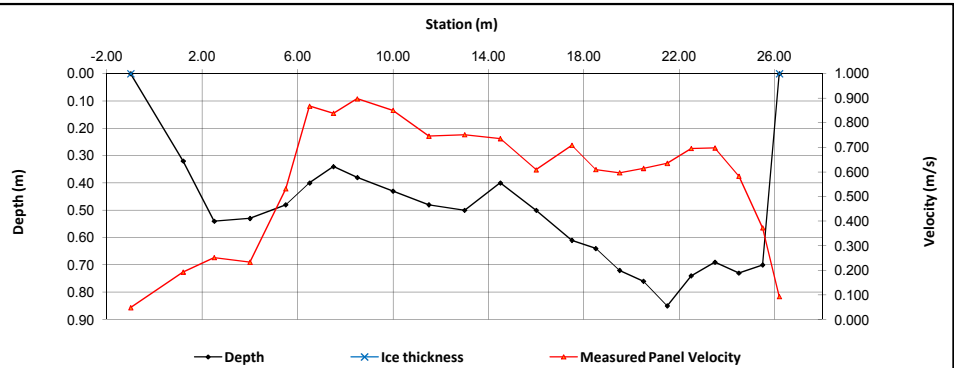
Flow characteristics:

Total Flow:	8.433	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	14.03	(m ²)
Wetted Width:	25.75	(m)
Hydraulic Depth:	0.545	(m)
Mean Velocity:	0.601	(m/s)
Froude Number:	0.260	

Datalogger Details:

	Before	After
Transducer Reading:		0.9
Battery (Main):	13.0	
Battery (Aux):	-	
Datalogger Clock:	7:08	
Laptop Clock:	7:09	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	18.3	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" pipe	0.785	100.000	0.775	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.733	101.161	0.725	101.161	-
Top of Ice:						
Water Level:		2.916	97.869	2.910	97.865	97.867
Transducer Reading:		0.900	96.969	0.900	96.965	96.967
Other:						

General Notes:

TSS at 4m

Field Personnel:	DB, KW	Trip Date:	15-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: September 15, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
RB	1.00	0.00	0.00	0.000	0.000	0.000	1.0	1.00	1.25	0.25	0.15	0.062	0.062	0.04	0.002	0%
1	1.50	0.58		0.246			1.0	1.25	1.75	0.50	0.58	0.246	0.246	0.29	0.071	2%
2	2.00	0.46		0.496			1.0	1.75	2.25	0.50	0.46	0.496	0.496	0.23	0.114	4%
3	2.50	0.82			0.302	0.494	1.0	2.25	2.75	0.50	0.82	0.398	0.398	0.41	0.163	5%
4	3.00	0.84			0.108	0.556	1.0	2.75	3.25	0.50	0.84	0.332	0.332	0.42	0.139	5%
5	3.50	0.78			0.256	0.529	1.0	3.25	3.75	0.50	0.78	0.393	0.393	0.39	0.153	5%
6	4.00	0.70		0.362			1.0	3.75	4.25	0.50	0.70	0.362	0.362	0.35	0.127	4%
7	4.50	0.73		0.400			1.0	4.25	4.75	0.50	0.73	0.400	0.400	0.37	0.146	5%
8	5.00	0.72		0.506			1.0	4.75	5.25	0.50	0.72	0.506	0.506	0.36	0.182	6%
9	5.50	0.71		0.352			1.0	5.25	5.75	0.50	0.71	0.352	0.352	0.36	0.125	4%
10	6.00	0.56		0.485			1.0	5.75	6.50	0.75	0.56	0.485	0.485	0.42	0.204	7%
11	7.00	0.54		0.377			1.0	6.50	7.50	1.00	0.54	0.377	0.377	0.54	0.204	7%
12	8.00	0.52		0.337			1.0	7.50	8.50	1.00	0.52	0.337	0.337	0.52	0.175	6%
13	9.00	0.52		0.465			1.0	8.50	9.50	1.00	0.52	0.465	0.465	0.52	0.242	8%
14	10.00	0.56		0.188			1.0	9.50	10.50	1.00	0.56	0.188	0.188	0.56	0.105	4%
15	11.00	0.50		0.272			1.0	10.50	11.50	1.00	0.50	0.272	0.272	0.50	0.136	5%
16	12.00	0.43		0.233			1.0	11.50	12.50	1.00	0.43	0.233	0.233	0.43	0.100	3%
17	13.00	0.50		0.314			1.0	12.50	13.50	1.00	0.50	0.314	0.314	0.50	0.157	5%
18	14.00	0.51		0.179			1.0	13.50	14.50	1.00	0.51	0.179	0.179	0.51	0.091	3%
19	15.00	0.54		0.153			1.0	14.50	15.50	1.00	0.54	0.153	0.153	0.54	0.083	3%
20	16.00	0.53		0.182			1.0	15.50	16.50	1.00	0.53	0.182	0.182	0.53	0.096	3%
21	17.00	0.50		0.110			1.0	16.50	17.50	1.00	0.50	0.110	0.110	0.50	0.055	2%
22	18.00	0.45		0.157			1.0	17.50	18.50	1.00	0.45	0.157	0.157	0.45	0.071	2%
23	19.00	0.40		0.103			1.0	18.50	19.50	1.00	0.40	0.103	0.103	0.40	0.041	1%
24	20.00	0.27		0.072			1.0	19.50	20.50	1.00	0.27	0.072	0.072	0.27	0.019	1%
LB	21.00	0.00	0.00	0.000	0.000	0.000	1.0	20.50	21.00	0.50	0.07	0.018	0.018	0.03	0.001	0%
Total Flow															3.003	

Measurement Details:

Start Time (MST):	16:00
End Time (MST):	16:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Sunny, 15°C

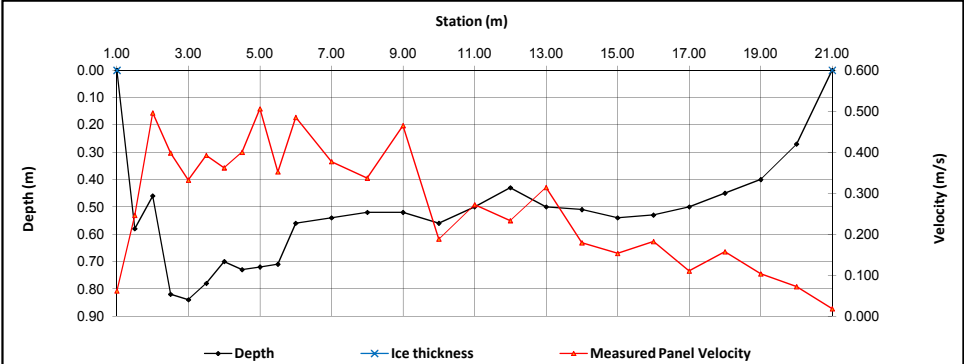
Flow characteristics:

Total Flow:	3.003	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	10.43	(m ²)
Wetted Width:	20.00	(m)
Hydraulic Depth:	0.522	(m)
Mean Velocity:	0.288	(m/s)
Froude Number:	0.127	

Datalogger Details:

	Before	After
Transducer Reading:		0.672
Battery (Main):	14.2	
Battery (Aux):	-	
Datalogger Clock:	16:04	
Laptop Clock:	16:04	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	10.8	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe	0.786	100.000	0.771	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.735	101.161	0.723	101.161	-
Top of Ice:						
Water Level:		3.140	97.646	3.126	97.645	97.646
Transducer Reading:		0.672	96.974	0.672	96.973	96.974
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	15-Sep-11
Data Entry Personnel:	CM	Date:	27-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Elys River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: October 28, 2011



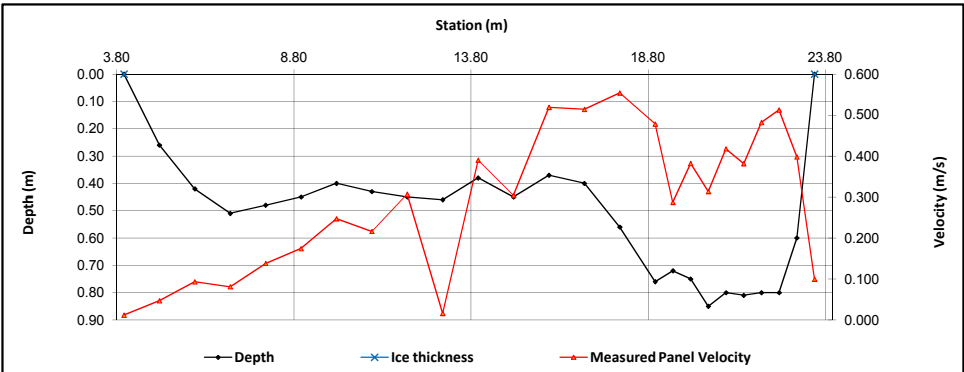
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	4.00	0.00	0.00	0.000	0.000	0.000	1.0	4.00	4.50	0.50	0.07	0.012	0.012	0.03	0.000	0%
1	5.00	0.26		0.047			1.0	4.50	5.50	1.00	0.26	0.047	0.047	0.26	0.012	0%
2	6.00	0.42		0.093			1.0	5.50	6.50	1.00	0.42	0.093	0.093	0.42	0.039	1%
3	7.00	0.51		0.081			1.0	6.50	7.50	1.00	0.51	0.081	0.081	0.51	0.041	1%
4	8.00	0.48		0.138			1.0	7.50	8.50	1.00	0.48	0.138	0.138	0.48	0.066	2%
5	9.00	0.45		0.174			1.0	8.50	9.50	1.00	0.45	0.174	0.174	0.45	0.078	3%
6	10.00	0.40		0.247			1.0	9.50	10.50	1.00	0.40	0.247	0.247	0.40	0.099	3%
7	11.00	0.43		0.216			1.0	10.50	11.50	1.00	0.43	0.216	0.216	0.43	0.093	3%
8	12.00	0.45		0.307			1.0	11.50	12.50	1.00	0.45	0.307	0.307	0.45	0.138	5%
9	13.00	0.46		0.016			1.0	12.50	13.50	1.00	0.46	0.016	0.016	0.46	0.007	0%
10	14.00	0.38		0.390			1.0	13.50	14.50	1.00	0.38	0.390	0.390	0.38	0.148	5%
11	15.00	0.45		0.304			1.0	14.50	15.50	1.00	0.45	0.304	0.304	0.45	0.137	4%
12	16.00	0.37		0.519			1.0	15.50	16.50	1.00	0.37	0.519	0.519	0.37	0.192	6%
13	17.00	0.40		0.514			1.0	16.50	17.50	1.00	0.40	0.514	0.514	0.40	0.206	7%
14	18.00	0.56		0.554			1.0	17.50	18.50	1.00	0.56	0.554	0.554	0.56	0.310	10%
15	19.00	0.76			0.294	0.662	1.0	18.50	19.25	0.75	0.76	0.478	0.478	0.57	0.272	9%
16	19.50	0.72		0.287			1.0	19.25	19.75	0.50	0.72	0.287	0.287	0.36	0.103	3%
17	20.00	0.75			0.021	0.743	1.0	19.75	20.25	0.50	0.75	0.382	0.382	0.38	0.143	5%
18	20.50	0.85			-0.032	0.659	1.0	20.25	20.75	0.50	0.85	0.314	0.314	0.43	0.133	4%
19	21.00	0.80		0.161	0.674		1.0	20.75	21.25	0.50	0.80	0.418	0.418	0.40	0.167	5%
20	21.50	0.81			0.336	0.427	1.0	21.25	21.75	0.50	0.81	0.382	0.382	0.41	0.155	5%
21	22.00	0.80			0.321	0.643	1.0	21.75	22.25	0.50	0.80	0.482	0.482	0.40	0.193	6%
22	22.50	0.80			0.432	0.593	1.0	22.25	22.75	0.50	0.80	0.513	0.513	0.40	0.205	7%
23	23.00	0.60		0.398			1.0	22.75	23.25	0.50	0.60	0.398	0.398	0.30	0.119	4%
RB	23.50	0.00	0.00	0.000	0.000	0.000	1.0	23.25	23.50	0.25	0.15	0.100	0.100	0.04	0.004	0%
Total Flow															3.062	

Measurement Details:	
Start Time (MST):	15:50
End Time (MST):	17:00
Equipment:	ADV
Method:	Wading
River Condition:	Low, Open
Quality/Error (see reverse):	Good
Weather:	Clear, Calm, 2°C

Flow characteristics:		
Total Flow:	3.062	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	9.73	(m ²)
Wetted Width:	19.50	(m)
Hydraulic Depth:	0.499	(m)
Mean Velocity:	0.315	(m/s)
Froude Number:	0.142	

Datalogger Details:		
	Before	After
Transducer Reading:		0.668
Battery (Main):	14.1	
Battery (Aux):	-	
Datalogger Clock:	15:15	
Laptop Clock:	15:16	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.4	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:
 PLS cable was pulled from logger box, cable was reconnected and is operating.



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe	0.614	100.000	0.594	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.565	101.161	0.545	101.161	-
Top of Ice:						
Water Level:		2.967	97.647	2.946	97.648	97.648
Transducer Reading:		0.668	96.979	0.668	96.980	96.980
Other:						

General Notes:
BM Heights
 BM1: 0.6m

Field Personnel:	DW, SM	Trip Date:	28-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S45 - Eells River above Joslyn Creek Diversion

UTM Location: 440605 E, 6342459 N

Site Visit Date: December 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
L	6.50	0.00		0.000	0.000	0.000	1.0	6.50	6.98	0.48	0.02	0.083	0.083	0.01	0.001	0%
1	7.45	0.34	0.25	0.330			1.0	6.98	7.80	0.83	0.09	0.330	0.330	0.07	0.025	1%
2	8.15	0.43	0.28	0.270			1.0	7.80	8.53	0.73	0.15	0.270	0.270	0.11	0.029	2%
3	8.90	0.51	0.28	0.110			1.0	8.53	9.30	0.78	0.23	0.110	0.110	0.18	0.020	1%
4	9.70	0.59	0.29	0.120			1.0	9.30	10.15	0.85	0.30	0.120	0.120	0.25	0.031	2%
5	10.60	0.63	0.29	0.130			1.0	10.15	10.95	0.80	0.34	0.130	0.130	0.27	0.035	2%
6	11.30	0.72	0.27	0.150			1.0	10.95	11.70	0.75	0.45	0.150	0.150	0.34	0.051	3%
7	12.10	0.78	0.28	0.150			1.0	11.70	12.55	0.85	0.50	0.150	0.150	0.43	0.064	4%
8	13.00	0.88	0.28	0.160			1.0	12.55	13.45	0.90	0.60	0.160	0.160	0.54	0.086	5%
9	13.90	1.00	0.27	0.170			1.0	13.45	14.35	0.90	0.73	0.170	0.170	0.66	0.112	7%
10	14.80	1.10	0.27		0.200	0.200	1.0	14.35	15.25	0.90	0.83	0.200	0.200	0.75	0.149	9%
11	15.70	1.10	0.27		0.230	0.240	1.0	15.25	16.00	0.75	0.83	0.235	0.235	0.62	0.146	9%
12	16.30	1.12	0.27		0.240	0.250	1.0	16.00	16.75	0.75	0.85	0.245	0.245	0.64	0.156	9%
13	17.20	1.32	0.28		0.240	0.230	1.0	16.75	17.60	0.85	1.04	0.235	0.235	0.88	0.208	13%
14	18.00	1.32	0.30		0.170	0.230	1.0	17.60	18.40	0.80	1.02	0.200	0.200	0.82	0.163	10%
15	18.80	1.38	0.32		0.190	0.210	1.0	18.40	19.20	0.80	1.06	0.200	0.200	0.85	0.170	10%
16	19.60	1.16	0.33		0.110	0.170	1.0	19.20	19.93	0.72	0.83	0.140	0.140	0.60	0.084	5%
17	20.25	0.79	0.35	0.130			1.0	19.93	20.68	0.75	0.44	0.130	0.130	0.33	0.043	3%
18	21.10	0.60	0.35	0.030			1.0	20.68	21.60	0.93	0.25	0.030	0.030	0.23	0.007	0%
19	22.10	0.61	0.35	0.140			1.0	21.60	22.55	0.95	0.26	0.140	0.140	0.25	0.035	2%
20	23.00	0.61	0.34	0.110			1.0	22.55	23.45	0.90	0.27	0.110	0.110	0.24	0.027	2%
21	23.90	0.59	0.34	0.040			1.0	23.45	24.20	0.75	0.25	0.040	0.040	0.19	0.008	0%
R	24.50	0.00		0.000	0.000	0.000	1.0	24.20	24.50	0.30	0.06	0.010	0.010	0.02	0.000	0%

Total Flow 1.648

Measurement Details:

Start Time (MST):	13:05
End Time (MST):	13:50
Equipment:	Marsh
Method:	ICE
River Condition:	ICE
Quality/Error (see reverse):	Good
Weather:	Clear, Calm, -6C

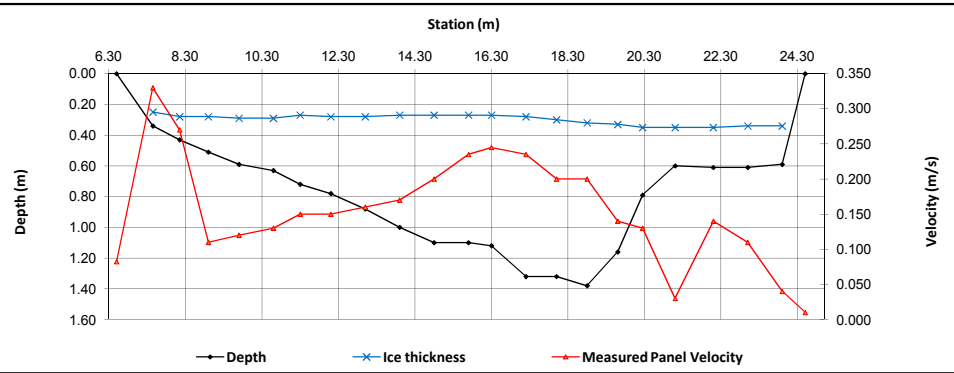
Flow characteristics:

Total Flow:	1.648	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	9.27	(m ²)
Wetted Width:	18.00	(m)
Hydraulic Depth:	0.515	(m)
Mean Velocity:	0.178	(m/s)
Froude Number:	0.079	

Datalogger Details:

	Before	After
Transducer Reading:		0.727
Battery (Main):	14.4	
Battery (Aux):	-	
Datalogger Clock:	13:13	
Laptop Clock:	13:15	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" pipe	0.805	100.000	0.797	100.000	-
Bench Mark 2:	Nail in stump on ledge	0.756	101.161	0.747	101.161	-
Top of Ice:		3.082	97.723	3.073	97.724	97.724
Water Level:		3.107	97.698	3.101	97.696	97.697
Transducer Reading:		0.727	96.971	0.727	96.969	96.970
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	3-Dec-11
Data Entry Personnel:	DW	Date:	5-Dec-11
Data Check Personnel:	SG	Date:	15-Dec-11

Hydrometric Measurement / Site Visit Record

Site: S46 - Athabasca River above the Delta

UTM Location: 470235 E, 6463205 N

Site Visit Date: July 25, 2011



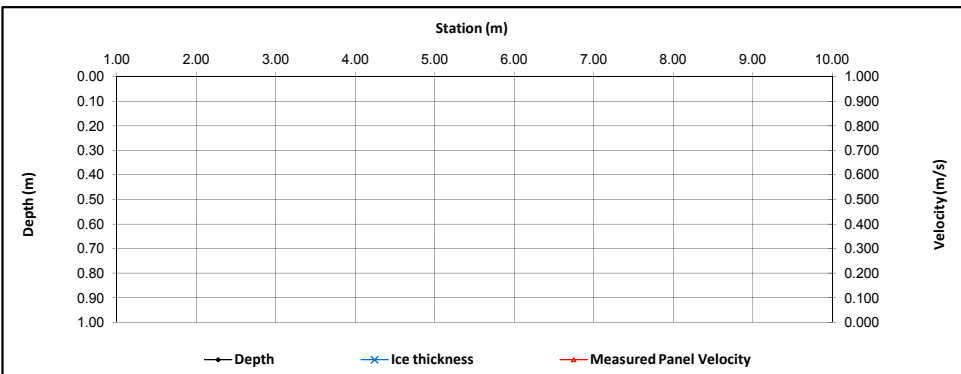
Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:	
Start Time (MST):	10:00
End Time (MST):	10:40
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	-

Flow characteristics:		
Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" Pipe on Upper Bench		100.000		100.000	-
Bench Mark 2:	3/4" Pipe on Lower Bench		98.503		98.503	-
Top of Ice:						
Water Level:		3.484	97.589	3.474	97.589	97.589
Transducer Reading:						
Other:	Top of coupler facing river	1.293	99.780	1.283	99.780	

General Notes:

Installed Datalogger and solar panels. Did survey level using temporary benchmark.

Field Personnel:	DB, SM, SG	Trip Date:	25-Jul-11
Data Entry Personnel:	JP	Date:	5-Aug-11
Data Check Personnel:	DB	Date:	25-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S46 - Athabasca River above the Delta

UTM Location: 470235 E, 6463205 N

Site Visit Date: August 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB	0	0.00	0.00	0.000	0.000	0.000	1.0	0.00	10.00	10.00	0.83	0.178	0.178	8.27	1.469	0%
1	20	3.31		0.61	0.81		1.0	10.00	31.00	21.00	3.31	0.710	0.710	69.51	49.351	4%
2	42	2.91		0.71	0.98		1.0	31.00	50.50	19.50	2.91	0.845	0.845	56.75	47.950	4%
3	59	2.81		0.65	0.92		1.0	50.50	69.50	19.00	2.81	0.785	0.785	53.39	41.911	4%
4	80	2.69		0.68	0.91		1.0	69.50	91.00	21.50	2.69	0.795	0.795	57.84	45.979	4%
5	102	2.52		0.65	0.85		1.0	91.00	109.00	18.00	2.52	0.750	0.750	45.36	34.020	3%
6	116	2.33		0.58	0.84		1.0	109.00	129.00	20.00	2.33	0.710	0.710	46.60	33.086	3%
7	142	1.96		0.68	0.78		1.0	129.00	153.00	24.00	1.96	0.730	0.730	47.04	34.339	3%
8	164	1.77		0.66	0.69		1.0	153.00	173.00	20.00	1.77	0.675	0.675	35.40	23.895	2%
9	182	1.93		0.50	0.75		1.0	173.00	194.00	21.00	1.93	0.625	0.625	40.53	25.331	2%
10	206	2.00		0.57	0.77		1.0	194.00	210.00	16.00	2.00	0.670	0.670	32.00	21.440	2%
11	214	2.26		0.53	0.68		1.0	210.00	227.50	17.50	2.26	0.605	0.605	39.55	23.928	2%
12	241	3.15		0.59	0.74		1.0	227.50	251.00	23.50	3.15	0.665	0.665	74.03	49.227	4%
13	261	3.75		0.66	0.82		1.0	251.00	272.50	21.50	3.75	0.740	0.740	80.63	59.663	5%
14	284	4.94		0.65	0.94		1.0	272.50	293.50	21.00	4.94	0.795	0.795	103.74	82.473	7%
15	303	4.90		0.88	0.97		1.0	293.50	312.00	18.50	4.90	0.925	0.925	90.65	83.851	7%
16	321	4.97		0.92	1.15		1.0	312.00	331.00	19.00	4.97	1.035	1.035	94.43	97.735	9%
17	341	4.72		0.80	1.19		1.0	331.00	352.00	21.00	4.72	0.995	0.995	99.12	98.624	9%
18	363	4.37		0.79	1.08		1.0	352.00	373.50	21.50	4.37	0.935	0.935	93.96	87.848	8%
19	384	4.19		0.88	1.03		1.0	373.50	393.50	20.00	4.19	0.955	0.955	83.80	80.029	7%
20	403	3.62		0.75	0.89		1.0	393.50	413.00	19.50	3.62	0.820	0.820	70.59	57.884	5%
21	423	3.80		0.61	0.78		1.0	413.00	429.00	16.00	3.80	0.695	0.695	60.80	42.256	4%
RB	435	0.00	0.00	0.000	0.000	0.000	1.0	429.00	435.00	6.00	0.95	0.174	0.174	5.70	0.990	0%

Total Flow 1123.3

Measurement Details:

Start Time (MST):	11:30
End Time (MST):	13:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Partly Cloudy, 20°C

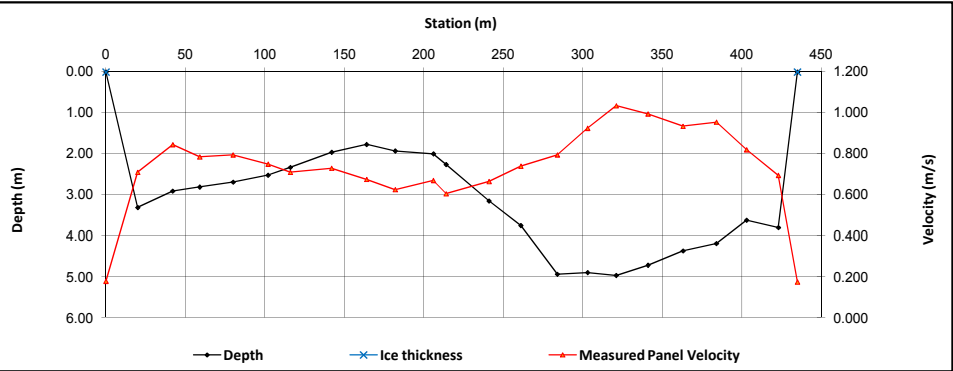
Flow characteristics:

Total Flow:	1123.279	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1389.67	(m ²)
Wetted Width:	435.00	(m)
Hydraulic Depth:	3.195	(m)
Mean Velocity:	0.808	(m/s)
Froude Number:	0.144	

Datalogger Details:

	Before	After
Transducer Reading:		2.050
Battery (Main):	12.8	
Battery (Aux):	-	
Datalogger Clock:	14:20	
Laptop Clock:	14:20	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	20.3	
Memory Used:	-	
Dessicant:	New	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" Pipe on Upper Bench		100.000		0.000	-
Bench Mark 2:	3/4" Pipe on Lower Bench		98.503		98.503	-
Top of Ice:						
Water Level:		3.650	96.362	3.644	96.362	96.362
Transducer Reading:		2.050	94.312	2.050	94.312	94.312
Other:	Stake in ground	1.712	98.300	1.706	98.300	
Other:	Top of coupler facing river	0.234	99.780	0.228	99.780	

General Notes:

TSS collected at 182m offset

Field Personnel:	DB SM	Trip Date:	16-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	31-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S46 - Athabasca River above the Delta

UTM Location: 470235 E, 6463205 N

Site Visit Date: September 17, 2011



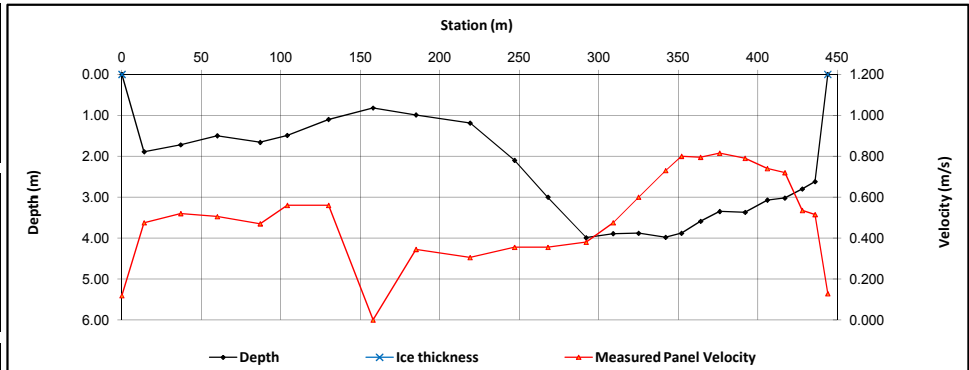
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	7.00	7.00	0.47	0.119	0.119	3.31	0.393	0%
1	14.00	1.89			0.410	0.540	1.0	7.00	25.50	18.50	1.89	0.475	0.475	34.96	16.608	3%
2	37.00	1.72			0.380	0.660	1.0	25.50	48.50	23.00	1.72	0.520	0.520	39.56	20.571	4%
3	60.00	1.50			0.360	0.650	1.0	48.50	73.50	25.00	1.50	0.505	0.505	37.50	18.938	4%
4	87.00	1.66			0.280	0.660	1.0	73.50	95.50	22.00	1.66	0.470	0.470	36.52	17.164	3%
5	104.00	1.49			0.520	0.600	1.0	95.50	117.00	21.50	1.49	0.560	0.560	32.04	17.940	3%
6	130.00	1.10			0.510	0.610	1.0	117.00	144.00	27.00	1.10	0.560	0.560	29.70	16.632	3%
7	158.00	0.82			0.500	0.500	1.0	144.00	171.50	27.50	0.82	0.000	0.000	22.55	0.000	0%
8	185.00	0.99			0.260	0.430	1.0	171.50	202.00	30.50	0.99	0.345	0.345	30.20	10.417	2%
9	219.00	1.19			0.270	0.340	1.0	202.00	233.00	31.00	1.19	0.305	0.305	36.89	11.251	2%
10	247.00	2.10			0.280	0.430	1.0	233.00	257.50	24.50	2.10	0.355	0.355	51.45	18.265	3%
11	268.00	3.00			0.310	0.400	1.0	257.50	280.00	22.50	3.00	0.355	0.355	67.50	23.963	4%
12	292.00	3.99			0.360	0.400	1.0	280.00	300.50	20.50	3.99	0.380	0.380	81.80	31.082	6%
13	309.00	3.89			0.410	0.540	1.0	300.50	317.00	16.50	3.89	0.475	0.475	64.19	30.488	6%
14	325.00	3.88			0.540	0.660	1.0	317.00	333.50	16.50	3.88	0.600	0.600	64.02	38.412	7%
15	342.00	3.98			0.630	0.830	1.0	333.50	347.00	13.50	3.98	0.730	0.730	53.73	39.223	7%
16	352.00	3.88			0.670	0.930	1.0	347.00	358.00	11.00	3.88	0.800	0.800	42.68	34.144	6%
17	364.00	3.59			0.660	0.930	1.0	358.00	370.00	12.00	3.59	0.795	0.795	43.08	34.249	6%
18	376.00	3.35			0.730	0.900	1.0	370.00	384.00	14.00	3.35	0.815	0.815	46.90	38.224	7%
19	392.00	3.37			0.550	1.030	1.0	384.00	399.00	15.00	3.37	0.790	0.790	50.55	39.935	7%
20	406.00	3.07			0.630	0.850	1.0	399.00	411.50	12.50	3.07	0.740	0.740	38.38	28.396	5%
21	417.00	3.02			0.530	0.910	1.0	411.50	422.50	11.00	3.02	0.720	0.720	33.22	23.918	4%
22	428.00	2.80			0.410	0.660	1.0	422.50	432.00	9.50	2.80	0.535	0.535	26.60	14.231	3%
23	436.00	2.62			0.440	0.590	1.0	432.00	440.00	8.00	2.62	0.515	0.515	20.96	10.794	2%
RB	444.00	0.00	0.00	0.000	0.000	0.000	1.0	425.00	444.00	19.00	0.77	0.129	0.129	14.58	1.877	0%
Total Flow															537.12	

Measurement Details:	
Start Time (MST):	8:30
End Time (MST):	12:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Light rain, 10°C

Flow characteristics:	
Total Flow:	537.116 (m ³ /s)
Perceived Measurement Quality:	Excellent
Cross Section Area:	1002.85 (m ²)
Wetted Width:	444.00 (m)
Hydraulic Depth:	2.259 (m)
Mean Velocity:	0.536 (m/s)
Froude Number:	0.114

Datalogger Details:		Before	After
Transducer Reading:			1.083
Battery (Main):		12.5	
Battery (Aux):		-	
Datalogger Clock:		8:57	
Laptop Clock:		8:57	
Air Temperature °C:		-	
Air Pressure:		-	
RH:		-	
Water °C:		13.3	
Memory Used:		-	
Dessicant:		OK	
Logger# (if Δ):			
PT# (if Δ):			

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" Pipe on Upper Bench	0.110	100.000	0.100	100.000	-
Bench Mark 2:	3/4" Pipe on Lower Bench	1.607	98.503	1.598	98.503	-
Top of Ice:						
Water Level:		4.780	95.330	4.770	95.330	95.330
Transducer Reading:			1.083		1.083	94.247
Other:	Stake in ground	1.808	98.300	1.799	98.300	
Other:	Top of coupler facing river	0.325	99.780	0.315	99.780	

General Notes:

Field Personnel:	DB, SM	Trip Date:	17-Sep-11
Data Entry Personnel:	CM	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S46 - Athabasca River above the Delta
 UTM Location: 470235 E, 6463205 N

Site Visit Date: October 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	6.50	6.50	0.22	0.154	0.154	1.40	0.215	0%
1	13.00	0.86			0.560	0.670	1.0	6.50	18.50	12.00	0.86	0.615	0.615	10.32	6.347	2%
2	24.00	2.20			0.840	1.050	1.0	18.50	33.00	14.50	2.20	0.945	0.945	31.90	30.146	8%
3	42.00	2.25			0.840	1.130	1.0	33.00	53.50	20.50	2.25	0.985	0.985	46.13	45.433	12%
4	65.00	2.73			0.560	1.120	1.0	53.50	73.50	20.00	2.73	0.840	0.840	54.60	45.864	12%
5	82.00	3.32			0.690	0.910	1.0	73.50	93.00	19.50	3.32	0.800	0.800	64.74	51.792	13%
6	104.00	3.15			0.660	0.840	1.0	93.00	115.00	22.00	3.15	0.750	0.750	69.30	51.975	13%
7	126.00	3.39			0.470	0.500	1.0	115.00	136.50	21.50	3.39	0.485	0.485	72.89	35.349	9%
8	147.00	3.43			0.210	0.310	1.0	136.50	156.00	19.50	3.43	0.260	0.260	66.89	17.390	4%
9	165.00	3.39			0.190	0.190	1.0	156.00	175.00	19.00	3.39	0.190	0.190	64.41	12.238	3%
10	185.00	3.35			0.070	0.150	1.0	175.00	194.00	19.00	3.35	0.110	0.110	63.65	7.002	2%
11	203.00	1.63			0.090	0.110	1.0	194.00	213.50	19.50	1.63	0.100	0.100	31.79	3.179	1%
12	224.00	0.91			0.100	0.190	1.0	213.50	234.00	20.50	0.91	0.145	0.145	18.66	2.705	1%
13	244.00	0.45		0.140			1.0	234.00	253.00	19.00	0.45	0.140	0.140	8.55	1.197	0%
14	262.00	0.45		0.170			1.0	253.00	271.50	18.50	0.45	0.170	0.170	8.33	1.415	0%
15	281.00	0.48		0.180			1.0	271.50	293.50	22.00	0.48	0.180	0.180	10.56	1.901	0%
16	306.00	0.65		0.170			1.0	293.50	315.00	21.50	0.65	0.170	0.170	13.98	2.376	1%
17	324.00	0.90			0.410	0.620	1.0	315.00	333.50	18.50	0.90	0.515	0.515	16.65	8.575	2%
18	343.00	1.07			0.390	0.520	1.0	333.50	353.50	20.00	1.07	0.455	0.455	21.40	9.737	2%
19	364.00	0.97			0.510	0.620	1.0	353.50	383.00	29.50	0.97	0.565	0.565	28.62	16.167	4%
	402.00	0.95			0.480	0.790	1.0	383.00	415.00	32.00	0.95	0.635	0.635	30.40	19.304	5%
20	428.00	1.36			0.580	0.700	1.0	415.00	436.50	21.50	1.36	0.640	0.640	29.24	18.714	5%
LB	445.00	0.00	0.00	0.000	0.000	0.000	1.0	436.50	445.00	8.50	0.34	0.160	0.160	2.89	0.462	0%
Total Flow															389.48	

Measurement Details:

Start Time (MST):	9:34
End Time (MST):	12:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	-

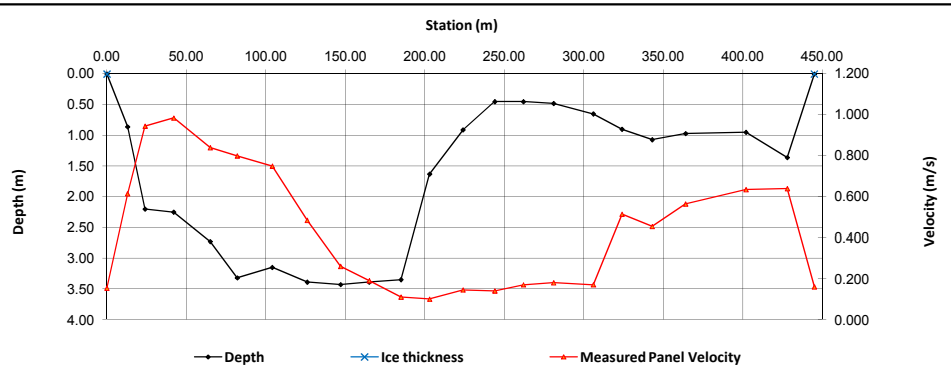
Flow characteristics:

Total Flow:	389.481	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	767.26	(m ²)
Wetted Width:	445.00	(m)
Hydraulic Depth:	1.724	(m)
Mean Velocity:	0.508	(m/s)
Froude Number:	0.123	

Datalogger Details:

	Before	After
Transducer Reading:		0.697
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	9:36	
Laptop Clock:	9:36	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	3.0	
Memory Used:	-	
Dessicant:	good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" Pipe on Upper Bench	0.742	100.000	0.722	100.000	-
Bench Mark 2:	3/4" Pipe on Lower Bench	2.239	98.503	2.221	98.503	-
Top of Ice:						
Water Level:		5.762	94.980	5.740	94.982	94.981
Transducer Reading:			94.980		94.982	94.981
Other:	Stake in ground	2.442	98.300	2.423	98.300	

General Notes:

Field Personnel:	DW, SM	Trip Date:	26-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S46 - Athabasca River above the Delta

UTM Location: 470235 E, 6463205 N

Site Visit Date: December 3, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
1		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow														0.000		

Measurement Details:

Start Time (MST):	9:48
End Time (MST):	10:05
Equipment:	-
Method:	-
River Condition:	Frozen
Quality/Error (see reverse):	-
Weather:	Wind, Clear -15°C

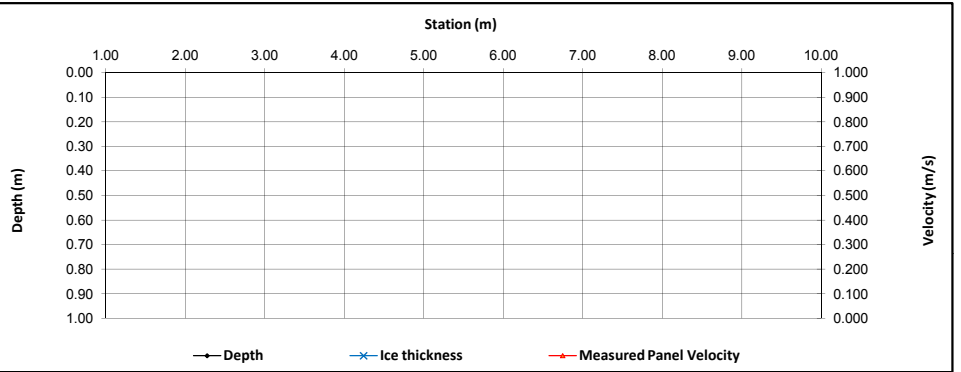
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.894
Battery (Main):	13.4	
Battery (Aux):	-	
Datalogger Clock:	9:51	
Laptop Clock:	9:51	
Air Temperature °C:	9:51	
Air Pressure:	-	
RH:	-	
Water °C:	0.1	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" Pipe on Upper Bench	1.000	100.000	0.987	100.000	-
Bench Mark 2:	3/4" Pipe on Lower Bench	2.495	98.503	2.483	98.503	-
Top of Ice:		5.878	95.122	5.866	95.121	95.122
Water Level:		5.838	95.162	5.822	95.165	95.164
Transducer Reading:		0.894	94.268	0.894	94.271	94.270
Other:						

General Notes:

Field Personnel:	SM, SG	Trip Date:	3-Dec-11
Data Entry Personnel:	SG	Date:	13-Jan-12
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S47 Christina at Mouth

UTM Location:

497703N, 6278751E (Flow) 500672N, 6276404E (Station)

Site Visit Date: July 28, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0	0.00	0.00	0.000	0.000	0.000	1.0	0.00	4.00	4.00	0.22	0.253	0.253	0.86	0.217	0%
1	8	0.86			0.910	1.110	1.0	4.00	9.50	5.50	0.86	1.010	1.010	4.73	4.777	4%
2	11	1.13			1.240	1.660	1.0	9.50	13.50	4.00	1.13	1.450	1.450	4.52	6.554	6%
3	16	1.35			1.393	1.850	1.0	13.50	18.00	4.50	1.35	1.622	1.622	6.08	9.852	8%
4	20	1.50			1.250	1.660	1.0	18.00	21.50	3.50	1.50	1.455	1.455	5.25	7.639	7%
5	23	1.40			1.500	1.990	1.0	21.50	26.50	5.00	1.40	1.745	1.745	7.00	12.215	11%
6	30	1.48			1.440	1.650	1.0	26.50	31.50	5.00	1.48	1.545	1.545	7.40	11.433	10%
7	33	1.58			1.390	1.720	1.0	31.50	35.50	4.00	1.58	1.555	1.555	6.32	9.828	8%
8	38	1.35			1.213	1.610	1.0	35.50	41.00	5.50	1.35	1.411	1.411	7.43	10.479	9%
9	44	1.37			1.340	1.810	1.0	41.00	47.00	6.00	1.37	1.575	1.575	8.22	12.947	11%
10	50	1.26			1.020	1.630	1.0	47.00	53.50	6.50	1.26	1.325	1.325	8.19	10.852	9%
11	57	1.10			1.030	1.460	1.0	53.50	60.50	7.00	1.10	1.245	1.245	7.70	9.587	8%
12	64	0.76			1.002	1.330	1.0	60.50	65.50	5.00	0.76	1.166	1.166	3.80	4.430	4%
13	67	0.83			1.030	1.460	1.0	65.50	70.50	5.00	0.83	1.245	1.245	4.15	5.167	4%
Right	74	0.00	0.00	0.000	0.000	0.000	1.0	70.50	74.00	3.50	0.21	0.311	0.311	0.73	0.226	0%
Total Flow															116.2	

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	13:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Fair (see notes)
Weather:	Partly cloudy

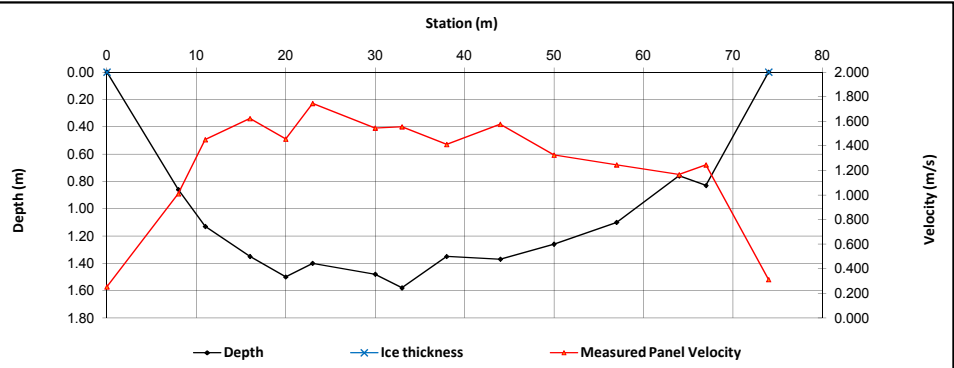
Flow characteristics:

Total Flow:	116.202	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	82.37	(m ²)
Wetted Width:	74.00	(m)
Hydraulic Depth:	1.113	(m)
Mean Velocity:	1.411	(m/s)
Froude Number:	0.427	

Datalogger Details:

	Before	After
Transducer Reading:		0.781
Battery (Main):	14.6	
Battery (Aux):	-	
Datalogger Clock:	14:23	
Laptop Clock:	14:23	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	20.4	
Memory Used:	-	
Dessicant:	New	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, ~3m west of datalogger	0.443	100.000	0.428	100.000	-
Bench Mark 2:	Nail in base of tree with logger	0.282	100.159	0.269	100.159	-
Top of Ice:						
Water Level:		3.165	97.278	3.150	97.278	97.278
Transducer Reading:		0.781	96.497	0.781	96.497	96.497
Other:						

General Notes:

Flow assessment determined as 'fair' due to the presence of moderate waves and some estimated velocities.

Field Personnel:	DB, SM	Trip Date:	28-Jul-11
Data Entry Personnel:	DB	Date:	3-Aug-11
Data Check Personnel:	JP	Date:	5-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S47 Christina at Mouth

UTM Location:

497703N, 6278751E (Flow) 500672N, 6276404E (Station)

Site Visit Date: August 13, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	74	0.00	0.00	0.000	0.000	0.000	1.0	74.00	68.50	5.50	0.19	0.208	0.208	1.06	0.220	0%
1	63	0.77		0.830			1.0	68.50	60.00	8.50	0.77	0.830	0.830	6.55	5.432	8%
2	57	0.91		0.730			1.0	60.00	53.50	6.50	0.91	0.730	0.730	5.92	4.318	7%
3	50	1.10		1.030			1.0	53.50	46.50	7.00	1.10	1.030	1.030	7.70	7.931	12%
4	43	1.33		1.250			1.0	46.50	41.50	5.00	1.33	1.250	1.250	6.65	8.313	13%
5	40	1.22		1.300			1.0	41.50	38.50	3.00	1.22	1.300	1.300	3.66	4.758	7%
6	37	1.31		1.210			1.0	38.50	33.00	5.50	1.31	1.210	1.210	7.21	8.718	14%
7	29	1.02		1.160			1.0	33.00	26.50	6.50	1.02	1.160	1.160	6.63	7.691	12%
8	24	1.00		1.120			1.0	26.50	22.00	4.50	1.00	1.120	1.120	4.50	5.040	8%
9	20	0.92		1.000			1.0	22.00	17.50	4.50	0.92	1.000	1.000	4.14	4.140	6%
10	15	0.85		0.900			1.0	17.50	12.50	5.00	0.85	0.900	0.900	4.25	3.825	6%
11	10	0.61		0.830			1.0	12.50	5.00	7.50	0.61	0.830	0.830	4.57	3.797	6%
LB	0	0.00	0.00	0.000	0.000	0.000	1.0	5.00	0.00	5.00	0.15	0.208	0.208	0.76	0.158	0%
Total Flow															64.3	

Measurement Details:

Start Time (MST):	8:00
End Time (MST):	9:30
Equipment:	ADC
Method:	Boat
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Partly cloudy

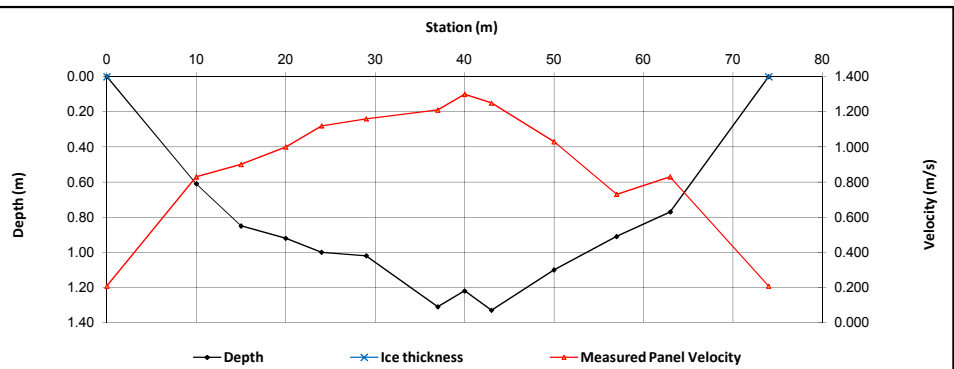
Flow characteristics:

Total Flow:	64.341	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	63.59	(m ²)
Wetted Width:	63.50	(m)
Hydraulic Depth:	1.001	(m)
Mean Velocity:	1.012	(m/s)
Froude Number:	0.323	

Datalogger Details:

	Before	After
Transducer Reading:		0.405
Battery (Main):	12.8	
Battery (Aux):	-	
Datalogger Clock:	10:50	
Laptop Clock:	10:50	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	18.7	
Memory Used:	-	
Dessicant:	OK	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" pipe, ~3m west of datalogger	0.850	100.000	0.841	100.000	-
Bench Mark 2:	Nail in base of tree with logger	0.693	100.159	0.685	100.159	
Top of Ice:						
Water Level:		3.963	96.887	3.951	96.890	96.889
Transducer Reading:		0.405	96.482	0.405	96.485	96.484
Other:						

General Notes:

More problems with ADC readouts. 0 velocities given for long periods, but water depths were fine. Began to work OK at 0.6D but more problems at 0.8D hence decision to go with 0.6D. Problems to be investigated with OTT, and backup (Marsh/ADV) to be taken on future visits.

Field Personnel:	DB, SM	Trip Date:	13-Aug-11
Data Entry Personnel:	DB	Date:	27-Aug-11
Data Check Personnel:	JP	Date:	26-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S47 Christina at Mouth

UTM Location:

497703N, 6278751E (Flow) 500672N, 6276404E (Station)

Site Visit Date: August 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
LB		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
RB		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.0	

Measurement Details:

Start Time (MST):	16:00
End Time (MST):	17:00
Equipment:	-
Method:	-
River Condition:	-
Quality/Error (see reverse):	-
Weather:	Overcast

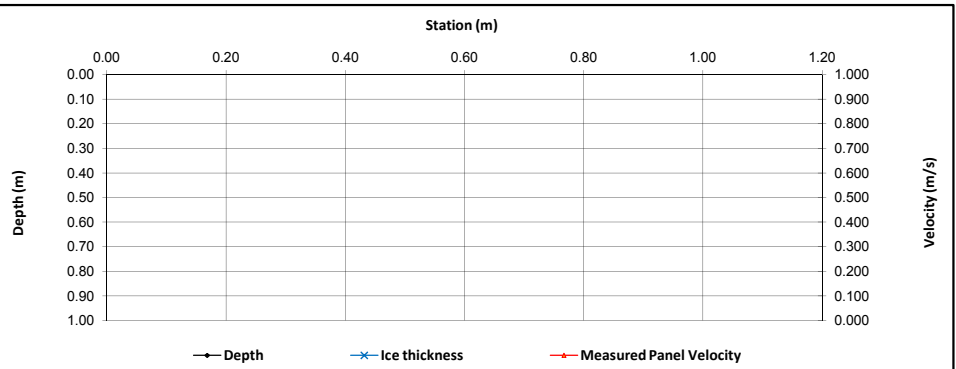
Flow characteristics:

Total Flow:	0.000	(m ³ /s)
Perceived Measuremt Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	-	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:	0.467	0.683
Battery (Main):	-	-
Battery (Aux):	-	-
Datalogger Clock:	-	16:47
Laptop Clock:	-	16:47
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	-	4.4
Memory Used:	-	-
Dessicant:	OK	OK
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, ~3m west of datalogger	0.587	100.000	0.577	100.000	-
Bench Mark 2:	Nail in base of tree with logger	0.426	100.159	0.417	100.159	
Top of Ice:						
Water Level:		3.647	96.940	3.636	96.941	96.941
Transducer Reading:		0.683	96.257	0.683	96.258	96.258
Other:						

General Notes:

Purpose of extra trip was to dig up PT and place lower in water (was 40cm under water on 13-Aug) with remaining helicopter time available. PT wire etc had been pulled by wildlife that day (teeth marks visible) resulting in ~6hours loss of data. Maybe more burying at much lower water, required.

Field Personnel:	DB, SM	Trip Date:	16-Aug-11
Data Entry Personnel:	DB	Date:	25-Aug-11
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S47 Christina at Mouth

UTM Location:

497703N, 6278751E (Flow) 500672N, 6276404E (Station)

Site Visit Date: September 17, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
	0.00	0.00	0.00	0.000	0.000	0.000	1.0	0.00	2.50	2.50	0.10	0.096	0.096	0.24	0.023	0%
1	5.00	0.39		0.382			1.0	2.50	7.50	5.00	0.39	0.382	0.382	1.95	0.745	3%
2	10.00	0.60		0.412			1.0	7.50	12.00	4.50	0.60	0.412	0.412	2.70	1.112	4%
3	14.00	0.71		0.460			1.0	12.00	16.00	4.00	0.71	0.460	0.460	2.84	1.306	5%
4	18.00	0.80			0.414	0.535	1.0	16.00	20.00	4.00	0.80	0.475	0.475	3.20	1.518	6%
5	22.00	0.81			0.450	0.478	1.0	20.00	24.00	4.00	0.81	0.464	0.464	3.24	1.503	6%
6	26.00	0.85			0.535	0.608	1.0	24.00	28.00	4.00	0.85	0.572	0.572	3.40	1.943	7%
7	30.00	0.88			0.527	0.629	1.0	28.00	31.50	3.50	0.88	0.578	0.578	3.08	1.780	7%
8	33.00	0.92			0.454	0.635	1.0	31.50	34.50	3.00	0.92	0.545	0.545	2.76	1.503	6%
9	36.00	0.88			0.548	0.668	1.0	34.50	37.50	3.00	0.88	0.608	0.608	2.64	1.605	6%
10	39.00	0.87			0.555	0.569	1.0	37.50	40.50	3.00	0.87	0.562	0.562	2.61	1.467	6%
11	42.00	1.02			0.560	0.581	1.0	40.50	43.00	2.50	1.02	0.571	0.571	2.55	1.455	6%
12	44.00	1.01			0.542	0.620	1.0	43.00	45.00	2.00	1.01	0.581	0.581	2.02	1.174	4%
13	46.00	1.02			0.590	0.694	1.0	45.00	47.00	2.00	1.02	0.642	0.642	2.04	1.310	5%
14	48.00	1.01			0.560	0.634	1.0	47.00	49.00	2.00	1.01	0.597	0.597	2.02	1.206	5%
15	50.00	0.95			0.378	0.539	1.0	49.00	51.50	2.50	0.95	0.459	0.459	2.38	1.089	4%
16	53.00	0.87			0.351	0.522	1.0	51.50	54.50	3.00	0.87	0.437	0.437	2.61	1.139	4%
17	56.00	0.86			0.207	0.468	1.0	54.50	57.50	3.00	0.86	0.338	0.338	2.58	0.871	3%
18	59.00	0.77			0.334	0.408	1.0	57.50	60.50	3.00	0.77	0.371	0.371	2.31	0.857	3%
19	62.00	0.62		0.334			1.0	60.50	63.50	3.00	0.62	0.334	0.334	1.86	0.621	2%
20	65.00	0.70		0.318			1.0	63.50	70.00	6.50	0.70	0.318	0.318	4.55	1.447	6%
21	68.00	0.79			0.238	0.298	1.0	66.50	68.00	1.50	0.79	0.268	0.268	1.19	0.318	1%
22	71.00	0.70		0.198			1.0	69.50	71.00	1.50	0.70	0.198	0.198	1.05	0.208	1%
	75.00	0.00	0.00	0.000	0.000	0.000	1.0	70.00	75.00	5.00	0.18	0.050	0.050	0.88	0.043	0%
Total Flow															26.244	

Measurement Details:

Start Time (MST):	14:45
End Time (MST):	16:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Rain, 10°C

Flow characteristics:

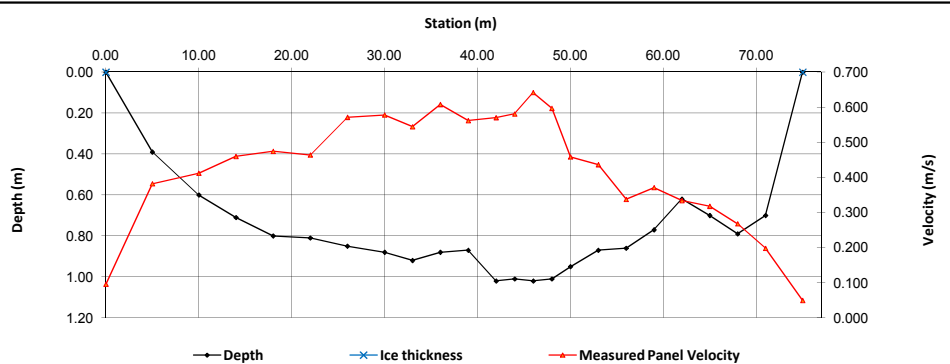
Total Flow:	26.244	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	56.69	(m ²)
Wetted Width:	75.00	(m)
Hydraulic Depth:	0.756	(m)
Mean Velocity:	0.463	(m/s)
Froude Number:	0.170	

Datalogger Details:

	Before	After
Transducer Reading:		0.206
Battery (Main):	12.9	12.9
Battery (Aux):	-	-
Datalogger Clock:	7:37	7:57
Laptop Clock:	7:37	7:57
Air Temperature °C:	-	-
Air Pressure:	-	-
RH:	-	-
Water °C:	11.7	11.7
Memory Used:	-	-
Dessicant:	Changed	Changed
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

7:30 on 18-Sept-11. PT Moved to lower point.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, ~3m west of datalogger	0.272	100.000	0.258	100.000	-
Bench Mark 2:	Nail in base of tree with logger	0.112	100.159	0.098	100.159	-
Top of Ice:						
Water Level:		3.798	96.474	3.783	96.475	96.475
Transducer Reading:		0.206	96.268	0.206	96.269	96.269
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	17-Sep-11
Data Entry Personnel:	CM	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S47 Christina at Mouth

UTM Location:

Site Visit Date: October 26, 2011

499621N, 6277162E (Flow) 500672N, 6276404E (Station)



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	0	0.00	0.00	0.000	0.000	0.000	1.0	0.00	2.00	2.00	0.03	0.001	0.001	0.05	0.000	0%
1	4	0.11		0.002			1.0	2.00	6.00	4.00	0.11	0.002	0.002	0.44	0.001	0%
2	8	0.18		0.180			1.0	6.00	10.00	4.00	0.18	0.180	0.180	0.72	0.130	1%
3	12	0.26		0.352			1.0	10.00	14.00	4.00	0.26	0.352	0.352	1.04	0.366	2%
4	16	0.35		0.404			1.0	14.00	18.00	4.00	0.35	0.404	0.404	1.40	0.566	3%
5	20	0.43		0.420			1.0	18.00	22.00	4.00	0.43	0.420	0.420	1.72	0.722	4%
6	24	0.61		0.512			1.0	22.00	26.00	4.00	0.61	0.512	0.512	2.44	1.249	7%
7	28	0.71		0.527			1.0	26.00	29.00	3.00	0.71	0.527	0.527	2.13	1.123	7%
8	30	0.75			0.518	0.620	1.0	29.00	31.00	2.00	0.75	0.569	0.569	1.50	0.854	5%
9	32	0.81			0.465	0.641	1.0	31.00	34.00	3.00	0.81	0.553	0.553	2.43	1.344	8%
10	36	0.79			0.561	0.714	1.0	34.00	37.00	3.00	0.79	0.638	0.638	2.37	1.511	9%
11	38	0.79			0.452	0.713	1.0	37.00	39.00	2.00	0.79	0.583	0.583	1.58	0.920	5%
12	40	0.67		0.366			1.0	39.00	42.00	3.00	0.67	0.366	0.366	2.01	0.736	4%
13	44	0.64		0.372			1.0	42.00	46.00	4.00	0.64	0.372	0.372	2.56	0.952	6%
14	48	0.35		0.623			1.0	46.00	50.00	4.00	0.35	0.623	0.623	1.40	0.872	5%
15	52	0.46		0.628			1.0	50.00	54.00	4.00	0.46	0.628	0.628	1.84	1.156	7%
16	56	0.59		0.569			1.0	54.00	58.00	4.00	0.59	0.569	0.569	2.36	1.343	8%
17	60	0.52		0.556			1.0	58.00	62.00	4.00	0.52	0.556	0.556	2.08	1.156	7%
18	64	0.48		0.448			1.0	62.00	66.00	4.00	0.48	0.448	0.448	1.92	0.860	5%
19	68	0.46		0.391			1.0	66.00	70.50	4.50	0.46	0.391	0.391	2.07	0.809	5%
20	73	0.48		0.361			1.0	70.50	73.50	3.00	0.48	0.361	0.361	1.44	0.520	3%
LB	74	0.00	0.00	0.000	0.000	0.000	1.0	73.50	74.00	0.50	0.12	0.090	0.090	0.06	0.005	0%
Total Flow														17.195		

Measurement Details:

Start Time (MST):	15:45
End Time (MST):	17:16
Equipment:	ADV
Method:	Wading
River Condition:	Open, low
Quality/Error (see reverse):	Excellent
Weather:	Clear, 5 C

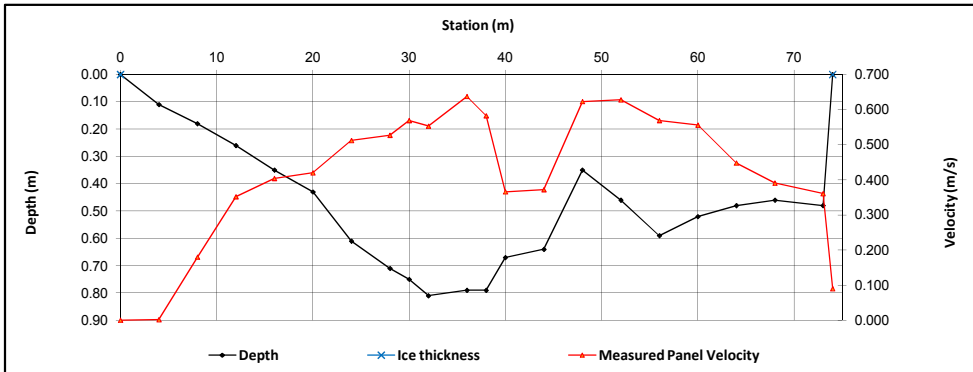
Flow characteristics:

Total Flow:	17.195	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	35.56	(m ²)
Wetted Width:	74.00	(m)
Hydraulic Depth:	0.481	(m)
Mean Velocity:	0.483	(m/s)
Froude Number:	0.223	

Datalogger Details:

	Before	After
Transducer Reading:		0.2
Battery (Main):	14.4	
Battery (Aux):	-	
Datalogger Clock:	15:38	
Laptop Clock:	15:38	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.9	
Memory Used:	-	
Dessicant:	good	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, ~3m west of datalogger	0.551	100.000	0.541	100.000	-
Bench Mark 2:	Nail in base of tree with logger	0.393	100.159	0.384	100.159	
Top of Ice:						
Water Level:		4.237	96.314	4.228	96.313	96.314
Transducer Reading:		0.200	96.114	0.200	96.113	96.114
Other:						

General Notes:

Flow was taken upstream from the usual location, Coordinates are 499621E 6277162 N (previous flow measurement coordinates: 497703N, 6278751E).

Field Personnel:	DW, SM	Trip Date:	26-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S47 Christina at Mouth

UTM Location:

Site Visit Date: December 4, 2011

497703N, 6278751E (Flow) 500672N, 6276404E (Station)



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	Velocity @	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
			(m)	Depth	0.8 Depth	Depth	(m)	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
Left	0	0.00	0.00	0.000	0.000	0.000	1.0	0.00	0.00	0.00	0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
Right		0.00	0.00	0.000	0.000	0.000					0.00	0.000	0.000	0.00	0.000	
Total Flow															0.0	

Measurement Details:

Start Time (MST):	13:20
End Time (MST):	14:00
Equipment:	-
Method:	-
River Condition:	Ice Covered
Quality/Error (see reverse):	-
Weather:	Overcast -7°C

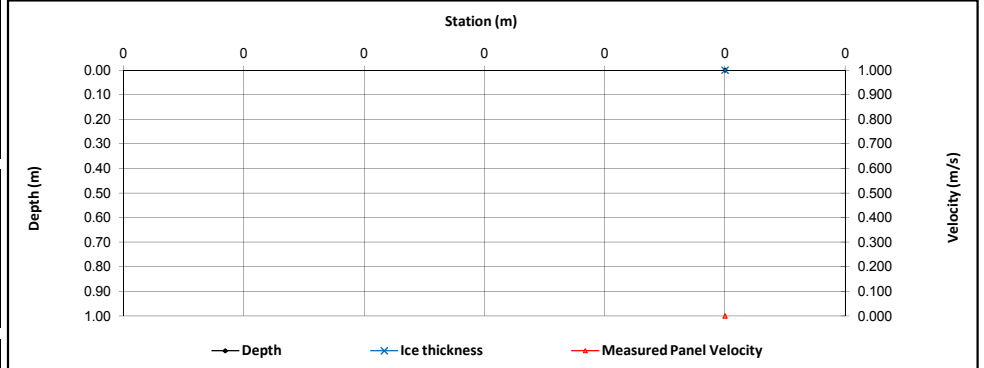
Flow characteristics:

Total Flow:	-	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.457
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	13:30	
Laptop Clock:	13:30	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.0	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe, ~3m west of datalogger	0.186	100.000	0.175	100.000	-
Bench Mark 2:	Nail in base of tree with logger	0.343	100.159	0.332	100.159	-
Top of Ice:		3.632	96.554	3.621	96.554	96.554
Water Level:		3.778	96.408	3.773	96.402	96.405
Transducer Reading:		0.457	95.951	0.457	95.945	95.948
Other:						

General Notes:

- need inclinometer to measure vertical angle from S47 station to hill top.

Field Personnel:	SM, SG	Trip Date:	4-Dec-12
Data Entry Personnel:	SG	Date:	13-Jan-12
Data Check Personnel:	MY	Date:	18-Jan-12

Hydrometric Measurement / Site Visit Record

Site: S48 Big Creek

UTM Location: 470895 E, 6389207 N

Site Visit Date: April 23, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.80	0.00		0.000	0.000	0.000	1.0	0.80	0.85	0.05	0.04	0.000	0.000	0.00	0.000	0%
1	0.90	0.17		-0.001			1.0	0.85	0.95	0.10	0.17	-0.001	-0.001	0.02	0.000	0%
2	1.00	0.26		0.372			1.0	0.95	1.05	0.10	0.26	0.372	0.372	0.03	0.010	5%
3	1.10	0.31		0.422			1.0	1.05	1.15	0.10	0.31	0.422	0.422	0.03	0.013	7%
4	1.20	0.33		0.418			1.0	1.15	1.25	0.10	0.33	0.418	0.418	0.03	0.014	7%
5	1.30	0.32		0.469			1.0	1.25	1.35	0.10	0.32	0.469	0.469	0.03	0.015	7%
6	1.40	0.33		0.461			1.0	1.35	1.45	0.10	0.33	0.461	0.461	0.03	0.015	8%
7	1.50	0.34		0.397			1.0	1.45	1.55	0.10	0.34	0.397	0.397	0.03	0.013	7%
8	1.60	0.43		0.435			1.0	1.55	1.65	0.10	0.43	0.435	0.435	0.04	0.019	9%
9	1.70	0.44		0.405			1.0	1.65	1.75	0.10	0.44	0.405	0.405	0.04	0.018	9%
10	1.80	0.43		0.436			1.0	1.75	1.85	0.10	0.43	0.436	0.436	0.04	0.019	9%
11	1.90	0.34		0.468			1.0	1.85	1.95	0.10	0.34	0.468	0.468	0.03	0.016	8%
12	2.00	0.34		0.478			1.0	1.95	2.05	0.10	0.34	0.478	0.478	0.03	0.016	8%
13	2.10	0.32		0.508			1.0	2.05	2.15	0.10	0.32	0.508	0.508	0.03	0.016	8%
14	2.20	0.30		0.536			1.0	2.15	2.25	0.10	0.30	0.536	0.536	0.03	0.016	8%
Right	2.30	0.00		0.000	0.000	0.000	1.0	2.25	2.30	0.05	0.06	0.134	0.134	0.00	0.001	0%
Total Flow															0.201	

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Bed Ice
Quality/Error (see reverse):	Good
Weather:	Overcast, 10°C

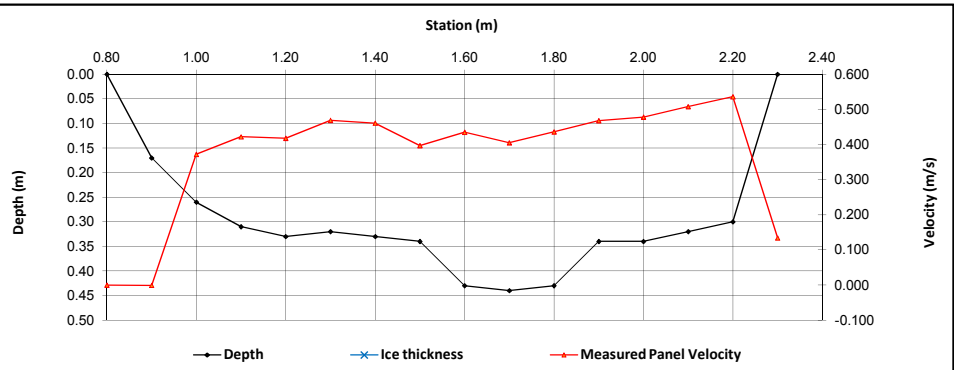
Flow characteristics:

Total Flow:	0.201	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.47	(m ²)
Wetted Width:	1.50	(m)
Hydraulic Depth:	0.315	(m)
Mean Velocity:	0.425	(m/s)
Froude Number:	0.242	

Datalogger Details:

	Before	After
Transducer Reading:		0.213
Battery (Main):	13.1	
Battery (Aux):	-	
Datalogger Clock:	12:49	
Laptop Clock:	12:49	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.2	
Memory Used:	-	
Dessicant:	New	
Logger# (if Δ):	16118	
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 2m from logger		100.000		100.000	-
Bench Mark 2:	Spike in Base of Tree	1.142	99.774	1.137	99.774	-
Top of Ice:						
Water Level:		1.994	98.922	1.986	98.925	98.924
Transducer Reading:		0.213	98.709	0.213	98.712	98.711
Other:						

General Notes:

Could not measure some flow under ice. WL has ice included.

Field Personnel:	DB, SG	Trip Date:	23-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S48 Big Creek

UTM Location: 470895 E, 6389207 N

Site Visit Date: July 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	2.80	0.00	0.00	0.000	0.000	0.000	1.0	2.80	3.05	0.25	0.10	0.054	0.054	0.03	0.001	0%
1	3.30	0.40		0.215			1.0	3.05	3.50	0.45	0.40	0.215	0.215	0.18	0.039	4%
2	3.70	0.40		0.374			1.0	3.50	3.90	0.40	0.40	0.374	0.374	0.16	0.060	7%
3	4.10	0.38		0.369			1.0	3.90	4.30	0.40	0.38	0.369	0.369	0.15	0.056	6%
4	4.50	0.40		0.413			1.0	4.30	4.70	0.40	0.40	0.413	0.413	0.16	0.066	7%
5	4.90	0.34		0.355			1.0	4.70	5.10	0.40	0.34	0.355	0.355	0.14	0.048	5%
6	5.30	0.32		0.408			1.0	5.10	5.50	0.40	0.32	0.408	0.408	0.13	0.052	6%
7	5.70	0.34		0.352			1.0	5.50	5.90	0.40	0.34	0.352	0.352	0.14	0.048	5%
8	6.10	0.37		0.360			1.0	5.90	6.30	0.40	0.37	0.360	0.360	0.15	0.053	6%
9	6.50	0.37		0.348			1.0	6.30	6.70	0.40	0.37	0.348	0.348	0.15	0.052	6%
10	6.90	0.38		0.366			1.0	6.70	7.10	0.40	0.38	0.366	0.366	0.15	0.056	6%
11	7.30	0.38		0.402			1.0	7.10	7.50	0.40	0.38	0.402	0.402	0.15	0.061	7%
12	7.70	0.39		0.421			1.0	7.50	7.90	0.40	0.39	0.421	0.421	0.16	0.066	7%
13	8.10	0.39		0.326			1.0	7.90	8.30	0.40	0.39	0.326	0.326	0.16	0.051	6%
14	8.50	0.44		0.247			1.0	8.30	8.70	0.40	0.44	0.247	0.247	0.18	0.043	5%
15	8.90	0.50		0.219			1.0	8.70	9.10	0.40	0.50	0.219	0.219	0.20	0.044	5%
16	9.30	0.55		0.219			1.0	9.10	9.50	0.40	0.55	0.219	0.219	0.22	0.048	5%
17	9.70	0.56		0.214			1.0	9.50	9.90	0.40	0.56	0.214	0.214	0.22	0.048	5%
18	10.10	0.42		0.074			1.0	9.90	10.45	0.55	0.42	0.074	0.074	0.23	0.017	2%
Right	10.80	0.00	0.00	0.000	0.000	0.000	1.0	10.45	10.80	0.35	0.11	0.019	0.019	0.04	0.001	0%
Total Flow															0.910	

Measurement Details:

Start Time (MST):	12:45
End Time (MST):	13:45
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Partly Cloudy, +25°C

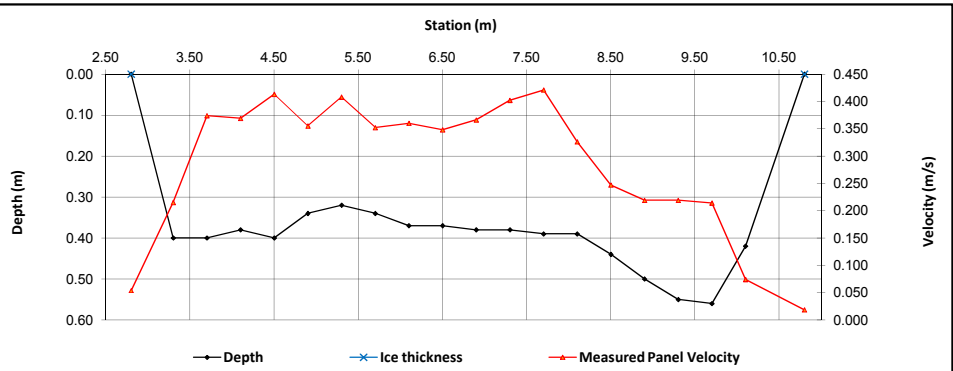
Flow characteristics:

Total Flow:	0.910	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	3.08	(m ²)
Wetted Width:	8.00	(m)
Hydraulic Depth:	0.385	(m)
Mean Velocity:	0.296	(m/s)
Froude Number:	0.152	

Datalogger Details:

	Before	After
Transducer Reading:		0.76
Battery (Main):	13.5	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	18.3	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 2m from logger	1.040	100.000	1.029	100.000	-
Bench Mark 2:	Spike in Base of Tree	1.264	99.774	1.253	99.774	-
Top of Ice:						
Water Level:		2.366	98.674	2.356	98.673	98.674
Transducer Reading:		0.760	97.914	0.760	97.913	97.914
Other:						

General Notes:

Pressure transducer damaged. Potentially by fire causing a large tree to fall into and move along river, pulling on transducer conduit and wiring. Data stopped collecting end of May.

Field Personnel:	DB SM	Trip Date:	26-Jul-11
Data Entry Personnel:	DB	Date:	3-Aug-11
Data Check Personnel:	JP	Date:	5-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S48 Big Creek

UTM Location: ~470866 E, ~6389000 N

Site Visit Date: August 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	2.50	0.00	0.00	0.000	0.000	0.000	1.0	2.50	2.65	0.15	0.06	0.022	0.022	0.01	0.000	0%
1	2.80	0.25		0.089			1.0	2.65	2.95	0.30	0.25	0.089	0.089	0.08	0.007	2%
2	3.10	0.25		0.160			1.0	2.95	3.30	0.35	0.25	0.160	0.160	0.09	0.014	4%
3	3.50	0.25		0.243			1.0	3.30	3.70	0.40	0.25	0.243	0.243	0.10	0.024	6%
4	3.90	0.23		0.213			1.0	3.70	4.10	0.40	0.23	0.213	0.213	0.09	0.020	5%
5	4.30	0.20		0.238			1.0	4.10	4.50	0.40	0.20	0.238	0.238	0.08	0.019	5%
6	4.70	0.19		0.302			1.0	4.50	4.90	0.40	0.19	0.302	0.302	0.08	0.023	6%
7	5.10	0.20		0.279			1.0	4.90	5.30	0.40	0.20	0.279	0.279	0.08	0.022	6%
8	5.50	0.20		0.277			1.0	5.30	5.70	0.40	0.20	0.277	0.277	0.08	0.022	6%
9	5.90	0.20		0.255			1.0	5.70	6.10	0.40	0.20	0.255	0.255	0.08	0.020	5%
10	6.30	0.21		0.251			1.0	6.10	6.50	0.40	0.21	0.251	0.251	0.08	0.021	5%
11	6.70	0.20		0.230			1.0	6.50	6.90	0.40	0.20	0.230	0.230	0.08	0.018	5%
12	7.10	0.20		0.214			1.0	6.90	7.30	0.40	0.20	0.214	0.214	0.08	0.017	4%
13	7.50	0.18		0.201			1.0	7.30	7.70	0.40	0.18	0.201	0.201	0.07	0.014	4%
14	7.90	0.18		0.217			1.0	7.70	8.10	0.40	0.18	0.217	0.217	0.07	0.016	4%
15	8.30	0.18		0.145			1.0	8.10	8.50	0.40	0.18	0.145	0.145	0.07	0.010	3%
16	8.70	0.18		0.222			1.0	8.50	8.90	0.40	0.18	0.222	0.222	0.07	0.016	4%
17	9.10	0.21		0.194			1.0	8.90	9.25	0.35	0.21	0.194	0.194	0.07	0.014	4%
18	9.40	0.33		0.185			1.0	9.25	9.55	0.30	0.33	0.185	0.185	0.10	0.018	5%
19	9.70	0.38		0.210			1.0	9.55	9.85	0.30	0.38	0.210	0.210	0.11	0.024	6%
20	10.00	0.34		0.217			1.0	9.85	10.15	0.30	0.34	0.217	0.217	0.10	0.022	6%
21	10.30	0.36		0.179			1.0	10.15	10.40	0.25	0.36	0.179	0.179	0.09	0.016	4%
22	10.50	0.36		0.127			1.0	10.40	10.60	0.20	0.36	0.127	0.127	0.07	0.009	2%
LB	10.70	0.00	0.00	0.000	0.000	0.000	1.0	10.60	10.70	0.10	0.09	0.032	0.032	0.01	0.000	0%
Total Flow															0.389	

Measurement Details:

Start Time (MST):	10:17
End Time (MST):	11:05
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast

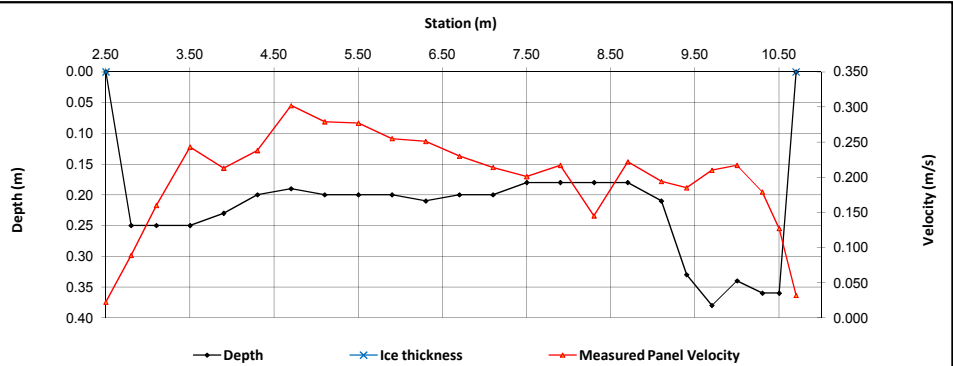
Flow Characteristics:

Total Flow:	0.389	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.85	(m ²)
Wetted Width:	8.20	(m)
Hydraulic Depth:	0.226	(m)
Mean Velocity:	0.210	(m/s)
Froude Number:	0.141	

Datalogger Details:

	Before	After
Transducer Reading:		0.547
Battery (Main):	13.9	
Battery (Aux):		
Datalogger Clock:	10:17	
Laptop Clock:	10:19	
Air Temperature °C:	20	
Air Pressure:	-	
RH:	-	
Water °C:	15.4	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 2m from logger	0.935	100.000	0.928	100.000	-
Bench Mark 2:	Spike in Base of Tree	1.161	99.774	1.153	99.774	-
Top of Ice:						
Water Level:		2.448	98.487	2.437	98.491	98.489
Transducer Reading:		0.547	97.940	0.547	97.944	97.942
Other:						

General Notes:

Field Personnel:	DB, KM	Trip Date:	14-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S48 Big Creek

UTM Location: ~470866 E, ~6389000 N

Site Visit Date: September 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.30	0.00	0.00	0.000	0.000	0.000	1.0	3.30	3.45	0.15	0.04	0.045	0.045	0.01	0.000	0%
1	3.60	0.16		0.179			1.0	3.45	3.80	0.35	0.16	0.179	0.179	0.06	0.010	6%
2	4.00	0.13		0.142			1.0	3.80	4.20	0.40	0.13	0.142	0.142	0.05	0.007	5%
3	4.40	0.11		0.167			1.0	4.20	4.60	0.40	0.11	0.167	0.167	0.04	0.007	5%
4	4.80	0.10		0.207			1.0	4.60	5.00	0.40	0.10	0.207	0.207	0.04	0.008	5%
5	5.20	0.11		0.151			1.0	5.00	5.40	0.40	0.11	0.151	0.151	0.04	0.007	4%
6	5.60	0.11		0.169			1.0	5.40	5.80	0.40	0.11	0.169	0.169	0.04	0.007	5%
7	6.00	0.12		0.189			1.0	5.80	6.20	0.40	0.12	0.189	0.189	0.05	0.009	6%
8	6.40	0.10		0.166			1.0	6.20	6.60	0.40	0.10	0.166	0.166	0.04	0.007	4%
9	6.80	0.10		0.188			1.0	6.60	7.00	0.40	0.10	0.188	0.188	0.04	0.008	5%
10	7.20	0.09		0.149			1.0	7.00	7.40	0.40	0.09	0.149	0.149	0.04	0.005	3%
11	7.60	0.08		0.157			1.0	7.40	7.80	0.40	0.08	0.157	0.157	0.03	0.005	3%
12	8.00	0.06		0.145			1.0	7.80	8.20	0.40	0.06	0.145	0.145	0.02	0.003	2%
13	8.40	0.08		0.177			1.0	8.20	8.60	0.40	0.08	0.177	0.177	0.03	0.006	4%
14	8.80	0.11		0.192			1.0	8.60	9.00	0.40	0.11	0.192	0.192	0.04	0.008	5%
15	9.20	0.11		0.157			1.0	9.00	9.40	0.40	0.11	0.157	0.157	0.04	0.007	4%
16	9.60	0.20		0.140			1.0	9.40	9.70	0.30	0.20	0.140	0.140	0.06	0.008	5%
17	9.80	0.24		0.176			1.0	9.70	9.90	0.20	0.24	0.176	0.176	0.05	0.008	5%
18	10.00	0.26		0.185			1.0	9.90	10.10	0.20	0.26	0.185	0.185	0.05	0.010	6%
19	10.20	0.30		0.139			1.0	10.10	10.30	0.20	0.30	0.139	0.139	0.06	0.008	5%
20	10.40	0.32		0.126			1.0	10.30	10.50	0.20	0.32	0.126	0.126	0.06	0.008	5%
21	10.60	0.24		0.124			1.0	10.50	10.70	0.20	0.24	0.124	0.124	0.05	0.006	4%
22	10.80	0.20		0.002			1.0	10.70	10.95	0.25	0.20	0.002	0.002	0.05	0.000	0%
LB	11.10	0.00	0.00	0.000	0.000	0.000	1.0	10.95	11.10	0.15	0.05	0.001	0.001	0.01	0.000	0%
Total Flow															0.154	

Measurement Details:

Start Time (MST):	8:45
End Time (MST):	9:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Cloudy, 10°C

Flow characteristics:

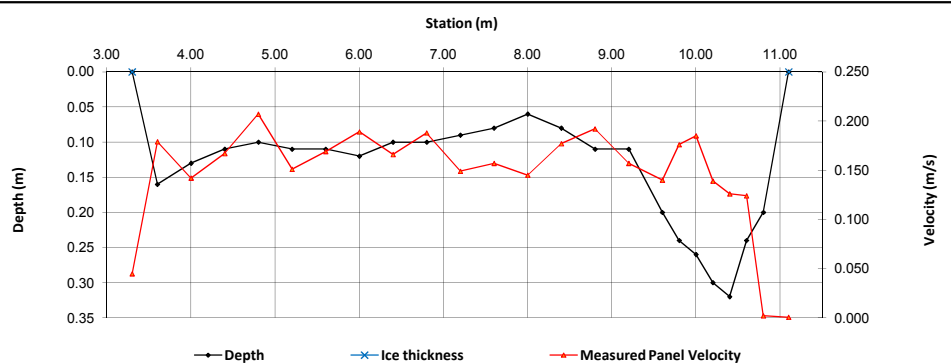
Total Flow:	0.154	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.02	(m ²)
Wetted Width:	7.80	(m)
Hydraulic Depth:	0.130	(m)
Mean Velocity:	0.152	(m/s)
Froude Number:	0.135	

Datalogger Details:

	Before	After
Transducer Reading:		0.447
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	8:46	
Laptop Clock:	8:44	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	8.1	
Memory Used:	-	
Dessicant:	changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Broken tree above point. Moved at 9:20, check at 9:30.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 2m from logger	0.917	100.000	0.902	100.000	-
Bench Mark 2:	Spike in Base of Tree	1.145	99.774	1.128	99.774	-
Top of Ice:						
Water Level:		2.528	98.389	2.513	98.389	98.389
Transducer Reading:		0.447	97.942	0.447	97.942	97.942
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	CM	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S48 Big Creek

UTM Location: 470895 E, 6389207 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	3.70	0.00	0.00	0.000	0.000	0.000	1.0	3.70	4.10	0.40	0.06	0.060	0.060	0.02	0.001	1%
1	4.50	0.24		0.241			1.0	4.10	4.75	0.65	0.24	0.241	0.241	0.16	0.038	19%
2	5.00	0.20		0.231			1.0	4.75	5.13	0.38	0.20	0.231	0.231	0.08	0.017	9%
3	5.25	0.17		0.241			1.0	5.13	5.38	0.25	0.17	0.241	0.241	0.04	0.010	5%
4	5.50	0.24		0.200			1.0	5.38	5.63	0.25	0.24	0.200	0.200	0.06	0.012	6%
5	5.75	0.12		0.130			1.0	5.63	5.88	0.25	0.12	0.130	0.130	0.03	0.004	2%
6	6.00	0.09		0.164			1.0	5.88	6.25	0.38	0.09	0.164	0.164	0.03	0.006	3%
7	6.50	0.07		0.098			1.0	6.25	6.75	0.50	0.07	0.098	0.098	0.04	0.003	2%
8	7.00	0.06		0.013			1.0	6.75	7.25	0.50	0.06	0.013	0.013	0.03	0.000	0%
9	7.50	0.08		0.148			1.0	7.25	7.75	0.50	0.08	0.148	0.148	0.04	0.006	3%
10	8.00	0.11		0.147			1.0	7.75	8.13	0.38	0.11	0.147	0.147	0.04	0.006	3%
11	8.25	0.13		0.199			1.0	8.13	8.38	0.25	0.13	0.199	0.199	0.03	0.006	3%
12	8.50	0.13		0.202			1.0	8.38	8.63	0.25	0.13	0.202	0.202	0.03	0.007	3%
13	8.75	0.17		0.199			1.0	8.63	8.88	0.25	0.17	0.199	0.199	0.04	0.008	4%
14	9.00	0.20		0.232			1.0	8.88	9.13	0.25	0.20	0.232	0.232	0.05	0.012	6%
15	9.25	0.18		0.254			1.0	9.13	9.38	0.25	0.18	0.254	0.254	0.05	0.011	6%
16	9.50	0.16		0.242			1.0	9.38	9.63	0.25	0.16	0.242	0.242	0.04	0.010	5%
17	9.75	0.16		0.223			1.0	9.63	9.88	0.25	0.16	0.223	0.223	0.04	0.009	5%
18	10.00	0.10		0.191			1.0	9.88	10.25	0.38	0.10	0.191	0.191	0.04	0.007	4%
19	10.50	0.10		0.147			1.0	10.25	10.75	0.50	0.10	0.147	0.147	0.05	0.007	4%
20	11.00	0.14		0.116			1.0	10.75	11.13	0.38	0.14	0.116	0.116	0.05	0.006	3%
21	11.25	0.14		0.144			1.0	11.13	11.43	0.30	0.14	0.144	0.144	0.04	0.006	3%
RB	11.60	0.00	0.00	0.000	0.000	0.000	1.0	11.43	11.60	0.17	0.04	0.036	0.036	0.01	0.000	0%
Total Flow															0.194	

Measurement Details:

Start Time (MST):	9:55
End Time (MST):	11:02
Equipment:	ADV
Method:	Wading
River Condition:	Low, Open
Quality/Error (see reverse):	Fair
Weather:	Clear, 2°C

Flow characteristics:

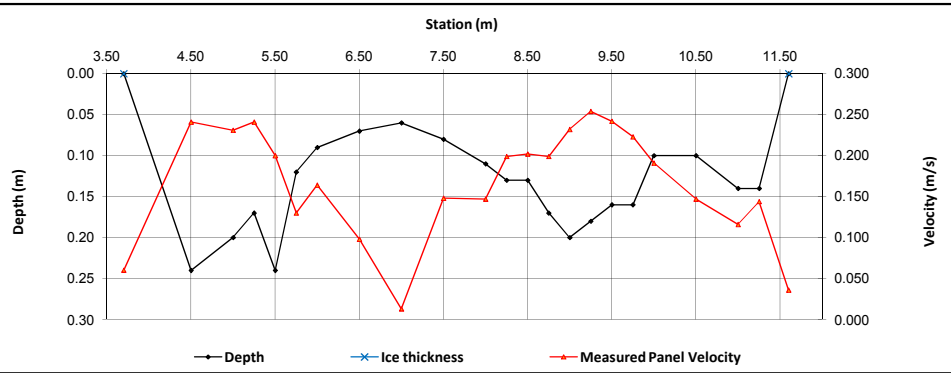
Total Flow:	0.194	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	1.04	(m ²)
Wetted Width:	7.90	(m)
Hydraulic Depth:	0.131	(m)
Mean Velocity:	0.187	(m/s)
Froude Number:	0.165	

Datalogger Details:

Transducer Reading:	Before	After
		0.434
Battery (Main):	14.7	
Battery (Aux):	-	
Datalogger Clock:	10:05	
Laptop Clock:	10:06	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.9	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

PLS, battery and CR800 removed



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" pipe 2m from logger	0.849	100.000	0.862	100.000	-
Bench Mark 2:	Spike in Base of Tree	1.076	99.774	1.089	99.774	-
Top of Ice:						
Water Level:		2.475	98.374	2.487	98.375	98.375
Transducer Reading:		0.434	97.940	0.434	97.941	97.941
Other:						

General Notes:

BM Heights

BM1: 0.44m
PLS weight left

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S49 Eymundson

UTM Location: 465524 E, 6372768 N

Site Visit Date: April 24, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	1.00	0.00		0.000	0.000	0.000	0.9	1.00	1.05	0.05	0.07	0.009	0.008	0.00	0.000	0%
1	1.10	0.26		0.037			0.9	1.05	1.15	0.10	0.26	0.037	0.033	0.03	0.001	1%
2	1.20	0.36		0.066			0.9	1.15	1.25	0.10	0.36	0.066	0.059	0.04	0.002	3%
3	1.30	0.39		0.055			0.9	1.25	1.35	0.10	0.39	0.055	0.050	0.04	0.002	3%
4	1.40	0.26		0.103			0.9	1.35	1.45	0.10	0.26	0.103	0.093	0.03	0.002	4%
5	1.50	0.26		0.103			0.9	1.45	1.55	0.10	0.26	0.103	0.093	0.03	0.002	4%
6	1.60	0.26		0.134			0.9	1.55	1.65	0.10	0.26	0.134	0.121	0.03	0.003	5%
7	1.70	0.27		0.144			0.9	1.65	1.75	0.10	0.27	0.144	0.130	0.03	0.003	5%
8	1.80	0.26		0.159			0.9	1.75	1.85	0.10	0.26	0.159	0.143	0.03	0.004	5%
9	1.90	0.26		0.221			0.9	1.85	1.95	0.10	0.26	0.221	0.199	0.03	0.005	8%
10	2.00	0.26		0.223			0.9	1.95	2.05	0.10	0.26	0.223	0.201	0.03	0.005	8%
11	2.10	0.26		0.238			0.9	2.05	2.15	0.10	0.26	0.238	0.214	0.03	0.006	8%
12	2.20	0.26		0.236			0.9	2.15	2.25	0.10	0.26	0.236	0.212	0.03	0.006	8%
13	2.30	0.26		0.223			0.9	2.25	2.35	0.10	0.26	0.223	0.201	0.03	0.005	8%
14	2.40	0.26		0.213			0.9	2.35	2.45	0.10	0.26	0.213	0.192	0.03	0.005	7%
15	2.50	0.26		0.217			0.9	2.45	2.55	0.10	0.26	0.217	0.195	0.03	0.005	7%
16	2.60	0.26		0.166			0.9	2.55	2.65	0.10	0.26	0.166	0.149	0.03	0.004	6%
17	2.70	0.26		0.217			0.9	2.65	2.80	0.15	0.26	0.217	0.195	0.04	0.008	11%
Right	2.90	0.00		0.000	0.000	0.000	1.0	2.80	2.90	0.10	0.07	0.054	0.054	0.01	0.000	1%
Total Flow														0.069		

Measurement Details:

Start Time (MST):	8:30
End Time (MST):	9:10
Equipment:	ADV
Method:	Wading
River Condition:	Ice
Quality/Error (see reverse):	Good
Weather:	Sunny, 5°C

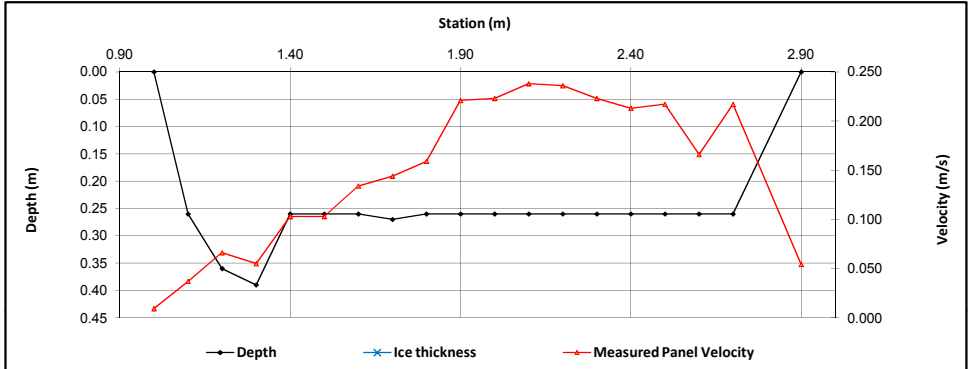
Flow characteristics:

Total Flow:	0.069	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.49	(m ²)
Wetted Width:	1.90	(m)
Hydraulic Depth:	0.257	(m)
Mean Velocity:	0.141	(m/s)
Froude Number:	0.089	

Datalogger Details:

	Before	After
Transducer Reading:		
Battery (Main):	-	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:						
Bench Mark 2:						
Top of Ice:						
Water Level:						
Transducer Reading:						
Other:						

General Notes:

Station not installed due to poor location, more scouting required.

Field Personnel:	SG, DB	Trip Date:	24-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S49 Eymundson

UTM Location: 465470E, 6372689N

Site Visit Date: July 27, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	3.50	0.00		0.000	0.000	0.000	1.0	3.50	3.75	0.25	0.05	0.040	0.040	0.01	0.000	0%
1	4.00	0.18		0.159			1.0	3.75	4.25	0.50	0.18	0.159	0.159	0.09	0.014	1%
2	4.50	0.32		-0.142			1.0	4.25	4.75	0.50	0.32	-0.142	-0.142	0.16	-0.023	-1%
3	5.00	0.38		0.117			1.0	4.75	5.25	0.50	0.38	0.117	0.117	0.19	0.022	1%
4	5.50	0.44		0.113			1.0	5.25	5.70	0.45	0.44	0.113	0.113	0.20	0.022	1%
5	5.90	0.48		0.132			1.0	5.70	6.10	0.40	0.48	0.132	0.132	0.19	0.025	1%
6	6.30	0.55		0.239			1.0	6.10	6.50	0.40	0.55	0.239	0.239	0.22	0.053	3%
7	6.70	0.64		0.251			1.0	6.50	6.90	0.40	0.64	0.251	0.251	0.26	0.064	4%
8	7.10	0.62		0.297			1.0	6.90	7.25	0.35	0.62	0.297	0.297	0.22	0.064	4%
9	7.40	0.63		0.352			1.0	7.25	7.55	0.30	0.63	0.352	0.352	0.19	0.067	4%
10	7.70	0.66		0.359			1.0	7.55	7.85	0.30	0.66	0.359	0.359	0.20	0.071	4%
11	8.00	0.66		0.382			1.0	7.85	8.15	0.30	0.66	0.382	0.382	0.20	0.076	4%
12	8.30	0.68		0.425			1.0	8.15	8.45	0.30	0.68	0.425	0.425	0.20	0.087	5%
13	8.60	0.66		0.403			1.0	8.45	8.75	0.30	0.66	0.403	0.403	0.20	0.080	5%
14	8.90	0.67		0.456			1.0	8.75	9.05	0.30	0.67	0.456	0.456	0.20	0.092	5%
15	9.20	0.72		0.515			1.0	9.05	9.35	0.30	0.72	0.515	0.515	0.22	0.111	6%
16	9.50	0.69		0.528			1.0	9.35	9.65	0.30	0.69	0.528	0.528	0.21	0.109	6%
17	9.80	0.62		0.588			1.0	9.65	9.95	0.30	0.62	0.588	0.588	0.19	0.109	6%
18	10.10	0.66		0.531			1.0	9.95	10.25	0.30	0.66	0.531	0.531	0.20	0.105	6%
19	10.40	0.68		0.530			1.0	10.25	10.55	0.30	0.68	0.530	0.530	0.20	0.108	6%
20	10.70	0.68		0.364			1.0	10.55	10.85	0.30	0.68	0.364	0.364	0.20	0.074	4%
21	11.00	0.68		0.422			1.0	10.85	11.15	0.30	0.68	0.422	0.422	0.20	0.086	5%
22	11.30	0.68		0.330			1.0	11.15	11.50	0.35	0.68	0.330	0.330	0.24	0.079	5%
23	11.70	0.69		0.343			1.0	11.50	11.90	0.40	0.69	0.343	0.343	0.28	0.095	5%
24	12.10	0.72		0.320			1.0	11.90	12.30	0.40	0.72	0.320	0.320	0.29	0.092	5%
25	12.50	0.69		0.064			1.0	12.30	12.70	0.40	0.69	0.064	0.064	0.28	0.018	1%
26	12.90	0.45		0.005			1.0	12.70	13.05	0.35	0.45	0.005	0.005	0.16	0.001	0%
Right	13.20	0.00		0.000	0.000	0.000	1.0	11.50	13.20	1.70	0.16	0.147	0.147	0.26	0.039	2%

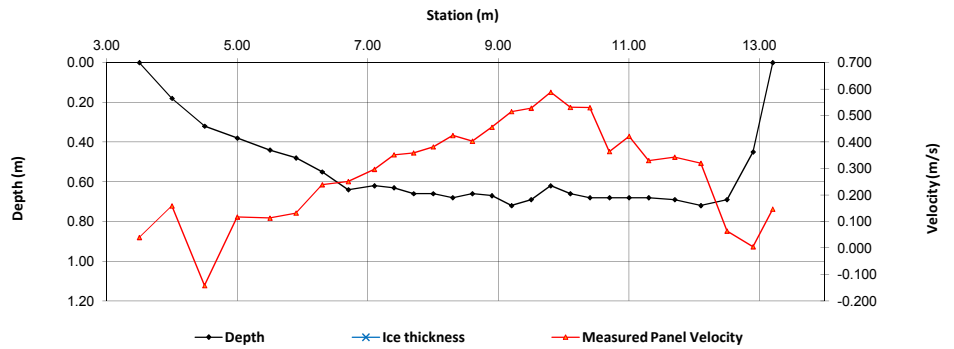
Total Flow 1.741

Measurement Details:

Start Time (MST):	12:30
End Time (MST):	13:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Partly Cloudy, 25°C

Flow characteristics:

Total Flow:	1.741	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	5.64	(m ²)
Wetted Width:	9.70	(m)
Hydraulic Depth:	0.581	(m)
Mean Velocity:	0.309	(m/s)
Froude Number:	0.129	



Datalogger Details:

	Before	After
Transducer Reading:		0.578
Battery (Main):	11.71	
Battery (Aux):	-	
Datalogger Clock:	-	
Laptop Clock:	-	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	18°C	
Memory Used:	-	
Dessicant:	-	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 5m N of station	1.150	100.000	1.141	100.000	-
Bench Mark 2:	Nail in tree 4m NE of logger	1.274	99.876	1.264	99.876	
Top of Ice:						
Water Level:		2.672	98.478	2.664	98.477	98.478
Transducer Reading:		0.578	97.900	0.578	97.899	97.900
Other:						

General Notes:

Station installed. Location is ~1.5km upstream from Athabasca, and about ~5 metres higher

Field Personnel:	DB, SM	Trip Date:	27-Jul-11
Data Entry Personnel:	DB	Date:	3-Aug-11
Data Check Personnel:	JP	Date:	5-Aug-11

Hydrometric Measurement / Site Visit Record

Site: Eymundson

UTM Location: 465524 E, 6372768 N

Site Visit Date: August 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	5.60	0.00	0.00	0.000	0.000	0.000	1.0	5.60	5.90	0.30	0.07	0.036	0.036	0.02	0.001	0%
1	6.20	0.29		0.142			1.0	5.90	6.45	0.55	0.29	0.142	0.142	0.16	0.023	3%
2	6.70	0.36		0.144			1.0	6.45	6.90	0.45	0.36	0.144	0.144	0.16	0.023	3%
3	7.10	0.38		0.160			1.0	6.90	7.30	0.40	0.38	0.160	0.160	0.15	0.024	3%
4	7.50	0.40		0.210			1.0	7.30	7.70	0.40	0.40	0.210	0.210	0.16	0.034	4%
5	7.90	0.43		0.286			1.0	7.70	8.10	0.40	0.43	0.286	0.286	0.17	0.049	6%
6	8.30	0.43		0.374			1.0	8.10	8.50	0.40	0.43	0.374	0.374	0.17	0.064	8%
7	8.70	0.44		0.398			1.0	8.50	8.90	0.40	0.44	0.398	0.398	0.18	0.070	9%
8	9.10	0.44		0.395			1.0	8.90	9.30	0.40	0.44	0.395	0.395	0.18	0.070	9%
9	9.50	0.43		0.403			1.0	9.30	9.70	0.40	0.43	0.403	0.403	0.17	0.069	9%
10	9.90	0.42		0.420			1.0	9.70	10.10	0.40	0.42	0.420	0.420	0.17	0.071	9%
11	10.30	0.40		0.303			1.0	10.10	10.50	0.40	0.40	0.303	0.303	0.16	0.048	6%
12	10.70	0.40		0.295			1.0	10.50	10.90	0.40	0.40	0.295	0.295	0.16	0.047	6%
13	11.10	0.39		0.241			1.0	10.90	11.30	0.40	0.39	0.241	0.241	0.16	0.038	5%
14	11.50	0.38		0.196			1.0	11.30	11.70	0.40	0.38	0.196	0.196	0.15	0.030	4%
15	11.90	0.40		0.181			1.0	11.70	12.10	0.40	0.40	0.181	0.181	0.16	0.029	4%
16	12.30	0.38		0.130			1.0	12.10	12.50	0.40	0.38	0.130	0.130	0.15	0.020	3%
17	12.70	0.40		0.118			1.0	12.50	12.90	0.40	0.40	0.118	0.118	0.16	0.019	2%
18	13.10	0.38		0.104			1.0	12.90	13.30	0.40	0.38	0.104	0.104	0.15	0.016	2%
19	13.50	0.37		0.090			1.0	13.30	13.70	0.40	0.37	0.090	0.090	0.15	0.013	2%
20	13.90	0.35		0.039			1.0	13.70	14.45	0.75	0.35	0.039	0.039	0.26	0.010	1%
RB	15.00	0.00	0.00	0.000	0.000	0.000	1.0	14.45	15.00	0.55	0.09	0.010	0.010	0.05	0.000	0%
Total Flow														0.768		

Measurement Details:

Start Time (MST):	12:40
End Time (MST):	13:25
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast

Flow characteristics:

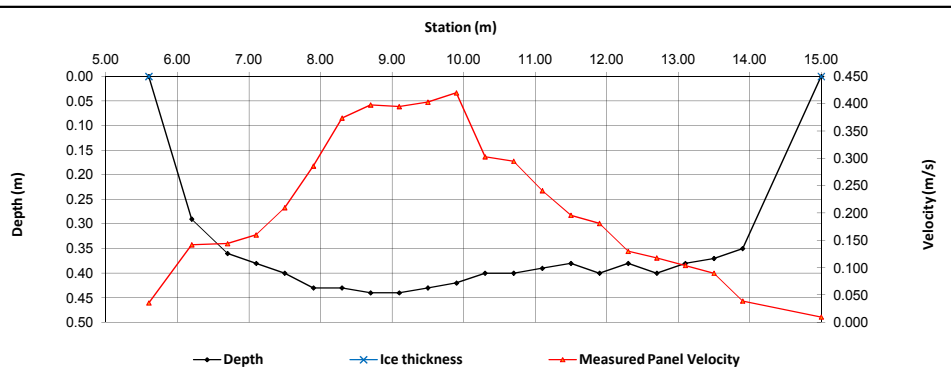
Total Flow:	0.768	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	3.40	(m ²)
Wetted Width:	9.40	(m)
Hydraulic Depth:	0.362	(m)
Mean Velocity:	0.226	(m/s)
Froude Number:	0.120	

Datalogger Details:

	Before	After
Transducer Reading:		0.394
Battery (Main):	14.42	
Battery (Aux):	-	
Datalogger Clock:	12:43	
Laptop Clock:	12:43	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	16.10	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

Daily minimum battery above 12.5V



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 5m N of station	1.041	100.000	1.034	100.000	-
Bench Mark 2:	Nail in tree 4m NE of logger	1.165	99.876	1.159	99.876	-
Top of Ice:						
Water Level:		2.765	98.276	2.757	98.277	98.277
Transducer Reading:		0.394	97.882	0.394	97.883	97.883
Other:						

General Notes:

Field Personnel:	DB, KW	Trip Date:	15-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: Eymundson

UTM Location: 465473.46 E, 6372693.56 N

Site Visit Date: September 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	3.90	0.00	0.00	0.000	0.000	0.000	1.0	3.90	4.05	0.15	0.03	0.028	0.028	0.00	0.000	0%
1	4.20	0.10		0.113			1.0	4.05	4.35	0.30	0.10	0.113	0.113	0.03	0.003	2%
2	4.50	0.12		0.135			1.0	4.35	4.65	0.30	0.12	0.135	0.135	0.04	0.005	3%
3	4.80	0.17		0.071			1.0	4.65	4.95	0.30	0.17	0.071	0.071	0.05	0.004	2%
4	5.10	0.09		0.108			1.0	4.95	5.25	0.30	0.09	0.108	0.108	0.03	0.003	2%
5	5.40	0.22		0.157			1.0	5.25	5.55	0.30	0.22	0.157	0.157	0.07	0.010	6%
6	5.70	0.24		0.157			1.0	5.55	5.85	0.30	0.24	0.157	0.157	0.07	0.011	7%
7	6.00	0.24		0.158			1.0	5.85	6.15	0.30	0.24	0.158	0.158	0.07	0.011	7%
8	6.30	0.25		0.161			1.0	6.15	6.45	0.30	0.25	0.161	0.161	0.07	0.012	7%
9	6.60	0.22		0.142			1.0	6.45	6.75	0.30	0.22	0.142	0.142	0.07	0.009	5%
10	6.90	0.22		0.164			1.0	6.75	7.05	0.30	0.22	0.164	0.164	0.07	0.011	6%
11	7.20	0.23		0.140			1.0	7.05	7.35	0.30	0.23	0.140	0.140	0.07	0.010	6%
12	7.50	0.22		0.154			1.0	7.35	7.65	0.30	0.22	0.154	0.154	0.07	0.010	6%
13	7.80	0.22		0.151			1.0	7.65	7.95	0.30	0.22	0.151	0.151	0.07	0.010	6%
14	8.10	0.21		0.144			1.0	7.95	8.25	0.30	0.21	0.144	0.144	0.06	0.009	5%
15	8.40	0.19		0.146			1.0	8.25	8.55	0.30	0.19	0.146	0.146	0.06	0.008	5%
16	8.70	0.18		0.136			1.0	8.55	8.85	0.30	0.18	0.136	0.136	0.05	0.007	4%
17	9.00	0.16		0.134			1.0	8.85	9.15	0.30	0.16	0.134	0.134	0.05	0.006	4%
18	9.30	0.14		0.134			1.0	9.15	9.45	0.30	0.14	0.134	0.134	0.04	0.006	3%
19	9.60	0.17		0.131			1.0	9.45	9.75	0.30	0.17	0.131	0.131	0.05	0.007	4%
20	9.90	0.14		0.100			1.0	9.75	10.05	0.30	0.14	0.100	0.100	0.04	0.004	2%
21	10.20	0.12		0.095			1.0	10.05	10.35	0.30	0.12	0.095	0.095	0.04	0.003	2%
22	10.50	0.13		0.081			1.0	10.35	10.65	0.30	0.13	0.081	0.081	0.04	0.003	2%
23	10.80	0.13		0.072			1.0	10.65	10.95	0.30	0.13	0.072	0.072	0.04	0.003	2%
24	11.10	0.16		0.051			1.0	10.95	11.25	0.30	0.16	0.051	0.051	0.05	0.002	1%
25	11.40	0.13		0.053			1.0	11.25	11.50	0.25	0.13	0.053	0.053	0.03	0.002	1%
RB	11.60	0.00	0.00	0.000	0.000	0.000	1.0	11.50	11.60	0.10	0.03	0.013	0.013	0.00	0.000	0%
Total Flow														0.171		

Measurement Details:

Start Time (MST):	11:00
End Time (MST):	11:50
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast, 10°C

Flow characteristics:

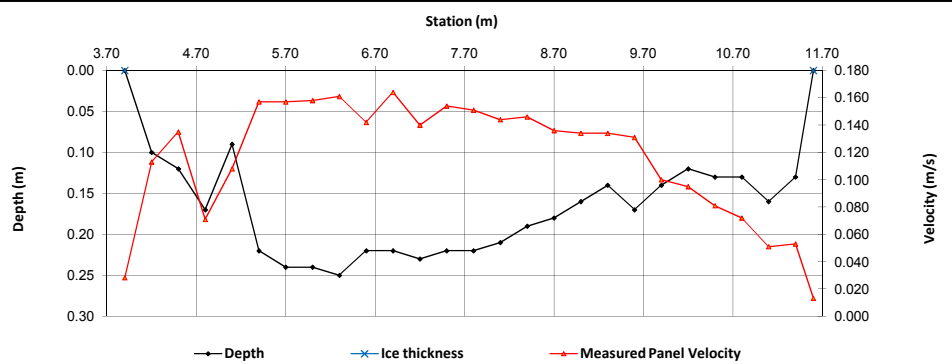
Total Flow:	0.171	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	1.32	(m ²)
Wetted Width:	7.70	(m)
Hydraulic Depth:	0.171	(m)
Mean Velocity:	0.130	(m/s)
Froude Number:	0.100	

Datalogger Details:

	Before	After
Transducer Reading:	0.166	0.334
Battery (Main):	14.00	
Battery (Aux):	-	
Datalogger Clock:	11:08	11:32
Laptop Clock:	11:08	11:32
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	7.90	8.10
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

transducer moved



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 5m N of logger	1.125	100.000	1.138	100.000	-
Bench Mark 2:	Nail in tree, 4m NE of logger	1.249	99.876	1.263	99.876	-
Top of Ice:						
Water Level:		3.082	98.043	3.095	98.043	98.043
Transducer Reading:		0.166	97.877	0.166	97.877	97.877
Other:						

General Notes:

GPS BM1

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	CM	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: Eymundson

UTM Location: 465524 E, 6372768 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
LB	4.10	0.00	0.00	0.000	0.000	0.000	1.0	4.10	4.35	0.25	0.05	0.005	0.005	0.01	0.000	0%
1	4.60	0.20		0.019			1.0	4.35	4.80	0.45	0.20	0.019	0.019	0.09	0.002	1%
2	5.00	0.24		0.049			1.0	4.80	5.20	0.40	0.24	0.049	0.049	0.10	0.005	2%
3	5.40	0.26		0.135			1.0	5.20	5.60	0.40	0.26	0.135	0.135	0.10	0.014	5%
4	5.80	0.32		0.156			1.0	5.60	6.00	0.40	0.32	0.156	0.156	0.13	0.020	7%
5	6.20	0.40		0.146			1.0	6.00	6.30	0.30	0.40	0.146	0.146	0.12	0.018	6%
6	6.40	0.42		0.183			1.0	6.30	6.50	0.20	0.42	0.183	0.183	0.08	0.015	5%
7	6.60	0.43		0.174			1.0	6.50	6.70	0.20	0.43	0.174	0.174	0.09	0.015	5%
8	6.80	0.43		0.162			1.0	6.70	6.90	0.20	0.43	0.162	0.162	0.09	0.014	5%
9	7.00	0.42		0.163			1.0	6.90	7.10	0.20	0.42	0.163	0.163	0.08	0.014	5%
10	7.20	0.42		0.166			1.0	7.10	7.30	0.20	0.42	0.166	0.166	0.08	0.014	5%
11	7.40	0.40		0.171			1.0	7.30	7.50	0.20	0.40	0.171	0.171	0.08	0.014	5%
12	7.60	0.39		0.170			1.0	7.50	7.70	0.20	0.39	0.170	0.170	0.08	0.013	5%
13	7.80	0.42		0.150			1.0	7.70	8.00	0.30	0.42	0.150	0.150	0.13	0.019	7%
14	8.20	0.36		0.136			1.0	8.00	8.40	0.40	0.36	0.136	0.136	0.14	0.020	7%
15	8.60	0.34		0.128			1.0	8.40	8.80	0.40	0.34	0.128	0.128	0.14	0.017	6%
16	9.00	0.29		0.133			1.0	8.80	9.20	0.40	0.29	0.133	0.133	0.12	0.015	5%
17	9.40	0.27		0.145			1.0	9.20	9.60	0.40	0.27	0.145	0.145	0.11	0.016	6%
18	9.80	0.26		0.161			1.0	9.60	10.00	0.40	0.26	0.161	0.161	0.10	0.017	6%
19	10.20	0.24		0.151			1.0	10.00	10.40	0.40	0.24	0.151	0.151	0.10	0.014	5%
20	10.60	0.24		0.035			1.0	10.40	10.80	0.40	0.24	0.035	0.035	0.10	0.003	1%
21	11.00	0.15		0.083			1.0	10.80	11.25	0.45	0.15	0.083	0.083	0.07	0.006	2%
RB	11.50	0.00	0.00	0.000	0.000	0.000	1.0	11.25	11.50	0.25	0.04	0.021	0.021	0.01	0.000	0%
Total Flow															0.284	

Measurement Details:

Start Time (MST):	11:15
End Time (MST):	12:28
Equipment:	ADV
Method:	Wading
River Condition:	low, open
Quality/Error (see reverse):	Excellent
Weather:	clear, 2°C

Flow characteristics:

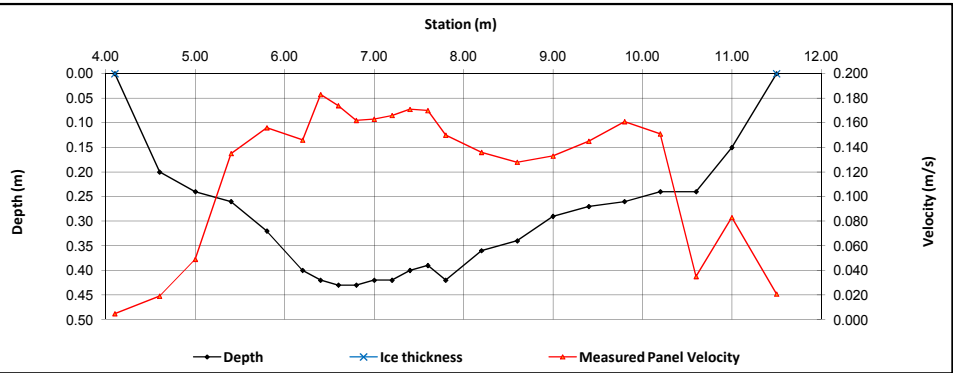
Total Flow:	0.284	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	2.14	(m ²)
Wetted Width:	7.40	(m)
Hydraulic Depth:	0.289	(m)
Mean Velocity:	0.133	(m/s)
Froude Number:	0.079	

Datalogger Details:

Transducer Reading:	Before	After
		0.361
Battery (Main):	13.63	
Battery (Aux):	-	
Datalogger Clock:	11:34	
Laptop Clock:	11:34	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	0.30	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

PLS, CR800, Battery removed



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 5 m N or Iggr	1.023	100.000	1.006	100.000	-
Bench Mark 2:	Nail in tree, 4m NE of Iggr	1.148	99.876	1.131	99.876	-
Top of Ice:						
Water Level:		2.933	98.090	2.921	98.085	98.088
Transducer Reading:		0.361	97.729	0.361	97.724	97.727
Other:						

General Notes:

BM Heights:

BM1: 0.35 m

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S50 Red Clay

UTM Location: 474945 E, 6396124 N

Site Visit Date: April 23, 2011



Flow Measurement:

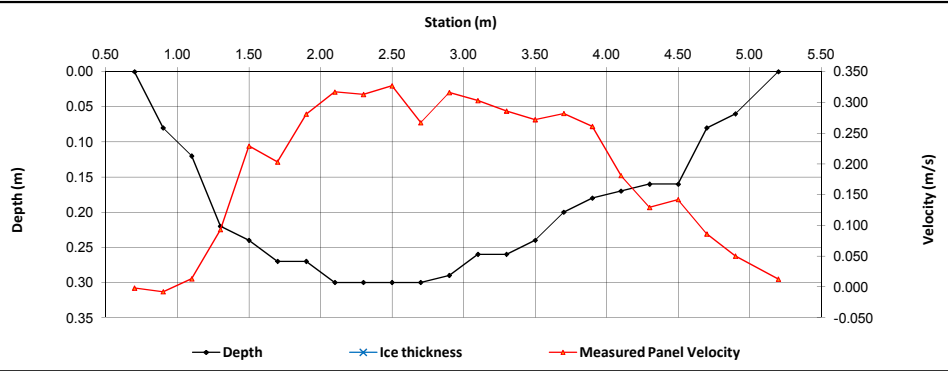
Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Left	0.70	0.00		0.000	0.000	0.000	1.0	0.70	0.80	0.10	0.02	-0.002	-0.002	0.00	0.000	0%
1	0.90	0.08		-0.008			1.0	0.80	1.00	0.20	0.08	-0.008	-0.008	0.02	0.000	0%
2	1.10	0.12		0.013			1.0	1.00	1.20	0.20	0.12	0.013	0.013	0.02	0.000	0%
3	1.30	0.22		0.093			1.0	1.20	1.40	0.20	0.22	0.093	0.093	0.04	0.004	2%
4	1.50	0.24		0.229			1.0	1.40	1.60	0.20	0.24	0.229	0.229	0.05	0.011	5%
5	1.70	0.27		0.203			1.0	1.60	1.80	0.20	0.27	0.203	0.203	0.05	0.011	5%
6	1.90	0.27		0.281			1.0	1.80	2.00	0.20	0.27	0.281	0.281	0.05	0.015	7%
7	2.10	0.30		0.317			1.0	2.00	2.20	0.20	0.30	0.317	0.317	0.06	0.019	9%
8	2.30	0.30		0.313			1.0	2.20	2.40	0.20	0.30	0.313	0.313	0.06	0.019	9%
9	2.50	0.30		0.327			1.0	2.40	2.60	0.20	0.30	0.327	0.327	0.06	0.020	9%
10	2.70	0.30		0.267			1.0	2.60	2.80	0.20	0.30	0.267	0.267	0.06	0.016	7%
11	2.90	0.29		0.316			1.0	2.80	3.00	0.20	0.29	0.316	0.316	0.06	0.018	9%
12	3.10	0.26		0.303			1.0	3.00	3.20	0.20	0.26	0.303	0.303	0.05	0.016	7%
13	3.30	0.26		0.286			1.0	3.20	3.40	0.20	0.26	0.286	0.286	0.05	0.015	7%
14	3.50	0.24		0.272			1.0	3.40	3.60	0.20	0.24	0.272	0.272	0.05	0.013	6%
15	3.70	0.20		0.282			1.0	3.60	3.80	0.20	0.20	0.282	0.282	0.04	0.011	5%
16	3.90	0.18		0.261			1.0	3.80	4.00	0.20	0.18	0.261	0.261	0.04	0.009	4%
17	4.10	0.17		0.181			1.0	4.00	4.20	0.20	0.17	0.181	0.181	0.03	0.006	3%
18	4.30	0.16		0.129			1.0	4.20	4.40	0.20	0.16	0.129	0.129	0.03	0.004	2%
19	4.50	0.16		0.142			1.0	4.40	4.60	0.20	0.16	0.142	0.142	0.03	0.005	2%
20	4.70	0.08		0.086			1.0	4.60	4.80	0.20	0.08	0.086	0.086	0.02	0.001	1%
21	4.90	0.06		0.050			1.0	4.80	5.05	0.25	0.06	0.050	0.050	0.02	0.001	0%
Right	5.20	0.00		0.000	0.000	0.000	1.0	5.05	5.20	0.15	0.02	0.013	0.013	0.00	0.000	0%
Total Flow															0.215	

Measurement Details:	
Start Time (MST):	10:00
End Time (MST):	-
Equipment:	ADV
Method:	Wading
River Condition:	Bed Ice
Quality/Error (see reverse):	Good
Weather:	Partly cloudy

Flow characteristics:		
Total Flow:	0.215	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	0.90	(m ²)
Wetted Width:	4.50	(m)
Hydraulic Depth:	0.200	(m)
Mean Velocity:	0.239	(m/s)
Froude Number:	0.170	

Datalogger Details:		
	Before	After
Transducer Reading:		0.263
Battery (Main):	14.61	
Battery (Aux):	-	
Datalogger Clock:	10:48	
Laptop Clock:	10:48	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	1.10	
Memory Used:	-	
Dessicant:	New	
Logger# (if Δ):	16568	
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:						
Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" pipe 4m to west of station					
Bench Mark 2:	Nail in base of tree, 6m to N or station	1.048	99.769	1.038	99.769	-
Top of Ice:						
Water Level:		1.778	99.039	1.769	99.038	99.039
Transducer Reading:		0.263	98.776	0.263	98.775	98.776
Other:						

General Notes:
Ice on bottom of channel.

Field Personnel:	SG, DB	Trip Date:	23-Apr-11
Data Entry Personnel:	CM	Date:	4-May-11
Data Check Personnel:	JO	Date:	10-May-11

Hydrometric Measurement / Site Visit Record

Site: S50 Red Clay

UTM Location: 474945 E, 6396124 N

Site Visit Date: July 26, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
Right	3.20	0.00		0.000	0.000	0.000	1.0	3.20	3.35	0.15	0.13	-0.024	-0.024	0.02	0.000	0%
1	3.50	0.52		-0.095			1.0	3.35	3.65	0.30	0.52	-0.095	-0.095	0.16	-0.015	-4%
2	3.80	0.56		0.082			1.0	3.65	3.95	0.30	0.56	0.082	0.082	0.17	0.014	4%
3	4.10	0.49		0.000			1.0	3.95	4.25	0.30	0.49	0.000	0.000	0.15	0.000	0%
4	4.40	0.48		0.158			1.0	4.25	4.55	0.30	0.48	0.158	0.158	0.14	0.023	6%
5	4.70	0.55		0.106			1.0	4.55	4.85	0.30	0.55	0.106	0.106	0.16	0.017	5%
6	5.00	0.60		0.111			1.0	4.85	5.15	0.30	0.60	0.111	0.111	0.18	0.020	6%
7	5.30	0.76			0.029	0.177	1.0	5.15	5.45	0.30	0.76	0.103	0.103	0.23	0.023	7%
8	5.60	0.74		0.091			1.0	5.45	5.75	0.30	0.74	0.091	0.091	0.22	0.020	6%
9	5.90	0.82			0.064	0.272	1.0	5.75	6.05	0.30	0.82	0.168	0.168	0.25	0.041	12%
10	6.20	0.92			0.040	0.205	1.0	6.05	6.35	0.30	0.92	0.123	0.123	0.28	0.034	10%
11	6.50	0.92			0.075	0.138	1.0	6.35	6.65	0.30	0.92	0.107	0.107	0.28	0.029	8%
12	6.80	1.02			0.026	0.154	1.0	6.65	6.88	0.23	1.02	0.090	0.090	0.23	0.021	6%
13	6.95	1.06			0.148	0.162	1.0	6.88	7.03	0.15	1.06	0.155	0.155	0.16	0.025	7%
14	7.10	1.02			0.149	0.140	1.0	7.03	7.18	0.15	1.02	0.145	0.145	0.15	0.022	6%
15	7.25	1.00			0.087	0.134	1.0	7.18	7.33	0.15	1.00	0.111	0.111	0.15	0.017	5%
16	7.40	0.96			0.149	0.088	1.0	7.33	7.55	0.23	0.96	0.119	0.119	0.22	0.026	7%
17	7.70	0.84			0.125	0.026	1.0	7.55	7.85	0.30	0.84	0.076	0.076	0.25	0.019	5%
18	8.00	0.74		0.076			1.0	7.85	8.15	0.30	0.74	0.076	0.076	0.22	0.017	5%
19	8.30	0.80		0.013			1.0	8.15	8.40	0.25	0.80	0.013	0.013	0.20	0.003	1%
Left	8.50	0.00		0.000	0.000	0.000	1.0	8.40	8.50	0.10	0.20	0.003	0.003	0.02	0.000	0%
Total Flow														0.355		

Measurement Details:

Start Time (MST):	14:30
End Time (MST):	15:30
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Good
Weather:	Partly Cloudy, 25°C

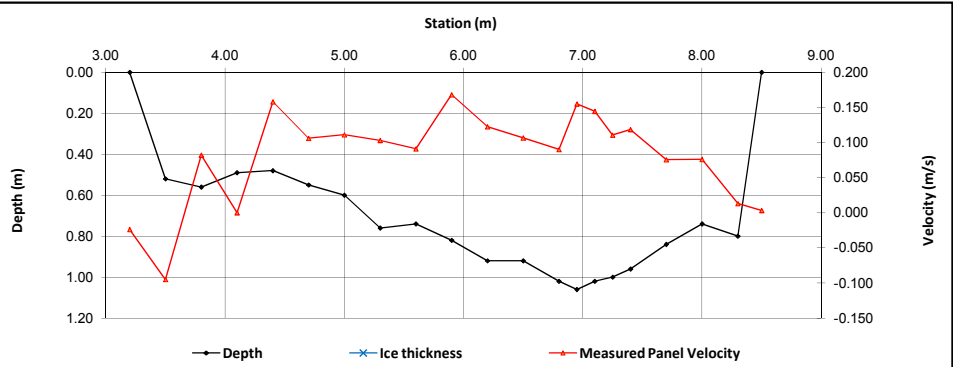
Flow characteristics:

Total Flow:	0.355	(m ³ /s)
Perceived Measurement Quality:	Good	
Cross Section Area:	3.83	(m ²)
Wetted Width:	5.30	(m)
Hydraulic Depth:	0.722	(m)
Mean Velocity:	0.093	(m/s)
Froude Number:	0.035	

Datalogger Details:

	Before	After
Transducer Reading:		0.683
Battery (Main):	13.54	
Battery (Aux):	-	
Datalogger Clock:	14:04	
Laptop Clock:	14:04	
Air Temperature °C:	17	
Air Pressure:	-	
RH:	-	
Water °C:	-	
Memory Used:	-	
Dessicant:	Replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 4m to west of station	1.097	100.000	1.083	100.000	-
Bench Mark 2:	Nail in base of tree, 6m to N or station	-	99.769	-	99.769	-
Top of Ice:						
Water Level:		1.861	99.236	1.849	99.234	99.235
Transducer Reading:		0.683	98.553	0.683	98.551	98.552
Other:						

General Notes:

Field Personnel:	DB, SM	Trip Date:	26-Jul-11
Data Entry Personnel:	DB	Date:	3-Aug-11
Data Check Personnel:	JP	Date:	5-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S50 Red Clay

UTM Location: 474945 E, 6396124 N

Site Visit Date: August 14, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	3.00	0.00	0.00	0.000	0.000	0.000	1.0	3.00	3.25	0.25	0.13	0.013	0.013	0.03	0.000	0%
1	3.50	0.53		0.051			1.0	3.25	3.65	0.40	0.53	0.051	0.051	0.21	0.011	4%
2	3.80	0.51		0.044			1.0	3.65	3.95	0.30	0.51	0.044	0.044	0.15	0.007	2%
3	4.10	0.47		0.030			1.0	3.95	4.25	0.30	0.47	0.030	0.030	0.14	0.004	1%
4	4.40	0.51		0.093			1.0	4.25	4.55	0.30	0.51	0.093	0.093	0.15	0.014	5%
5	4.70	0.62		0.057			1.0	4.55	4.85	0.30	0.62	0.057	0.057	0.19	0.011	4%
6	5.00	0.59		0.089			1.0	4.85	5.15	0.30	0.59	0.089	0.089	0.18	0.016	5%
7	5.30	0.71		0.060			1.0	5.15	5.40	0.25	0.71	0.060	0.060	0.18	0.011	4%
8	5.50	0.78			0.016	0.112	1.0	5.40	5.60	0.20	0.78	0.064	0.064	0.16	0.010	3%
9	5.70	0.80			0.045	0.130	1.0	5.60	5.80	0.20	0.80	0.088	0.088	0.16	0.014	5%
10	5.90	0.74		0.077			1.0	5.80	6.00	0.20	0.74	0.077	0.077	0.15	0.011	4%
11	6.10	0.85			0.031	0.163	1.0	6.00	6.20	0.20	0.85	0.097	0.097	0.17	0.016	6%
12	6.30	0.94			0.011	0.134	1.0	6.20	6.40	0.20	0.94	0.073	0.073	0.19	0.014	5%
13	6.50	0.88			0.063	0.092	1.0	6.40	6.60	0.20	0.88	0.078	0.078	0.18	0.014	5%
14	6.70	0.91			0.086	0.195	1.0	6.60	6.80	0.20	0.91	0.141	0.141	0.18	0.026	9%
15	6.90	0.95			0.103	0.142	1.0	6.80	7.00	0.20	0.95	0.123	0.123	0.19	0.023	8%
16	7.10	0.95			0.128	0.160	1.0	7.00	7.20	0.20	0.95	0.144	0.144	0.19	0.027	9%
17	7.30	0.91			0.094	0.139	1.0	7.20	7.40	0.20	0.91	0.117	0.117	0.18	0.021	7%
18	7.50	0.84			0.097	0.115	1.0	7.40	7.60	0.20	0.84	0.106	0.106	0.17	0.018	6%
19	7.70	0.76			0.092	0.069	1.0	7.60	7.80	0.20	0.76	0.081	0.081	0.15	0.012	4%
20	7.90	0.76			0.053	0.001	1.0	7.80	8.05	0.25	0.76	0.027	0.027	0.19	0.005	2%
21	8.20	0.80			0.047	0.001	1.0	8.05	8.30	0.25	0.80	0.024	0.024	0.20	0.005	2%
LB	8.40	0.00	0.00	0.000	0.000	0.000	1.0	8.30	8.40	0.10	0.20	0.006	0.006	0.02	0.000	0%
Total Flow															0.290	

Measurement Details:

Start Time (MST):	8:10
End Time (MST):	-
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Excellent
Weather:	Overcast

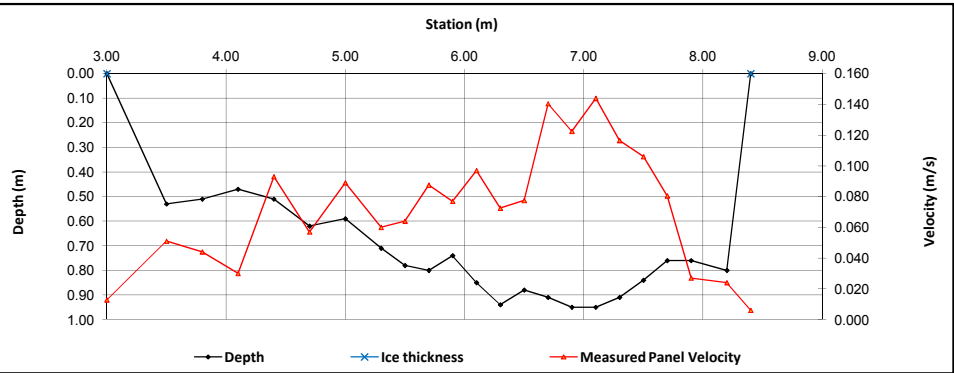
Flow characteristics:

Total Flow:	0.290	(m ³ /s)
Perceived Measurement Quality:	Excellent	
Cross Section Area:	3.70	(m ²)
Wetted Width:	5.40	(m)
Hydraulic Depth:	0.686	(m)
Mean Velocity:	0.078	(m/s)
Froude Number:	0.030	

Datalogger Details:

	Before	After
Transducer Reading:	0.655	0.994
Battery (Main):	14.48	
Battery (Aux):	-	
Datalogger Clock:	8:18	
Laptop Clock:	8:18	
Air Temperature °C:	15	
Air Pressure:	-	
RH:	-	
Water °C:	15.70	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 4m to west of station	0.908	100.000	0.892	100.000	-
Bench Mark 2:	Nail in base of tree, 6m to N or station	1.073	99.769	1.058	99.769	-
Top of Ice:						
Water Level:		1.699	99.209	1.683	99.209	99.209
Transducer Reading:		0.994	98.215	0.994	98.215	98.215
Other:						

General Notes:

TSS @ 8.4m. Mini beaver dam near/almost above transducer location (see photos), transducer moved a few metres downstream into clear water.

Field Personnel:	DB, KW	Trip Date:	14-Aug-11
Data Entry Personnel:	JP	Date:	26-Aug-11
Data Check Personnel:	DB	Date:	30-Aug-11

Hydrometric Measurement / Site Visit Record

Site: S50 Red Clay

UTM Location: 474953.76 E, 6396094.36 N

Site Visit Date: September 16, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/ Mmt #	Offset (m)	Depth (m)	Ice Thickness (m)	Velocity @ 0.6 Depth (m/s)	Velocity @ 0.8 Depth (m/s)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor	Pannel Start (m)	Pannel End (m)	Pannel Width (m)	Effective Pannel Depth (m)	Measured Pannel Velocity (m/s)	Average Pannel Velocity (m/s)	Pannel Area (m ²)	Pannel Discharge (m ³ /s)	Percent of total flow
RB	5.50	0.00	0.00	0.000	0.000	0.000	1.0	5.50	5.63	0.13	0.11	0.003	0.003	0.01	0.000	0%
1	5.75	0.42		0.011			1.0	5.63	5.88	0.25	0.42	0.011	0.011	0.11	0.001	8%
2	6.00	0.54		-0.003			1.0	5.88	6.13	0.25	0.54	-0.003	-0.003	0.14	0.000	-3%
3	6.25	0.56		-0.013			1.0	6.13	6.38	0.25	0.56	-0.013	-0.013	0.14	-0.002	-13%
4	6.50	0.62		0.003			1.0	6.38	6.63	0.25	0.62	0.003	0.003	0.16	0.000	3%
5	6.75	0.60		0.010			1.0	6.63	6.88	0.25	0.60	0.010	0.010	0.15	0.002	11%
6	7.00	0.79		-0.002			1.0	6.88	7.13	0.25	0.79	-0.002	-0.002	0.20	0.000	-3%
7	7.25	0.73		0.005			1.0	7.13	7.38	0.25	0.73	0.005	0.005	0.18	0.001	7%
8	7.50	0.62		0.011			1.0	7.38	7.63	0.25	0.62	0.011	0.011	0.16	0.002	12%
9	7.75	0.96		0.006			1.0	7.63	7.88	0.25	0.96	0.006	0.006	0.24	0.001	10%
10	8.00	0.94		0.003			1.0	7.88	8.13	0.25	0.94	0.003	0.003	0.24	0.001	5%
11	8.25	0.98		0.004			1.0	8.13	8.38	0.25	0.98	0.004	0.004	0.25	0.001	7%
12	8.50	1.00		0.004			1.0	8.38	8.63	0.25	1.00	0.004	0.004	0.25	0.001	7%
13	8.75	1.03		0.000			1.0	8.63	8.88	0.25	1.03	0.000	0.000	0.26	0.000	0%
14	9.00	1.08		0.001			1.0	8.88	9.13	0.25	1.08	0.001	0.001	0.27	0.000	2%
15	9.25	1.03		0.008			1.0	9.13	9.38	0.25	1.03	0.008	0.008	0.26	0.002	15%
16	9.50	0.96		0.012			1.0	9.38	9.58	0.20	0.96	0.012	0.012	0.19	0.002	17%
17	9.65	0.95		0.012			1.0	9.58	9.70	0.13	0.95	0.012	0.012	0.12	0.001	10%
18	9.75	0.90		0.012			1.0	9.70	9.88	0.18	0.90	0.012	0.012	0.16	0.002	14%
19	10.00	0.81		0.007			1.0	9.88	10.13	0.25	0.81	0.007	0.007	0.20	0.001	10%
20	10.25	0.83		-0.007			1.0	10.13	10.38	0.25	0.83	-0.007	-0.007	0.21	-0.001	-10%
21	10.50	0.59		-0.005			1.0	10.38	10.80	0.43	0.59	-0.005	-0.005	0.25	-0.001	-9%
LB	11.10	0.00	0.00	0.000	0.000	0.000	1.0	10.80	11.10	0.30	0.15	-0.001	-0.001	0.04	0.000	0%

Total Flow 0.014

Measurement Details:

Start Time (MST):	7:20
End Time (MST):	8:00
Equipment:	ADV
Method:	Wading
River Condition:	Open
Quality/Error (see reverse):	Fair
Weather:	Partly cloudy, 8°C

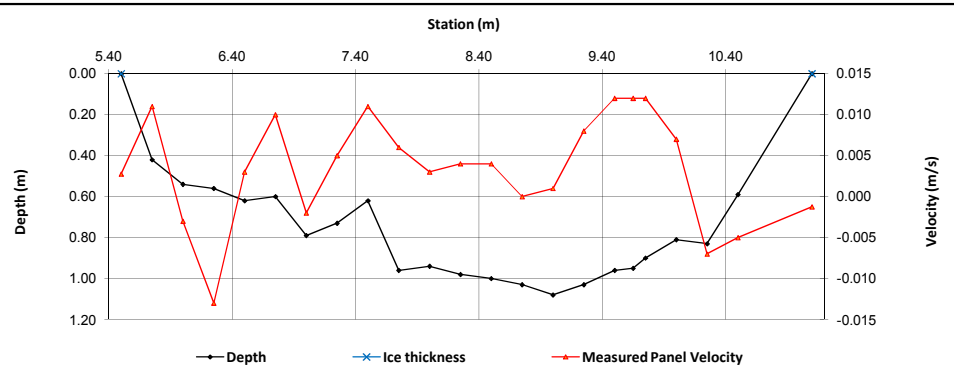
Flow characteristics:

Total Flow:	0.014	(m ³ /s)
Perceived Measurement Quality:	Fair	
Cross Section Area:	4.16	(m ²)
Wetted Width:	5.60	(m)
Hydraulic Depth:	0.743	(m)
Mean Velocity:	0.003	(m/s)
Froude Number:	0.001	

Datalogger Details:

	Before	After
Transducer Reading:		0.969
Battery (Main):	13.90	
Battery (Aux):	-	
Datalogger Clock:	7:21	
Laptop Clock:	7:21	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	8.10	
Memory Used:	-	
Dessicant:	Changed	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	EI (m)	(m)	EI (m)	
Bench Mark 1:	3/4" pipe 4m to west of station	0.869	100.000	0.857	100.000	-
Bench Mark 2:	Nail in base of tree, 6m to N or station	1.100	99.769	1.087	99.769	-
Top of Ice:						
Water Level:		1.693	99.176	1.679	99.178	99.177
Transducer Reading:		0.969	98.207	0.969	98.209	98.208
Other:	Upstream	1.350				

General Notes:

Beaver dam upstream of station. Water behind dam is higher, therefore changed flow pattern. Measured second tributary contributing to flow. Measured at 0.6 due to silty bottom. Small loss of flow in 3 -4 tributaries at side.

Field Personnel:	DB, SM	Trip Date:	16-Sep-11
Data Entry Personnel:	CM	Date:	26-Sep-11
Data Check Personnel:	DW	Date:	29-Nov-11

Hydrometric Measurement / Site Visit Record

Site: S50 Red Clay

UTM Location: 474945 E, 6396124 N

Site Visit Date: October 29, 2011



Flow Measurement:

Measured Data							Calculated Data									
Bank/	Offset	Depth	Ice	Velocity	Velocity	Velocity	Velocity	Pannel	Pannel	Pannel	Effective	Measured	Average	Pannel	Pannel	Percent of
Mmt #	(m)	(m)	Thickness	@ 0.6	@ 0.8	@ 0.2	Correction	Start	End	Width	Pannel	Pannel	Pannel	Area	Discharge	total flow
				Depth	Depth	Depth	Factor	(m)	(m)	(m)	Depth	Velocity	Velocity	(m ²)	(m ³ /s)	
		0.00	0.00	0.000	0.000	0.000	1.0	0.00			0.00	0.000	0.000	0.00	0.000	
1							1.0				0.00	0.000	0.000	0.00	0.000	
2							1.0				0.00	0.000	0.000	0.00	0.000	
3							1.0				0.00	0.000	0.000	0.00	0.000	
4							1.0				0.00	0.000	0.000	0.00	0.000	
5							1.0				0.00	0.000	0.000	0.00	0.000	
6							1.0				0.00	0.000	0.000	0.00	0.000	
7							1.0				0.00	0.000	0.000	0.00	0.000	
8							1.0				0.00	0.000	0.000	0.00	0.000	
9							1.0				0.00	0.000	0.000	0.00	0.000	
10							1.0				0.00	0.000	0.000	0.00	0.000	
11							1.0				0.00	0.000	0.000	0.00	0.000	
12							1.0				0.00	0.000	0.000	0.00	0.000	
13							1.0				0.00	0.000	0.000	0.00	0.000	
14							1.0				0.00	0.000	0.000	0.00	0.000	
15							1.0				0.00	0.000	0.000	0.00	0.000	
16							1.0				0.00	0.000	0.000	0.00	0.000	
17							1.0				0.00	0.000	0.000	0.00	0.000	
18							1.0				0.00	0.000	0.000	0.00	0.000	
19							1.0				0.00	0.000	0.000	0.00	0.000	
20							1.0				0.00	0.000	0.000	0.00	0.000	
		0.00	0.00	0.000	0.000	0.000	1.0				0.00	0.000	0.000	0.00	0.000	
Total Flow															0.000	

Measurement Details:

Start Time (MST):	9:05
End Time (MST):	9:46
Equipment:	-
Method:	-
River Condition:	dam, ice cover
Quality/Error (see reverse):	-
Weather:	clear, 1°C

Flow characteristics:

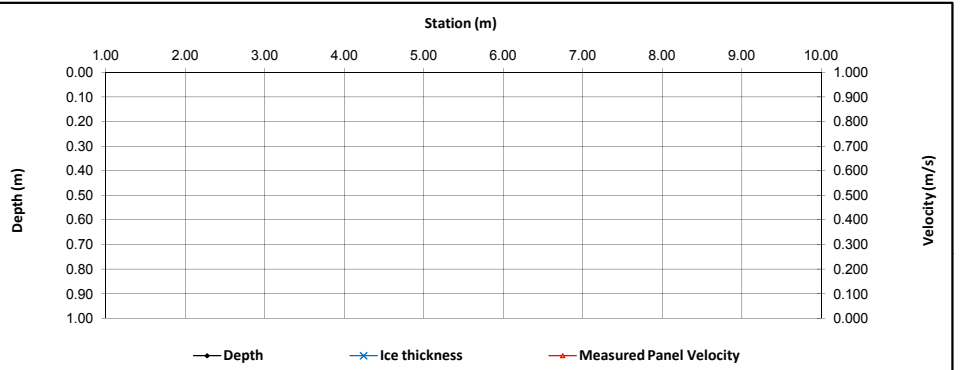
Total Flow:	0.000	(m ³ /s)
Perceived Measurement Quality:	-	
Cross Section Area:	0.00	(m ²)
Wetted Width:	0.00	(m)
Hydraulic Depth:	-	(m)
Mean Velocity:	-	(m/s)
Froude Number:	-	

Datalogger Details:

	Before	After
Transducer Reading:		0.795
Battery (Main):	14.61	
Battery (Aux):	-	
Datalogger Clock:	9:18	
Laptop Clock:	9:18	
Air Temperature °C:	-	
Air Pressure:	-	
RH:	-	
Water °C:	2.10	
Memory Used:	-	
Dessicant:	replaced	
Logger# (if Δ):		
PT# (if Δ):		

Datalogger / Station Notes:

PLS, Battery, CR800 removed.



Level Survey:

Position	Description	Setup 1		Setup 2		Average
		(m)	El (m)	(m)	El (m)	
Bench Mark 1:	3/4" pipe 4m to west of station	0.737	100.000	0.726	100.000	-
Bench Mark 2:	Nail in base of tree, 6m to N or station	0.968	99.769	0.958	99.769	-
Top of Ice:		1.736	99.001	1.727	98.999	99.000
Water Level:		1.741	98.996	1.732	98.994	98.995
Transducer Reading:		0.795	98.201	0.795	98.199	98.200
Other:						

General Notes:

BM Heights

BM1: 0.37m

PLS weight left at the base of the logger box.

Flow not measured due to beaver dam which has caused braided stream flow.

Field Personnel:	DW, SM	Trip Date:	29-Oct-11
Data Entry Personnel:	DW	Date:	8-Nov-11
Data Check Personnel:	VS	Date:	29-Nov-11

C.8 2011 WATER YEAR NATURALIZED FLOW CALCULATION RESULTS

The method used to calculate naturalized flows was outlined in Appendix C.3.3. The results from these calculations for the 2011 WY are presented below.

WSC Station 07DA008 (RAMP Station S7), Muskeg River near Fort McKay

NOTES

Negative baseline estimated values are set to zero when releases exceed observed flows.

LAND AREAS

	Total Area		Other Areas	
		Cleared	Closed-circuited	Effective
RAMP site (ha)	145,700	6,898	11,874	133,826
RAMP site (km ²)	1,457.0	69.0	118.7	1,338.3

Incremental Runoff from clearing

Factor

20%

RESULTS SUMMARY

Observed (m ³ / s)	Endpoint	Baseline	
		Baseline (m ³ / s)	%change of natural
43.52	Annual Sum (million cumecs)	38.04	14.4%
1.83	Mean open-water season (1-May : 31-Oct)	1.71	7.1%
0.55	Mean winter discharge (1-Nov : 31-Mar)	0.30	84.6%
9.21	Annual maximum daily discharge	9.63	-4.4%
0.29	Open-water season minimum daily discharge	0.08	261.2%

ANNUAL WATER BALANCE COMPONENTS

Observed Hydrograph	million m ³	43.52
Closed-circuit loss	million m ³	-3.10
Incremental runoff from land clearing	million m ³	0.36
Withdrawals from the stream	million m ³	-0.13
Releases into the stream	million m ³	0.001
Diversion into/out of watershed	million m ³	8.95
Tributary changes	million m ³	0.00
Incremental volume	million m ³	6.08
Naturalized Hydrograph	million m ³	38.04
Incremental volume	% of natural	14.4%

WSC Station 07DC001, RAMP Station S27, Firebag River near the mouth

NOTES

Using WSC catchment area of 5987.6 km², not total area (5681.7 km²): WSC area 5% higher.

LAND AREAS

	Total Area		Other Areas	
		Cleared	Closed-circuited	Effective
Joint site (ha)	598,760	4,282	257	598,503
Joint site (km ²)	5,987.6	42.8	2.6	5,985.0

Incremental Runoff from clearing *Factor* 20%

RESULTS SUMMARY

Observed (m ³ / s) Endpoint	Baseline	
	Baseline (m ³ / s)	%change of natural
614.76 Annual Sum (million cumecs)	614.05	0.12%
20.89 Mean open-water season (1-May : 31-Oct)	20.87	0.12%
16.16 Mean winter discharge (1-Nov : 31-Mar)	16.15	0.11%
54.10 Annual maximum daily discharge	54.04	0.10%
13.80 Open-water season minimum daily discharge	13.78	0.11%

ANNUAL WATER BALANCE COMPONENTS

Observed Hydrograph	million m ³	614.76
Closed-circuit loss	million m ³	-0.26
Incremental runoff from land clearing	million m ³	0.88
Withdrawals from the stream	million m ³	-0.002
Releases into the stream	million m ³	0.10
Diversion into/out of watershed	million m ³	0.00
Tributary changes	million m ³	0.00
Incremental volume	million m ³	0.71
Naturalized Hydrograph	million m ³	614.05
Incremental volume	% of natural	0.12%

**Christina River at the mouth (estimated as difference between flows measured at WSC Stations 07CD005, Clearwater River above Christina River, and 07CD001, Clearwater River at Draper)
RAMP funders (i.e., focal projects only)**

NOTES

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LAND AREAS

	Total Area		Other Areas	
	Cleared	Closed-circuited	Effective	
Mouth site (ha)	1,303,805	4,854	680	1,303,125
Mouth site (km ²)	13,038.0	48.5	6.8	13,031.2
<i>Incremental Runoff from clearing</i>		<i>Factor</i>		<i>20%</i>

RESULTS SUMMARY

Observed (m ³ / s) Endpoint	Baseline	
	Baseline (m ³ / s)	%change of natural
1164.02 Annual Sum (million cumecs)	1163.9	0.01%
66.70 Mean open-water season (1-May : 31-Oct)	66.69	0.02%
- Mean winter discharge (1-Nov : 31-Mar)	-	-
198.80 Annual maximum daily discharge	198.76	0.02%
18.40 Open-water season minimum daily discharge	18.40	0.01%

ANNUAL WATER BALANCE COMPONENTS

Observed Hydrograph	million m ³	1164.02
Closed-circuit loss	million m ³	-0.61
Incremental runoff from land clearing	million m ³	0.87
Withdrawals from the stream	million m ³	-0.10
Releases into the stream	million m ³	0.00
Diversion into/out of watershed	million m ³	0.00
Tributary changes	million m ³	0.00
Incremental volume	million m ³	0.16
Naturalized Hydrograph	million m ³	1163.86
Incremental volume	% of natural	0.01%

WSC Station 07CD004, Hangingstone River at Fort McMurray

NOTES

Using WSC area of 962 km², not total watershed area (1066.4 km²): WSC area 9.8% lower.

LAND AREAS

	Total Area		Other Areas	
		Cleared	Closed-circuited	Effective
WSC site (ha)	96,200	9	47	96,153
WSC site (km ²)	962.0	0.1	0.5	961.5

Incremental Runoff from clearing

Factor 20%

RESULTS SUMMARY

Observed (m ³ / s) Endpoint	Baseline	
	Baseline (m ³ / s)	%change of natural
75.61 Annual Sum (million cumecs)	75.65	-0.05%
4.279 Mean open-water season (1-May : 31-Oct)	4.281	-0.05%
0.20 Mean winter discharge (1-Nov : 31-Mar)	0.20	-0.05%
40.00 Annual maximum daily discharge	40.02	-0.05%
0.575 Open-water season minimum daily discharge	0.575	-0.05%

ANNUAL WATER BALANCE COMPONENTS

Observed Hydrograph	million m ³	75.611
Closed-circuit loss	million m ³	-0.037
Incremental runoff from land clearing	million m ³	0.001
Withdrawals from the stream	million m ³	0.000
Releases into the stream	million m ³	0.000
Diversion into/out of watershed	million m ³	0.000
Tributary changes	million m ³	0.000
Incremental volume	million m ³	-0.036
Naturalized Hydrograph	million m ³	75.646
Incremental volume	% of natural	-0.05%

RAMP Station S6, Mills Creek at Highway 63

NOTES

Hatfield- Mills Creek 890ha, or 8.9 km². Using 600 km² as estimated upstream area from geomatics group.

LAND AREAS

	Total Area		Other Areas	
		Cleared	Closed-circuited	Effective
RAMP site (ha)	600	58	235	365
RAMP site (km ²)	6.0	0.6	2.4	3.7

Incremental Runoff from clearing

Factor 20%

RESULTS SUMMARY

Observed (m ³ / s) Endpoint	Baseline	
	Baseline (m ³ / s)	%change of natural
0.45 Annual Sum (million cumecs)	0.71	-37.2%
0.014 Mean open-water season (1-May : 31-Oct)	0.022	-37.2%
0.012 Mean winter discharge (1-Nov : 31-Mar)	0.019	-37.2%
0.064 Annual maximum daily discharge	0.102	-37.2%
0.006 Open-water season minimum daily discharge	0.010	-37.2%

ANNUAL WATER BALANCE COMPONENTS

Observed Hydrograph	million m ³	0.45
Closed-circuit loss	million m ³	-0.28
Incremental runoff from land clearing	million m ³	0.01
Withdrawals from the stream	million m ³	0.00
Releases into the stream	million m ³	0.00
Diversion into/out of watershed	million m ³	0.00
Tributary changes	million m ³	0.00
Incremental volume	million m ³	-0.26
Naturalized Hydrograph	million m ³	0.71
Incremental volume	% of natural	-37.2%

Appendix D
Water Quality Component

D WATER QUALITY COMPONENT

D.1 ANALYTICAL CHEMISTRY METHODS

Analytical methods used for the RAMP Water Quality component, along with associated detection limits and analysis-specific Variable Method Values (VMV codes), are presented in Table D.1-1. Information about analyses for naphthenic acids/acid-extractable organics undertaken by AITF and University of Alberta have been excluded from this table and are discussed in detail in Section 6.

Table D.1-1 Analytical methods, method detection limits, and Variable Method Values (VMV codes) for water quality variables measured by analytical laboratories for RAMP in 2011.

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
Conventional variables	Alkalinity, Total (as CaCO ₃)	mg/L	5	APHA 4500-H, 2510, 2320	10165	ALS
Conventional variables	Conductivity	µS/cm	0.2	APHA 4500-H, 2510, 2320	2041	ALS
Conventional variables	Dissolved Organic Carbon	mg/L	1	APHA 5310 B-Instrumental	6101	ALS
Conventional variables	Hardness (as CaCO ₃)	mg/L	(Calculated)	APHA 1030E	10602	ALS
Conventional variables	pH	pH	0.1	APHA 4500-H, 2510, 2320	10301	ALS
Conventional variables	Total Dissolved Solids	mg/L	5 to 10	APHA 2540 C	10451	ALS
Conventional variables	Total Organic Carbon	mg/L	1	APHA 5310 B-Instrumental	6001	ALS
Conventional variables	Total Suspended Solids	mg/L	3	APHA 2540 D-Gravimetric	102455	ALS
Conventional variables	True Colour	T.C.U.	2	APHA 2120	2021	ALS
General Organics	Phenols (4AAP)	mg/L	0.001	AB ENV.06537-COLORIMETRIC	6537	ALS
General Organics	Total Recoverable Hydrocarbons	mg/L	1	APHA 5520 C-Tetra CI Ext Infrared		ALS
General Organics	Benzene	mg/L	0.0005	EPA 5021/8015&8260 GC-MS & FID	101278	ALS
General Organics	Toluene	mg/L	0.0005	EPA 5021/8015&8260 GC-MS & FID	101279	ALS
General Organics	Ethylbenzene	mg/L	0.0005	EPA 5021/8015&8260 GC-MS & FID		ALS
General Organics	Xylenes	mg/L	0.00071	EPA 5021/8015&8260 GC-MS & FID	101281	ALS
General Organics	F1-BTEX	mg/L	0.1	EPA 5021/8015&8260 GC-MS & FID	101283	ALS
General Organics	F1(C6-C10)	mg/L	0.1	EPA 5021/8015&8260 GC-MS & FID	101282	ALS
General Organics	F2(C10-C16)	mg/L	0.25	EPA SW846-3510/8015 GC-MS & FID		ALS
General Organics	F3(C16-C34)	mg/L	0.25	EPA SW846-3510/8015 GC-MS & FID		ALS
General Organics	F4(C34-C50)	mg/L	0.25	EPA SW846-3510/8015 GC-MS & FID		ALS
Major ions	Bicarbonate (HCO ₃)	mg/L	5	APHA 4500-H, 2510, 2320	6201	ALS

Table D.1-1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
Major ions	Calcium (Ca)	mg/L	0.5	APHA 3120 B-ICP-OES	104394	ALS
Major ions	Carbonate (CO ₃)	mg/L	5	APHA 4500-H, 2510, 2320	6301	ALS
Major ions	Chloride (Cl)	mg/L	0.5	APHA 4110 B-ION CHROMATOGRAPHY	99494	ALS
Major ions	Hydroxide (OH)	mg/L	5	APHA 4500-H, 2510, 2320	8501	ALS
Major ions	Magnesium (Mg)	mg/L	0.1	APHA 3120 B-ICP-OES	104407	ALS
Major ions	Potassium (K)	mg/L	0.5	APHA 3120 B-ICP-OES	104416	ALS
Major ions	Sodium (Na)	mg/L	1	APHA 3120 B-ICP-OES	104423	ALS
Major ions	Sulfate (SO ₄)	mg/L	0.5	APHA 4110 B-ION CHROMATOGRAPHY	98228	ALS
Major ions	Sulphide	mg/L	0.002	APHA 4500 -S E-Auto-Colorimetry	16003	ALS
Nutrients and BOD	Ammonia-N	mg/L	0.05	APHA4500NH3F Colorimetry	102626	ALS
Nutrients and BOD	Biochemical Oxygen Demand	mg/L	2	APHA 5210 B-5 day Incub.-O2 electrode	8202	ALS
Nutrients and BOD	Chlorophyll a	µg/L	0.01	EPA 445.0		ALS
Nutrients and BOD	Nitrate	mg/L	0.05	APHA 4110 B-ION CHROMATOGRAPHY		ALS
Nutrients and BOD	Nitrate+Nitrite	mg/L	0.071	Calculation		ALS
Nutrients and BOD	Nitrite	mg/L	0.05	APHA 4110 B-ION CHROMATOGRAPHY	102962	ALS
Nutrients and BOD	Phosphorus, dissolved	mg/L	0.001	APHA 4500 P B,E - AUTO-COLORIMETRY	15113	ALS
Nutrients and BOD	Phosphorus, total	mg/L	0.001	APHA 4500 P B,E - AUTO-COLORIMETRY	15406	ALS
Nutrients and BOD	Total Kjeldahl Nitrogen	mg/L	0.2	APHA 4500-NORG (TKN)		ALS
Total metals	Aluminum	mg/L	0.003	ICP/MS by DRC-II	103999	AITF
Total metals	Antimony	mg/L	0.00005	ICP/MS by DRC-II	80043	AITF
Total metals	Arsenic	mg/L	0.0001	ICP/MS by DRC-II	80020	AITF
Total metals	Barium	mg/L	0.0001	ICP/MS by DRC-II	80022	AITF
Total metals	Beryllium	mg/L	0.0001	ICP/MS by DRC-II	80023	AITF
Total metals	Bismuth	mg/L	0.0001	ICP/MS by DRC-II	80024	AITF
Total metals	Boron	mg/L	0.0008	ICP/MS by DRC-II	80021	AITF
Total metals	Cadmium	mg/L	0.000006	ICP/MS by DRC-II	80026	AITF
Total metals	Calcium	mg/L	0.1	ICP/MS by DRC-II	80025	AITF
Total metals	Chlorine	mg/L	0.3	ICP/MS by DRC-II	80027	AITF
Total metals	Chromium	mg/L	0.0003	ICP/MS by DRC-II	80029	AITF
Total metals	Cobalt	mg/L	0.0001	ICP/MS by DRC-II	80028	AITF
Total metals	Copper	mg/L	0.0001	ICP/MS by DRC-II	80030	AITF

Table D.1-1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
Total metals	Iron	mg/L	0.004	ICP/MS by DRC-II	80031	AITF
Total metals	Lead	mg/L	0.00001	ICP/MS by DRC-II	80041	AITF
Total metals	Lithium	mg/L	0.0002	ICP/MS by DRC-II	80034	AITF
Total metals	Manganese	mg/L	0.00001	ICP/MS by DRC-II	80036	AITF
Total metals	Mercury	mg/L	0.00005	ICP/MS by DRC-II	80032	AITF
Total metals	Molybdenum	mg/L	0.000008	ICP/MS by DRC-II	80037	AITF
Total metals	Nickel	mg/L	0.0001	ICP/MS by DRC-II	80039	AITF
Total metals	Selenium	mg/L	0.0003	ICP/MS by DRC-II	80044	AITF
Total metals	Silver	mg/L	0.00001	ICP/MS by DRC-II	103998	AITF
Total metals	Strontium	mg/L	0.0001	ICP/MS by DRC-II	80047	AITF
Total metals	Sulphur	mg/L	2	ICP/MS by DRC-II	80042	AITF
Total metals	Thallium	mg/L	0.0001	ICP/MS by DRC-II	80053	AITF
Total metals	Thorium	mg/L	0.0001	ICP/MS by DRC-II	80048	AITF
Total metals	Tin	mg/L	0.0001	ICP/MS by DRC-II	80046	AITF
Total metals	Titanium	mg/L	0.0001	ICP/MS by DRC-II	80049	AITF
Total metals	Uranium	mg/L	0.0001	ICP/MS by DRC-II	80054	AITF
Total metals	Vanadium	mg/L	0.0001	ICP/MS by DRC-II	80055	AITF
Total metals	Zinc	mg/L	0.0002	ICP/MS by DRC-II	80056	AITF
Total metals	Mercury (Hg), ultra-trace	ng/L	0.6	ICP/MS by DRC-II	101979	AITF
Dissolved metals	Aluminum	mg/L	0.001	ICP/MS by DRC-II	103927	AITF
Dissolved metals	Antimony	mg/L	0.00005	ICP/MS by DRC-II	103951	AITF
Dissolved metals	Arsenic	mg/L	0.0001	ICP/MS by DRC-II	103928	AITF
Dissolved metals	Barium	mg/L	0.0001	ICP/MS by DRC-II	103930	AITF
Dissolved metals	Beryllium	mg/L	0.0001	ICP/MS by DRC-II	103931	AITF
Dissolved metals	Bismuth	mg/L	0.0001	ICP/MS by DRC-II	103932	AITF
Dissolved metals	Boron	mg/L	0.0008	ICP/MS by DRC-II	103929	AITF
Dissolved metals	Cadmium	mg/L	0.0001	ICP/MS by DRC-II	103934	AITF
Dissolved metals	Calcium	mg/L	0.1	ICP/MS by DRC-II	103933	AITF
Dissolved metals	Chlorine	mg/L	0.3	ICP/MS by DRC-II	103935	AITF
Dissolved metals	Chromium	mg/L	0.0003	ICP/MS by DRC-II	103937	AITF
Dissolved metals	Cobalt	mg/L	0.00001	ICP/MS by DRC-II	103936	AITF
Dissolved metals	Copper	mg/L	0.0001	ICP/MS by DRC-II	103938	AITF
Dissolved metals	Iron	mg/L	0.004	ICP/MS by DRC-II	103939	AITF

Table D.1-1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
Dissolved metals	Lead	mg/L	0.0001	ICP/MS by DRC-II	103949	AITF
Dissolved metals	Lithium	mg/L	0.0002	ICP/MS by DRC-II	103942	AITF
Dissolved metals	Manganese	mg/L	0.0001	ICP/MS by DRC-II	103944	AITF
Dissolved metals	Mercury	mg/L	0.00005	ICP/MS by DRC-II	103940	AITF
Dissolved metals	Molybdenum	mg/L	0.0001	ICP/MS by DRC-II	103945	AITF
Dissolved metals	Nickel	mg/L	0.0001	ICP/MS by DRC-II	103947	AITF
Dissolved metals	Selenium	mg/L	0.0003	ICP/MS by DRC-II	103952	AITF
Dissolved metals	Silver	mg/L	0.00001	ICP/MS by DRC-II	103926	AITF
Dissolved metals	Strontium	mg/L	0.0001	ICP/MS by DRC-II	103955	AITF
Dissolved metals	Sulphur	mg/L	2	ICP/MS by DRC-II	103950	AITF
Dissolved metals	Thallium	mg/L	0.0001	ICP/MS by DRC-II	103958	AITF
Dissolved metals	Thorium	mg/L	0.0001	ICP/MS by DRC-II	103956	AITF
Dissolved metals	Tin	mg/L	0.0001	ICP/MS by DRC-II	103954	AITF
Dissolved metals	Titanium	mg/L	0.0001	ICP/MS by DRC-II	103957	AITF
Dissolved metals	Uranium	mg/L	0.0001	ICP/MS by DRC-II	103959	AITF
Dissolved metals	Vanadium	mg/L	0.0001	ICP/MS by DRC-II	103960	AITF
Dissolved metals	Zinc	mg/L	0.0002	ICP/MS by DRC-II	103961	AITF
General Organics	Naphthenic Acids	mg/L	0.002/ 0.0002	See Section 6		AITF/U of A
General Organics	Polycyclic Aromatic Hydrocarbons	ng/L	Varies (see D.2)			AXYS
Toxicity	Algal Growth Inhibition Test (72 h)	%	-	Biological test method: Growth Inhibition test using a freshwater alga <i>Pseudokirchneriella subcapitata</i> (formerly <i>Selenastrum capricornutum</i>). Environment Canada, EPS 1/RM/25, 2nd Edition, March 2007		HydroQual
Toxicity	Ceriodaphnia 6-day survival test	%	-	Biological test method: Test of reproduction and survival using the cladoceran <i>Ceriodaphnia dubia</i> , 2007. Environment Canada, EPS 1/RM/21		HydroQual
Toxicity	Ceriodaphnia 6-day reproduction test	%	-	Biological test method: Test of reproduction and survival using the cladoceran <i>Ceriodaphnia dubia</i> , 2007. Environment Canada, EPS 1/RM/21		HydroQual
Toxicity	Fathead minnow 7-d survival test	%	-	Biological test method: Test of larval growth and survival using fathead minnows, 1992. Environment Canada, EPS 1/RM/22. (amended September 2008).		HydroQual
Toxicity	Fathead minnow 7-d growth test	%	-	Biological test method: Test of larval growth and survival using fathead minnows, 1992. Environment Canada, EPS 1/RM/22. (amended September 2008).		HydroQual

D.2 CALCULATED DETECTION LIMITS FOR WATERBORNE PAHS

Ultra-trace analysis of PAHs in water was introduced to RAMP in the 2011 program, with analysis conducted by AXYS Analytical Ltd. (AXYS) using low-resolution mass spectrometry (LRMS). Results for 43 parent and alkylated PAH homologues were reported, with analytical reporting (detection) limits of approximately 0.1 ng/L. Details of the analytical method are presented in the method summary from AXYS included in this appendix.

As described in Section 6.3, reporting limits varied by PAH species across results (i.e., among stations and seasons). Also, several blank samples showed measurable concentrations of some PAH species. To allow for reliable comparisons of results among samples collected from different locations (and with different specific reporting limits), blank-corrected detection limits were calculated for all PAH species, and applied to each reported result for use in data reporting and interpretation. These blank-corrected detection limits for specific PAH species were applied across the entire 2011 RAMP water quality dataset, so that all results measured by RAMP for a given PAH species had the same detection limit applied for data from all stations and seasons. Mechanisms for calculating these blank-corrected detection limits for RAMP 2011 are discussed in Section 6.3. Comparisons between original and blank-corrected detection limits are provided in Table D.2-1.

This blank-correction process resulted in substantial increases in detection limits in most cases, although a small majority of analytes maintained detection limits below 1 ng/L. One result of applying these blank-corrected detection/reporting limits was an increase in the number of non-detectable concentrations. However, this was necessary to reduce the likelihood of false positives in the dataset.

Table D.2-1 Original reporting limits versus blank-corrected detection limits for individual PAH species/homologues, RAMP 2011 data.

Analyte	Mean of original Reporting Limits	Blank-corrected Detection Limit
Biphenyl	0.11	1.09
C1-Biphenyls	0.10	5.08
C2-Biphenyls	0.13	49.03
Naphthalene	0.19	14.13
C1-Naphthalenes	0.12	12.24
C2-Naphthalenes	0.22	4.34
C3-Naphthalenes	0.15	3.14
C4-Naphthalenes	0.24	5.55
Acenaphthylene	0.10	0.16
Acenaphthene	0.16	0.43
C1-Acenaphthenes	0.14	0.15
Fluorene	0.08	0.24
C1-Fluorenes	0.22	4.49
C2-Fluorenes	0.16	3.60
C3-Fluorenes	0.23	15.86
Phenanthrene	0.11	0.89
Anthracene	0.12	0.11
C1-Phenanthrenes/Anthracenes	0.14	1.00
C2-Phenanthrenes/Anthracenes	0.10	3.01
C3-Phenanthrenes/Anthracenes	0.18	3.25
C4-Phenanthrenes/Anthracenes	0.38	7.72
Retene	0.38	2.07
Dibenzothiophene	0.08	0.19
C1-Dibenzothiophenes	0.13	0.15
C2-Dibenzothiophenes	0.16	1.56
C3-Dibenzothiophenes	0.15	1.65
C4-Dibenzothiophenes	0.18	2.30
Fluoranthene	0.09	0.51
Pyrene	0.09	0.43
C1-Fluoranthenes/Pyrenes	0.21	1.65
C2-Fluoranthenes/Pyrenes	0.26	1.99
C3-Fluoranthenes/Pyrenes	0.40	1.14
Benz[a]anthracene	0.08	0.06
Chrysene	0.09	0.23
C1-Benzo[a]anthracenes/Chrysenes	0.10	0.48
C2-Benzo[a]anthracenes/Chrysenes	0.14	0.70
Benzo[b,j,k]fluoranthene	0.12	0.19
Benzo[a]pyrene	0.18	0.14
C1-Benzofluoranthenes/Benzopyrenes	0.18	0.92
C2-Benzofluoranthenes/Benzopyrenes	0.20	0.75
Indeno[1,2,3-c,d]-pyrene	0.14	0.31
Dibenz[a,h]anthracene	0.11	0.10
Benzo[g,h,i]perylene	0.13	0.17

Summary of AXYS Method MLA-021 Rev 10.02:

ANALYTICAL METHOD FOR THE DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH), ALKYLATED POLYCYCLIC AROMATIC HYDROCARBONS, AND ALKANES

AXYS Method MLA-021 describes the determination of concentrations of PAHs, alkylated PAHs and alkanes in solid (sediment, soil, ash), tissue (including blood), aqueous, XAD-2 column (resin and filters), air, and oil samples and in solvent extracts.

The method may be used for analysis of samples where USEPA Methods 1625B or 8270C/D have been requested **provided the modifications described in this document are permitted by contract.**

This summary document covers only the analysis of PAHs and alkylated PAHs.

Target Analytes

PAHs and alkylated PAHs determined by multi-point calibration

PAHs

Naphthalene	Benzo(b)fluoranthene
Acenaphthylene	Benzo(j/k)fluoranthenes
Acenaphthene	Benzofluoranthenes
Fluorene	Benzo(e)pyrene
Phenanthrene	Benzo(a)pyrene
Anthracene	Perylene
Fluoranthene	Dibenzo(ah)anthracene
Pyrene	Indeno(1,2,3-cd)pyrene
Benz(a)anthracene	Benzo(ghi)perylene
Chrysene	

Alkylated PAHs

1-Methylnaphthalene	9/4-Methylphenanthrenes
2-Methylnaphthalene	2-Methylantracene
C1-Naphthalenes	C1-Phenanthrenes/Anthracenes
1,2-Dimethylnaphthalene	1,7-Dimethylphenanthrene
2,6-Dimethylnaphthalene	1,8-Dimethylphenanthrene
C2-Naphthalenes	2,6-Dimethylphenanthrene
2,3,5-Trimethylnaphthalene	3,6-Dimethylphenanthrene
2,3,6-Trimethylnaphthalene	C2-Phenanthrenes/Anthracenes
C3-Naphthalenes	1,2,6-Trimethylphenanthrene
1,4,6,7-Tetramethylnaphthalene	C3-Phenanthrenes/Anthracenes
C4-Naphthalenes	Retene
1-Methylphenanthrene	C4-Phenanthrenes/Anthracenes
2-Methylphenanthrene	Biphenyl
3-Methylphenanthrene	Dibenzothiophene

PAHs and alkylated PAHs determined by single-point calibration

C1-Biphenyls	C1-Fluoranthenes/Pyrenes
C2-Biphenyls	C2-Fluoranthenes/Pyrenes
C1-Acenaphthenes	C3-Fluoranthenes/Pyrenes
2-Methylfluorene	C4-Fluoranthenes/Pyrenes
C1-Fluorenes	1-Methylchrysene
1,7-Dimethylfluorene	5/6-Methylchrysenes
C2-Fluorenes	C1-Benz(a)anthracenes/Chrysenes
C3-Fluorenes	5,9-Dimethylchrysene
2/3-Methyldibenzothiophenes	C2-Benz(a)anthracenes/Chrysenes
C1-Dibenzothiophene	C3-Benz(a)anthracenes/Chrysenes
2,4-Dimethyldibenzothiophene	C4-Benz(a)anthracenes/Chrysenes
C2-Dibenzothiophene	7-Methylbenzo(a)pyrene
C3-Dibenzothiophene	C1-Benzofluoranthenes/Benzopyrenes
C4-Dibenzothiophene	C2-Benzofluoranthenes/Benzopyrenes
3-Methylfluoranthene/Benzo(a)fluorene	

EXTRACTION

All samples are spiked with deuterated surrogate standards prior to extraction and extracted as per the table below. Optional extraction procedures are shown within parentheses.

Sample Extraction

Matrix	Extraction
Aqueous	Sample with less than 1% suspended solids - Liquid-liquid extraction with dichloromethane. Sample with ≥1% suspended solids - sample is centrifuged prior to extraction and the particulate fraction separately extracted by Soxhlet extraction with dichloromethane. The two extracts are then combined.(Optional: the supernatant can be added to the extraction solvent for the particulate)
Solid (sediment, soil, sludge, particles on filter paper)	Soxhlet extraction with dichloromethane (Optional: Base digestion and liquid-liquid extraction with hexane)
Solid (ash)	Soxhlet extraction with toluene
Solid (fly ash)	Sonication with hydrochloric acid and filtering. Liquid-liquid extraction of filtrate using dichloromethane, Soxhlet extraction of particulate using toluene:acetone 80:20. The two extracts are combined.
Tissue	Base digestion and liquid-liquid extraction with hexane (Optional: Soxhlet extraction with dichloromethane, this option is not recommended for samples with high lipid content)
Whole blood/serum	Liquid-liquid extraction with ethanol:hexane:saturated ammonium sulphate.
XAD-2 column and filter	XAD-2 columns and filters are usually co-extracted for multiple analyses (For example: PCB, dioxins, pesticides) and the resulting extracts are split with a portion being used for PAH analysis

Ambient air (PUF and filter)	The PUF and filter(s) are Soxhlet extracted together using dichloromethane
Stationary Source Air Samples (Stack Gas sample trains)	The filter is sonicated with dilute hydrochloride acid and filtered. Equipment rinsates are collected, filtered, dried and/or extracted depending on sampling conditions.

COLUMN CHROMATOGRAPHY CLEANUP

Extracts are routinely cleaned up using the following procedures:

- column chromatography on Silica
- gel permeation (Biobeads) column chromatography
- treatment with activated copper (except tissues)

Extracts may be cleaned up further, as necessary, using some or all of the following procedures:

- washing with base
- column chromatography on Biobeads
- column chromatography on alumina

INSTRUMENTAL ANALYSIS

Instrumental analysis is performed by low-resolution mass spectrometry (LRMS) using an RTX-5 capillary GC column. The LRMS is operated at a unit mass resolution in the electron impact (EI) ionization mode using multiple ion detection (MID) acquiring at least one characteristic ion for each target analyte and surrogate standard.

Analyte Ions Monitored, Surrogates Used and RRF Determination For PAH

TARGET ANALYTES	Quantification Ion (m/z)	Confirmation Ions (m/z)	Typical Ion Ratio (Conf./Quant.)	SURROGATE	Typical Retention Time (minutes)	RRF DETERMINED FROM
Naphthalene	128	102	0.064	d ₈ -Naphthalene	6.84	Naphthalene
Acenaphthylene	152	151	0.222	d ₈ -Acenaphthylene	10.83	Acenaphthylene
Acenaphthene	154	153	1.18	d ₈ -Acenaphthylene	11.33	Acenaphthene
Fluorene	166	165	1.01	d ₁₀ -Phenanthrene	12.63	Fluorene
Phenanthrene	178	176	0.202	d ₁₀ -Phenanthrene	15.04	Phenanthrene
Anthracene	178	176	0.196	d ₁₀ -Phenanthrene	15.15	Anthracene
Fluoranthene	202	200	0.214	d ₁₀ -Fluoranthene	18.06	Fluoranthene
Pyrene	202	200	0.219	d ₁₀ -Fluoranthene	18.60	Pyrene
Benz[a]anthracene	228	226	0.281	d ₁₂ -Benz[a]anthracene	21.68	Benz[a]anthracene
Chrysene ¹	228	226	0.312	d ₁₂ -Chrysene	21.79	Chrysene
Benzo[b]fluoranthene	252	253	0.218	d ₁₂ -Benzo[b]fluoranthene	25.21	Benzo[b]fluoranthene
Benzo[j,k]fluoranthenes	252	253	0.215	d ₁₂ -Benzo[k]fluoranthene	25.30	Benzo[k]fluoranthene
Benzo[e]pyrene	252	253	0.213	d ₁₂ -Benzo[a]pyrene	26.36	Benzo[e]pyrene
Benzo[a]pyrene	252	253	0.217	d ₁₂ -Benzo[a]pyrene	26.58	Benzo[a]pyrene
Perylene	252	253	0.212	d ₁₂ -Perylene	27.00	Perylene
Dibenzo[ah]anthracene ²	278	139	0.144	d ₁₄ -Dibenzo[ah]anthracene	31.86	Dibenz[ah]anthracene
Indeno[1,2,3-cd]pyrene	276	138	0.179	d ₁₂ -Indeno[1,2,3,cd]pyrene	31.71	Indeno[1,2,3-cd]pyrene
Benzo[ghi]perylene	276	138	0.194	d ₁₂ -Benzo[ghi]perylene	32.53	Benzo[ghi]perylene
Biphenyl ³	154	152	0.304	d ₁₀ -Biphenyl	9.81	Biphenyl
Dibenzothiophene ³	184	152	0.073	d ₁₀ -Phenanthrene	14.72	Dibenzothiophene
1-Methylnaphthalene ³	142	141	0.962	d ₁₀ -2-Methylnaphthalene	8.81	1-Methylnaphthalene
2-Methylnaphthalene ³	142	141	0.930	d ₁₀ -2-Methylnaphthalene	8.55	2-Methylnaphthalene
1-Naphthalenes ³	142	⁴	⁴	d ₁₀ -2-Methylnaphthalene	⁵	1- & 2-Methylnaphthalene
2,6-Dimethylnaphthalene ³	156	141	0.666	d ₁₂ -2,6 Dimethylnaphthalene	10.17	2,6-Dimethylnaphthalene
1,2-Dimethylnaphthalene	156	141	1.26	d ₁₂ -2,6 Dimethylnaphthalene	10.90	1,2-Dimethylnaphthalene
C2-Naphthalenes ³	156	⁴	⁴	d ₁₂ -2,6 Dimethylnaphthalene	⁵	2,6- & 1,2-Dimethylnaphthalene
2,3,5-Trimethylnaphthalene ³	170	155	0.873	d ₁₂ -2,6 Dimethylnaphthalene	12.35	2,3,5- Trimethylnaphthalene
2,3,6-Trimethylnaphthalene	170	155	0.876	d ₁₂ -2,6 Dimethylnaphthalene	12.17	2,3,6- Trimethylnaphthalene
C3-Naphthalenes ³	170			d ₁₂ -2,6 Dimethylnaphthalene	⁵	2,3,5- & 2,3,6-Trimethylnaphthalene
1,4,6,7-Tetramethylnaphthalene	184	139	0.027	d ₁₂ -2,6 Dimethylnaphthalene	13.89	1,4,6,7-Tetramethylnaphthalene
C4-Naphthalene		⁴	⁴	d ₁₂ -2,6 Dimethylnaphthalene	⁵	1,4,6,7-Tetramethylnaphthalene
2-Methylantracene	192	191	0.531	d ₁₀ -Phenanthrene	16.45	2-Methylantracene

¹ Coelutes with Triphenylene

² Coelutes with Dibenz[ac]anthracene

³ These compounds are in addition to the regular suite of analytes, and are analyzed by client request only.

⁴ Secondary ion confirmation procedures do not apply

⁵ RRT ranges apply to alkylated PAH Totals

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TARGET ANALYTES	Quantification Ion (m/z)	Confirmation Ions (m/z)	Typical Ion Ratio (Conf./Quant.)	SURROGATE	Typical Retention Time (minutes)	RRF DETERMINED FROM
3-Methylphenanthrene	192	191	0.608	d ₁₀ -Phenanthrene	16.27	1- & 2-Methylphenanthrene & 2-Methylanthracene
2-Methylphenanthrene	192	191	0.608	d ₁₀ -Phenanthrene	16.36	2-Methylphenanthrene
9/4-Methylphenanthrenes	192	191	0.634	d ₁₀ -Phenanthrene	16.59	1- & 2-Methylphenanthrene & 2-Methylanthracene
1-Methylphenanthrene ³	192	191	0.634	d ₁₀ -Phenanthrene	16.64	1-Methylphenanthrene
C1-Phenanthrenes/Anthracenes ³	192	4	4	d ₁₀ -Phenanthrene	5	1- & 2-Methylphenanthrene & 2-Methylanthracene
3,6-Dimethylphenanthrene ³	206	191	0.342	d ₁₀ -Fluoranthrene	17.46	3,6-Dimethylphenanthrene
2,6-Dimethylphenanthrene	206	191	0.342	d ₁₀ -Fluoranthrene	17.54	3,6- & 1,7-Dimethylphenanthrenes
1,7-Dimethylphenanthrene	206	191	0.332	d ₁₀ -Fluoranthrene	17.89	1,7-Dimethylphenanthrene
1,8-Dimethylphenanthrene	206	191	0.332	d ₁₀ -Fluoranthrene	18.13	3,6- & 1,7-Dimethylphenanthrenes
C2-Phenanthrenes/Anthracenes ³	206	4	4	d ₁₀ -Fluoranthrene	5	3,6- & 1,7-Dimethylphenanthrenes
1,2,6-Trimethylphenanthrene	220	205	0.581	d ₁₀ -Fluoranthrene	19.41	1,2,6-Trimethylphenanthrene
C3-Phenanthrenes/Anthracenes				d ₁₀ -Fluoranthrene	5	1,2,6-Trimethylphenanthrene
Retene ³	234	219	1.63	d ₁₀ -Fluoranthrene	19.53	Retene
C4-Phenanthrenes/Anthracenes	234	4	4	d ₁₀ -Fluoranthrene	5	Retene
C1-Biphenyls	168	4	4	d ₁₀ -Biphenyl	5	Biphenyl
C2-Biphenyls	182	4	4	d ₁₀ -Biphenyl	5	Biphenyl
C1-Acenaphthenes	168	4	4	d ₈ -Acenaphthylene	5	Acenaphthene
2-Methylfluorene	180	165	1.23	d ₁₀ -Phenanthrene	14.06	2-Methylfluorene
C1-Fluorenes	180	4	4	d ₁₀ -Phenanthrene	5	2-Methylfluorene
1,7-Dimethylfluorene	194	177	0.092	d ₁₀ -Phenanthrene	15.49	1,7-Dimethylfluorene
C2-Fluorenes	194	4	4	d ₁₀ -Phenanthrene	5	1,7-Dimethylfluorene
C3-Fluorenes	208	4	4	d ₁₀ -Phenanthrene	5	1,7-Dimethylfluorene
2/3-Methyldibenzothiophenes	198	197	0.738	d ₁₀ -Phenanthrene	16.07	2/3-Methyldibenzothiophenes
C1-Dibenzothiophenes	198	4	4	d ₁₀ -Phenanthrene	5	2/3-Methyldibenzothiophenes
2,4-Dimethyldibenzothiophene	212	197	0.514	d ₁₀ -Phenanthrene	17.08	2,4-Dimethyldibenzothiophene
C2-Dibenzothiophenes	212	4	4	d ₁₀ -Phenanthrene	5	2,4-Dimethyldibenzothiophene
C3-Dibenzothiophenes	226	4	4	d ₁₀ -Phenanthrene	5	2,4-Dimethyldibenzothiophene
C4-Dibenzothiophenes	240	4	4	d ₁₀ -Phenanthrene	5	2,4-Dimethyldibenzothiophene
3-Methylfluoranthene/Benzo(a)fluorene	216	215	0.880	d ₁₀ -Fluoranthrene	19.53	3-Methylfluoranthene
C1-Fluoranthenes/Pyrenes	216	4	4	d ₁₀ -Fluoranthrene	5	3-Methylfluoranthene
C2-Fluoranthenes/Pyrenes	230	4	4	d ₁₀ -Fluoranthrene	5	3-Methylfluoranthene
C3-Fluoranthenes/Pyrenes	244	4	4	d ₁₀ -Fluoranthrene	5	3-Methylfluoranthene
C4-Fluoranthenes/Pyrenes	258	4	4	d ₁₀ -Fluoranthrene	5	3-Methylfluoranthene
5/6-Methylchrysenes	242	4	4	d ₁₂ -Chrysene	23.15	6-Methylchrysene
1-Methylchrysene	242	4	4	d ₁₂ -Chrysene	23.32	1-Methylchrysene
C1-Benz(a)anthracenes/Chrysenes	242	4	4	d ₁₂ -Chrysene	5	1- & 6-Methylchrysenes
5,9-Dimethylchrysene	256	4	4	d ₁₂ -Chrysene	24.49	5,9-Dimethylchrysene

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TARGET ANALYTES	Quantification Ion (m/z)	Confirmation Ions (m/z)	Typical Ion Ratio (Conf./Quant.)	SURROGATE	Typical Retention Time (minutes)	RRF DETERMINED FROM
C2-Benz(a)anthracenes/Chrysenes	256	4	4	d ₁₂ -Chrysene	5	5,9-Dimethylchrysene
C3-Benz(a)anthracenes/Chrysenes	270	4	4	d ₁₂ -Chrysene	5	5,9-Dimethylchrysene
C4-Benz(a)anthracenes/Chrysenes	284	4	4	d ₁₂ -Chrysene	5	5,9-Dimethylchrysene
7-Methylbenzo(a)pyrene	266	4	4	d ₁₂ -Benzo[a]pyrene	29.35	7-Methylbenzo(a)pyrene
C1-Benzofluoranthenes/Benzopyrenes	266	4	4	d ₁₂ -Benzo[a]pyrene	5	7-Methylbenzo(a)pyrene
C2-Benzofluoranthenes/Benzopyrenes	280	4	4	d ₁₂ -Benzo[a]pyrene	5	7-Methylbenzo(a)pyrene
LABELLED SURROGATE STANDARDS	Quantification Ion (m/z)	Confirmation Ions (m/z)		RECOVERY CALCULATED AGAINST		
d ₈ -Naphthalene	136	134	0.095	d ₁₀ -Acenaphthene	6.80	
d ₁₀ -2-Methylnaphthalene	152	151	0.195	d ₁₀ -Acenaphthene	8.47	
d ₁₀ -Biphenyl	164	4	4	d ₁₀ -Acenaphthene	9.75	
d ₁₂ -2,6-Dimethylnaphthalene	168	150	0.747	d ₁₀ -Acenaphthene	10.07	
d ₈ -Acenaphthylene	160	158	0.159	d ₁₀ -Acenaphthene	10.80	
d ₁₀ -Phenanthrene	188	184	0.143	d ₁₀ -Pyrene	14.97	
d ₁₀ -Fluoranthene	212	208	0.173	d ₁₀ -Pyrene	18.02	
d ₁₂ -Benz[a]anthracene	240	236	0.250	d ₁₀ -Pyrene	21.63	
d ₁₂ -Chrysene	240	236	0.278	d ₁₀ -Pyrene	21.73	
d ₁₂ -Benzo[b]fluoranthene	264	260	0.216	d ₁₂ -Benzo[e]pyrene	25.11	
d ₁₂ -Benzo[k]fluoranthene	264	260	0.208	d ₁₂ -Benzo[e]pyrene	25.23	
d ₁₂ -Benzo[a]pyrene	264	260	0.216	d ₁₂ -Benzo[e]pyrene	26.47	
d ₁₂ -Perylene	264	260	0.256	d ₁₂ -Benzo[e]pyrene	26.88	
d ₁₂ -Indeno[1,2,3,cd]pyrene	288	284	0.192	d ₁₂ -Benzo[e]pyrene	31.63	
d ₁₄ -Dibenzo[ah]anthracene	292	288	0.260	d ₁₂ -Benzo[e]pyrene	31.75	
d ₁₂ -Benzo[ghi]perylene	288	284	0.205	d ₁₂ -Benzo[e]pyrene	32.45	
LABELLED RECOVERY STANDARDS	Quantification Ion (m/z)	Confirmation Ions (m/z)				
d ₁₀ -Acenaphthene	164	160	0.464		11.24	
d ₁₀ -Pyrene	212	208	0.176		18.56	
d ₁₂ -Benzo[e]pyrene	264	260	0.269		26.25	

CALIBRATION

Initial calibration is performed using a five point calibration series of solutions that encompass the working concentration range. Initial calibration solutions contain the suite of labelled surrogate and recovery standards and authentic target PAHs listed as “PAHs and alkylated PAHs determined by multi-point calibration”. Calibration procedures use the mean RRFs determined from the initial calibration to calculate analyte concentrations. Calibration is verified at least once every 12 hours by analysis of a mid-level calibration solution.

An additional calibration solution contains the suite of labelled surrogate and recovery standards and authentic target PAHs listed as “PAHs and alkylated PAHs determined by single-point calibration”. This calibration solution is analyzed at the beginning and end of each batch (bracket) of samples and is used to establish the relative response factors. The mean RRFs determined from the single calibration solution run before and after the samples are used for quantification of sample results.

Concentration of PAHs/Alkylated PAHs Calibration Standard Solutions

TARGET ANALYTE	Level A (Sens. Std) (ng/mL)	Concentration of Calibration Standard Solutions (ng/mL)					Conc. Of Native Std (Low Level) (ng/mL)	Conc. Of Native Std (High Level) (ng/mL)
		Level B	Level C	Level D	Level E	Level F		
Acenaphthene	10	50	100	500	2000	5000	2000	20 000
Acenaphthylene	10	50	100	500	2000	5000	2000	20 000
Anthracene	10	50	100	500	2000	5000	2000	20 000
Benz[a]anthracene	10	50	100	500	2000	5000	2000	20 000
Benzo[b]fluoranthene	10	50	100	500	2000	5000	2000	20 000
Benzo[k]fluoranthene	10	50	100	500	2000	5000	2000	20 000
Benzo[ghi]perylene	10	50	100	500	2000	5000	2000	20 000
Benzo[a]pyrene	10	50	100	500	2000	5000	2000	20 000
Benzo[e]pyrene	10	50	100	500	2000	5000	2000	20 000
Biphenyl	10	50	100	500	2000	5000	2000	20 000
Chrysene	10	50	100	500	2000	5000	2000	20 000
Dibenzo[ah]anthracene	10	50	100	500	2000	5000	2000	20 000
2,6-Dimethylnaphthalene	10	50	100	500	2000	5000	2000	20 000
Fluoranthene	10	50	100	500	2000	5000	2000	20 000
Fluorene	10	50	100	500	2000	5000	2000	20 000
Indeno[1,2,3-cd]pyrene	10	50	100	500	2000	5000	2000	20 000
1-Methylnaphthalene	10	50	100	500	2000	5000	2000	20 000
2-Methylnaphthalene	10	50	100	500	2000	5000	2000	20 000
1-Methylphenanthrene	10	50	100	500	2000	5000	2000	20 000
Naphthalene	10	50	100	500	2000	5000	2000	20 000
Perylene	10	50	100	500	2000	5000	2000	20 000
Phenanthrene	10	50	100	500	2000	5000	2000	20 000
Pyrene	10	50	100	500	2000	5000	2000	20 000
2,3,5-Trimethylnaphthalene	10	50	100	500	2000	5000	2000	20 000
Dibenzothiophene	10	50	100	500	2000	5000	2000	20 000
3,6-Dimethylphenanthrene	10	50	100	500	2000	5000	2000	20 000
Retene	10	50	100	500	2000	5000	2000	20 000
2-Methylantracene	10	50	100	500	2000	5000	2000	20 000
1,2-Dimethylnaphthalene	10	50	100	500	2000	5000	2000	20 000
2-Methylphenanthrene	10	50	100	500	2000	5000	2000	20 000
1,2,6-Trimethylphenanthrene	10	50	100	500	2000	5000	2000	20 000
2,3,6-Trimethylnaphthalene	10	50	100	500	2000	5000	2000	20 000
1,7-Dimethylphenanthrene	10	50	100	500	2000	5000	2000	20 000
1,4,6,7-Tetramethylnaphthalene	10	50	100	500	2000	5000	2000	20 000

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LABELLED SURROGATE STANDARDS	Level A (Sens. Std) (ng/mL)	Concentration of Calibration Standard Solutions					Conc. Of Surrogate Std (Low Level) (ng/mL)	Conc. Of Surrogate Std (High Level) (ng/mL)
		Level B	Level C	Level D	Level E	Level F		
d ₈ -Naphthalene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₀ -2-Methylnaphthalene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₈ -Acenaphthylene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₀ -Phenanthrene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₀ -Fluoranthene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Benz[a]anthracene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Chrysene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -2,6-Dimethylnaphthalene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Benzo[b]fluoranthene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Benzo[k]fluoranthene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Benzo[a]pyrene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Perylene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Indeno[1,2,3-cd]pyrene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₄ -Dibenzo[ah]anthracene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₂ -Benzo[ghi]perylene	2000	2000	2000	2000	2000	2000	2000	20 000
d ₁₀ -Biphenyl	2000	2000	2000	2000	2000	2000	2000	20 000
LABELLED RECOVERY STANDARDS							Conc. Of Recovery Std (Low Level) (ng/mL)	Conc. Of Recovery Std (High Level) (ng/mL)
d ₁₀ -Acenaphthene	2000	2000	2000	2000	2000	2000	4000	20 000
d ₁₀ -Pyrene	2000	2000	2000	2000	2000	2000	4000	20 000
d ₁₂ -Benzo[e]pyrene	2000	2000	2000	2000	2000	2000	4000	20 000

Concentrations of PAHs/Alkylated PAHs Single Point Calibration Solution

TARGET ANALYTE	Single Point Calibration Solution (ng/mL)	Conc. Of Native Std (Low Level) (ng/mL)	Conc. Of Native Std (High Level) (ng/mL)
2-Methylfluorene	2000	2000	20 000
1,7-Dimethylfluorene	2000	2000	20 000
2-Methyl dibenzothiophene	2000	2000	20 000
2,4-Dimethyl dibenzothiophene	2000	2000	20 000
5,9-Dimethylchrysene	2000	2000	20 000
7-Methylbenzo(a)pyrene	2000	2000	20 000
3-Methylfluoranthene	2000	2000	20 000
6-Methylchrysene	2000	2000	20 000
1-Methylchrysene	2000	2000	20 000
LABELLED SURROGATE STANDARDS		Conc. Of Surrogate Std (Low Level) (ng/mL)	Conc. Of Surrogate Std (High Level) (ng/mL)
d ₈ -Naphthalene	2000	2000	20 000
d ₁₀ -2-Methylnaphthalene	2000	2000	20 000
d ₈ -Acenaphthylene	2000	2000	20 000
d ₁₀ -Phenanthrene	2000	2000	20 000
d ₁₀ -Fluoranthene	2000	2000	20 000
d ₁₂ -Benz[a]anthracene	2000	2000	20 000
d ₁₂ -Chrysene	2000	2000	20 000
d ₁₂ -2,6-Dimethylnaphthalene	2000	2000	20 000
d ₁₂ -Benzo[b]fluoranthene	2000	2000	20 000
d ₁₂ -Benzo[k]fluoranthene	2000	2000	20 000
d ₁₂ -Benzo[a]pyrene	2000	2000	20 000

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d ₁₂ -Perylene	2000	2000	20 000
d ₁₂ -Indeno[1,2,3-cd]pyrene	2000	2000	20 000
d ₁₄ -Dibenzo[ah]anthracene	2000	2000	20 000
d ₁₂ -Benzo[ghi]perylene	2000	2000	20 000
d ₁₀ -Biphenyl	2000	2000	20 000
LABELLED RECOVERY STANDARDS		Conc. Of Surrogate Std (Low Level) (ng/mL)	Conc. Of Surrogate Std (High Level) (ng/mL)
d ₁₀ -Acenaphthene	2000	4000	20 000
d ₁₀ -Pyrene	2000	4000	20 000
d ₁₂ -Benzo[e]pyrene	2000	4000	20 000

ANALYTE IDENTIFICATION

A chromatographic peak is identified as a target compound if the following criteria are met for the quantification and confirmation ions (where confirmation ions are available):

1. Peak responses must be at least three times the background noise level.
2. The retention time must be within three seconds of that predicted from the calibration run and the sample retention time reference (labelled compound).
3. Peak centroids for the quantification and confirmation ions must coincide within two seconds.
4. The relative ion abundance ratios must be within 20% of the opening calibration values.

QUANTIFICATION

Concentrations of target PAHs are calculated using the isotope dilution method of quantification. Compounds are quantified by comparing the area of the quantification ion to that of the corresponding deuterium-labelled standard and correcting for response factors. Response factors are determined daily using authentic PAHs. Calculations are carried out using HP EnviroQuant and Prolab MS-Extended for targeting and quantification.

$$\text{Concentration of Target (ng/g or ng/L)} = \left(\frac{\text{area of Target}}{\text{area of Surr Std}} \right) \times \left(\frac{\text{weight of Surr Std (ng)}}{\text{RRF}} \right) \times \left(\frac{1}{\text{weight of sample (g or L)}} \right)$$

$$\text{where RRF} = \left(\frac{\text{area of Target}}{\text{area of Surr Std}} \right) \times \left(\frac{\text{concentration of Surr Std}}{\text{concentration of Target}} \right)$$

and the Surr Std is either the surrogate or the internal standard

REPORTING LIMITS

Concentrations and detection limits for the target PAHs are reported. Typical reporting units for all data are ng/g, ng/L, or ng/sample. Concentrations for solids are reported on a dry weight basis. Concentrations in tissues (including blood and milk) are reported on a wet weight basis and/or on a lipid weight basis when requested. Concentrations in aqueous are reported on a volume basis. Concentrations in XAD-2 resin, filters and stack gas samples are reported on a per sample basis or a per volume basis. Concentrations in particulate filters are reported on a per sample basis.

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The following are commonly requested reporting limits:

Sample Specific Detection Limit or Sample Detection Limit (SDL) – determined individually for every sample analysis run by converting the area equivalent of 3.0 times (2.5 times for EPA 1600 series methods) the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up. Equivalent term(s): Estimated Detection Limit (EDL) from EPA method 8290.

Method Detection Limit (MDL) - determined as specified by EPA Fed. Reg. 40 CFR Part 136 Appendix B (no iteration option). The 99% confidence level MDL is determined based on analysis of a minimum of 7 replicate matrix spikes fortified at 1-10 times the estimated detection limit. MDL is determined as required based on accreditation, contract and workload requirements.

Lower Method Calibration Limit (LMCL) - determined by prorating the concentration of the lowest calibration limit for sample size and extract volume. The following equation is used. $((\text{lowest level cal conc.}) \times (\text{extract volume})) / \text{sample size}$. Typical extract volume for aqueous and tissue samples is 100 μL for all other matrices typical extract volume is 500 μL .

For the analysis of PAHs AXYS standard is to report sample concentrations using the SDL as the reporting limit.

QUALITY ASSURANCE/QUALITY CONTROL

All samples are analyzed in batches with the following composition:

- Batch Size - Each batch consists of up to twenty test samples and additional QC samples.
- Blanks - One procedural blank is analyzed for each batch. The procedural blank is prepared by spiking an aliquot of the surrogate standard solution into a clean matrix.
- On-going Precision and Recovery (OPR) Samples – On-going Precision and Recovery (OPR) is demonstrated by the analysis of a spiked reference matrix (SPM) analyzed with each batch. The reference sample to be analyzed is assigned to the analyst when the batch is assigned. The OPR sample is prepared by spiking an aliquot of the authentic spiking solution into an accurately weighed in-house reference matrix (known to contain low background levels of target analytes). The matrix is spiked with an aliquot of surrogate standard solution and, after an equilibration time of at least 30 minutes is extracted.
- Duplicates - Sample duplicates are analyzed (provided sufficient sample is available) for batches with 7-20 test samples, or when specified by the contract. For some matrices (XAD columns, filters, air samples) only field duplicates (if available) can be analyzed.
- Reference Samples – Certified reference materials are commercially available and are used to validate and periodically check methods. Additionally reference samples may be analyzed with a batch at the client's request.

The batch composition may vary according to batch or quality control requirements specified by a client. Each batch is carried through the complete analytical process as a unit. For sample data to be reportable the batch QC data must meet the acceptance criteria.

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QC Specification Table: Authentic and Surrogate Standard Recoveries, OPR and Samples

MATRIX	Typical Sample Specific* Detection Limits						Procedural Blank Level (ng)	Acceptable Matrix Spike % Recovery
	Solid	Aqueous	Tissue	XAD-2 Column	PUF	Filter		
Analyte:	ng/g	ng/L	ng/g	ng	ng	ng		
Naphthalene	0.5	5	0.1	5	5	5	<10	70-130
Acenaphthylene	0.5	5	0.1	5	5	5	<5	70-140
Acenaphthene	0.5	5	0.1	5	5	5	<5	70-130
Fluorene	0.5	5	0.1	5	5	5	<5	60-140
Phenanthrene	0.5	5	0.1	5	5	5	<10	70-130
Anthracene	0.5	5	0.1	5	5	5	<5	70-130
Fluoranthene	0.5	5	0.1	5	5	5	<5	70-130
Pyrene	0.5	5	0.1	5	5	5	<5	70-130
Benz(a)anthracene	0.5	5	0.1	5	5	5	<5	70-130
Chrysene	0.5	5	0.1	5	5	5	<5	70-130
Benzo(b)fluoranthene	0.5	5	0.1	5	5	5	<5	70-130
Benzo(j/k)fluoranthenes	0.5	5	0.1	5	5	5	<5	70-130
Benzo(e)pyrene	0.5	5	0.1	5	5	5	<5	70-130
Benzo(a)pyrene	0.5	5	0.1	5	5	5	<5	70-130
Perylene	1.0	10	0.2	10	10	10	<5	70-130
Dibenzo(ah)anthracene	1.0	10	0.2	10	10	10	<5	70-130
Indeno(1,2,3-cd)pyrene	1.0	10	0.2	10	10	10	<5	70-130
Benzo(ghi)perylene	1.0	10	0.2	10	10	10	<5	70-130
Biphenyl	1.0	10	0.2	10	10	10	<5	70-130
Dibenzothiophene	1.0	10	0.2	10	10	10	<5	60-140
1-Methylnaphthalene	1.0	10	0.2	10	10	10	<5	70-130
2-Methylnaphthalene	1.0	10	0.2	10	10	10	<5	70-130
2,6-Dimethylnaphthalene	1.0	10	0.2	10	10	10	<10	70-130
1,2-Dimethylnaphthalene	1.0	10	0.2	10	10	10	<10	60-140
2,3,5-Trimethylnaphthalene	1.0	10	0.2	10	10	10	<10	50-150
2,3,6-Trimethylnaphthalene	1.0	10	0.2	10	10	10	<10	50-150
1,4,6,7-Tetramethylnaphthalene	1.0	10	0.2	10	10	10	<10	50-200
2-Methylanthracene	1.0	10	0.2	10	10	10	<5	50-150
3-Methylphenanthrene	1.0	10	0.2	10	10	10	<10	N.A.
2-Methylphenanthrene	1.0	10	0.2	10	10	10	<10	50-150
9/4-Methylphenanthrenes	1.0	10	0.2	10	10	10	<10	N.A.
1-Methylphenanthrene	1.0	10	0.2	10	10	10	<10	50-150
3,6-Dimethylphenanthrene	1.0	10	0.2	10	10	10	<10	50-150
2,6-Dimethylphenanthrene	1.0	10	0.2	10	10	10	<10	N.A.
1,7-Dimethylphenanthrenes	1.0	10	0.2	10	10	10	<10	50-150
1,8-Dimethylphenanthrene	1.0	10	0.2	10	10	10	<10	N.A.
1,2,6-Trimethylphenanthrene	1.0	10	0.2	10	10	10	<10	50-150
Retene	1.0	10	0.2	10	10	10	<5	50-150
2-Methylfluorene	1.0	10	0.2	10	10	10	<5	50-150
1,7-Dimethylfluorene	1.0	10	0.2	10	10	10	<5	50-150
2/3-Methyldibenzothiophenes	1.0	10	0.2	10	10	10	<10	50-150
2,4-Dimethyldibenzothiophene	1.0	10	0.2	10	10	10	<5	50-150
3-Methylfluoranthene/ Benzo(a)fluorene	1.0	10	0.2	10	10	10	<5	50-150

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5/6-Methylchrysenes	1.0	10	0.2	10	10	10	<5	50-150
1-Methylchrysene	1.0	10	0.2	10	10	10	<5	50-150
5,9-Dimethylchrysene	1.0	10	0.2	10	10	10	<5	50-150
7-Methylbenzo(a)pyrene	1.0	10	0.2	10	10	10	<5	50-150
Typical Sample Size	10 g	1 L	10 g	1 col	1 PUF	1 filter		
Typical Final Volume (µL)	500	100	100	500	500	500		

*Detection limits quoted are those routinely achieved. Lower detection limits can be achieved if required.

NOTE: QC acceptance criteria do not apply to alkylated PAH total values (e.g. C1-phenanthenes/anthracenes) as these are Tentatively Identified Compounds (TIC) of unknown accuracy.

SURROGATE STANDARD

% RECOVERY RANGES

RECOVERIES:

ALL MATRICES

d ₈ -naphthalene	15 – 130
d ₈ -acenaphthylene	20 – 130
d ₁₀ -phenanthrene	30 – 130
d ₁₀ -fluoranthene	30 – 130
d ₁₂ -benz[a]anthracene	30 – 130
d ₁₂ -chrysene	30 – 130
d ₁₂ -benzo[b]fluoranthene	30 – 130
d ₁₂ -benzo[k]fluoranthene	30 – 130
d ₁₂ -benzo[a]pyrene	30 – 130
d ₁₂ -perylene	30 – 130
d ₁₄ -dibenz[ah]anthracene	30 – 130
d ₁₂ -indeno[1,2,3-cd]pyrene	30 – 130
d ₁₂ -benzo[ghi]perylene	30 – 130
d ₁₀ -2-methylnaphthalene	20 – 130
d ₁₂ -2,6-dimethylnaphthalene	20 – 130
d ₁₀ -biphenyl	15 – 130

QC Specification Table: Instrumental Analysis, and Analyte Quantification

Parameter	Acceptance Specification
Procedural Blank	Refer to Table “QC Specification Table: Authentic and Surrogate Standard Recoveries, OPR and Samples” above, or 5 times lower than analogous analyte value detected in the samples.
Analysis Duplicate	Duplicates must fall within $\pm 20\%$ of the mean (applicable to concentrations > 10 times the DL) These are guidelines – departures based on professional judgement allowed.
Instrument Sensitivity	S/N 3:1 for 10 pg of acenaphthene, dibenzo(a,h)anthracene.
Instrument Resolution	Calibration gas PFTBA (FC43) unit mass resolution at m/e 69/70 and 219/220, Unit mass resolution is demonstrated by the presence of a resolved peak at m/z 70 and m/e 220.
Instrument Linearity	Linearity is demonstrated by a 5-point calibration over the working concentration range with a relative standard deviation of the RRFs $\leq 20\%$ for targets with a labelled analog present and all labelled compounds, $\leq 35\%$ for targets with no labelled analog present.
Bracketing Cal	RRFs for the opening and closing calibrations over a 12 hour period must agree to within $\pm 20\%$ of the mean (ie < 40 RPD between RRFs and for the opening and closing calibrations).
Continuing Cal Ver	Opening Cal Ver: Concentrations of native compounds and labelled surrogates must be within $\pm 25\%$ of expected values for all targets. Closing Cal Ver: Concentrations of native compounds must be within $\pm 25\%$ of expected values. Concentrations of labelled surrogates must be within $\pm 25\%$ of expected values, with any two (2) values allowed to be within $\pm 40\%$
GC Resolution	Benzo[b] & [k]fluoranthene valley height must be $\leq 75\%$ for equal concentrations. Phenanthrene/anthracene valley height must be $\leq 30\%$ for equal concentrations.
Chromatogram Quality	Maximum peak width must be ≤ 15 seconds for dibenzo[ghi]perylene peak at 10% peak height.
Retention Time Window for Target Compounds	RT within ± 3 seconds of the predicted retention time determined from the calibration standard and adjusted relative to the peak retention time reference (i.e. labelled surrogate). A second requirement is that an authentic elute after its labelled analog.
Ion Abundance Ratios	CAL VER: Ion ratios for dibenz[ah]anthracene, indeno[1,2,3-cd]pyrene and benzo[ghi]perylene must be within $\pm 35\%$ of the mid-point of the I-CAL. All other native analytes and labelled surrogates must be $\pm 20\%$ of the mid-point of the I-CAL. Samples: Ion ratios for dibenz[ah]anthracene, indeno[1,2,3-cd]pyrene and benzo[ghi]perylene must be within $\pm 35\%$ of the 12 hour CAL (CAL VER or Bracketing) calibration standard. All other native analytes and labelled surrogates must be $\pm 20\%$ of the 12 hour CAL (CAL VER or Bracketing) calibration standard.

APPENDIX – SUMMARY OF MODIFICATIONS TO EPA 8270C, 8270D AND 1625B

Analysis by GC/LRMS, Key Attributes of AXYS MLA-021, EPA 8270C/D and EPA 1625B				
	MLA-021	EPA 8270C	EPA 8270D	EPA 1625B
MS acquisition mode	SIM ¹	Full Scan or optional SIM ¹	Full Scan or optional SIM ¹	Full Scan
Qualitative Identification Criteria	Retention time & ratio of 2 ions	Retention time & ratio of 3 ² ions	Retention time & ratio of 3 ² ions	Retention time & ratio of all characteristic ions
MS Ion Ratio Criteria	Within 20 % of theoretical	Within 30 % of reference spectrum	Within 30 % of reference spectrum	Within -50 % and +200 % of reference spectrum
MS Tuning Type and Check Frequency	PTFBA, daily	DFTTP ³ , 12 hrs	DFTTP ³ , 12 hrs	DFTTP, 8 hrs
Quantification References	Isotopically labeled standards added prior to extraction	Internal standards added just before instrumental analysis	Internal standards added just before instrumental analysis	Isotopically labeled standards added prior to extraction
Recovery correction of results	YES	NO	NO	YES
Calibration, minimum # levels	CCV Procedure: 5 levels OPTIONAL Single Point BRACKETING: 1 level	5	5	5
Initial Calibration Limit (% rsd)	20 % (35 % for targets with no labelled analog)	15 %	20 %	20 % (35 % for targets with no labelled analog)
Calibration Verification Frequency	Initially and every 12 hrs	Initially and every 12 hrs	Initially and every 12 hrs	Initially and every 8 hrs
Calibration Verification Relative Response Limit (% diff.)	< 25 % of I-CAL	< 20 % of I-CAL	< 20 % of I-CAL	Vary by compound; most stringent is acenaphthene: -20% to +25% of I-CAL
Calibration Verification IS area (% of I-CAL midpoint)	50-200 %	50-200 %	50-200 %	n.a.
Calibration verification IS RT (diff. from I-CAL midpoint)	n.a.	30 sec.	30 sec.	n.a.

Notes:

¹ SIM (Selected Ion Monitoring) is an allowable alternate technique for high sensitivity applications

² Based on availability, use of less ions is permitted where necessary

³ Alternate MS tuning protocols are permitted

Appendix E

**Benthic Invertebrate
Communities and
Sediment Quality Component**

E BENTHIC INVERTEBRATE COMMUNITIES AND SEDIMENT QUALITY COMPONENT

E.1 BENTHIC INVERTEBRATE COMMUNITIES

The objective of this appendix is to provide technical details on laboratory methods used for the processing and identification of the benthic samples. This appendix also documents the calculations used to estimate the *baseline* ranges of variability for benthic invertebrate community measurement endpoints that were used in Section 5 as a measure against which to assess the significance of temporal trends in *test* reaches.

E.1.1 Benthic Invertebrate Sample Processing Procedures

E.1.1.1 Laboratory Methods

In preparation for laboratory processing, samples were checked upon arrival to the laboratory to ensure that they were adequately sealed, labeled and that the preservative had effectively penetrated the entire sample. Samples were then rinsed of the residual fine debris and preservative (provided a minimum exposure of 72 hours to formalin occurred). Samples were either sorted immediately, or transferred to 80% ethanol, prior to sorting and taxonomic work. After sorting and identification, freshwater macro-invertebrates were stored in a solution of 70 to 80% ethanol, and 5% glycerin in vials or jars with airtight lids.

To expedite the sorting process, samples with large pieces of organic matter were divided into appropriate size fractions in the laboratory. The most commonly used fractions were coarse (> 1.00 mm) and fine (250 µm - 1.00 mm), which corresponded to the divisions used to define coarse and fine particulate organic matter (CPOM and FPOM), respectively. Where there were very large pieces of organic material or large invertebrates, they were separated from the rest of the sample with a 4.00-mm sieve. All fractions were sorted. If warranted by large numbers of organisms, the fractions were sub-sampled (as described below). After the initial washing and fractionation of samples, the invertebrates were sorted from the debris by trained technicians on a gridded tray or petri dish under a dissecting microscope at 10X to 20X magnification. Samples that contained large amounts of debris, or large numbers of animals were further sub-sampled as per Figure E.1-1.

E.1.1.2 Coarse Fraction

The coarse fraction (contents of the 2-mm and 1-mm sieves) was transferred into individual containers and 70 % alcohol added, prior to sorting. At least ¼ of the coarse fraction was sorted, with the amount of material sorted determined either by volume or weight.

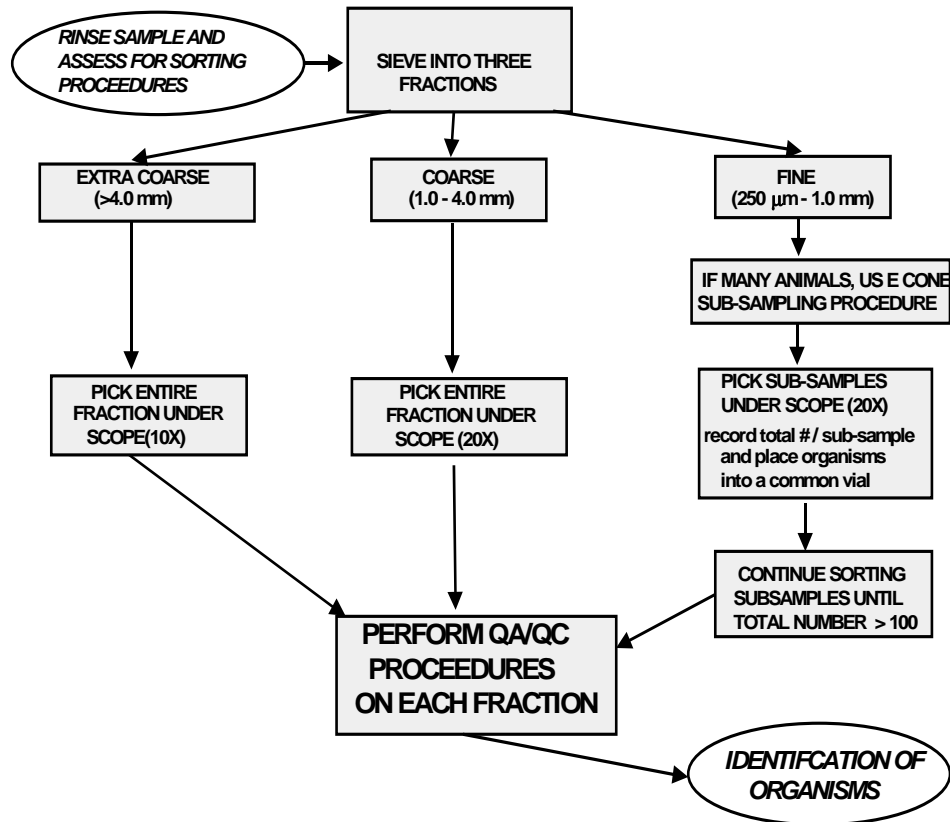
E.1.1.3 Fine Fraction

The fine fraction (contents of 0.180-mm sieve) was transferred into a 2-L container for decanting. Warm water was added to the 2-L container, swirled and decanted to mobilize organic material into a 0.180 mm sieve. This was repeated until all organic material was washed out of the sand. The sand was scanned under magnifying glass for heavy-shelled or stone-cased animals.

When there was a lot of organic material in the fine fractions and/or large numbers of organisms, a sub-sampling of the fine fractions was done as described below.

The fine fraction was sorted in its entirety when possible. When there were large amounts of the fine fraction, the material was sub-sampled using an Imhoff cone and bubbler (Wrona *et al.* 1982). Either ¼ of the sample was sorted, or at least 100 animals were removed from the debris. The fine fraction was stained with haematoxylin or rose Bengal to improve sorting.

Figure E.1-1 Benthic invertebrate sorting and sub-sampling protocol, applicable for samples with large detrital material and large numbers of small organisms.



Note: This is an illustrative example only, which should be modified as necessary for station-specific samples.

E.1.1.4 Identification

Invertebrates were identified using recognized taxonomic keys (Brooks and Kelton 1967, Teskey 1969, Edmunds *et al.* 1976, Oliver and Roussel 1983, Wiederholm 1983, McCafferty and Randolph 1998, Stewart and Stark 1988, Brinkhurst 1989, Pennak 1989, Clifford 1991, Merritt and Cummins 1996, Westfall and May 1996, Wiggins 1996, Zloty and Pritchard 1997, Epler 2001). Animals were identified to the lowest practical level, typically genus with the exception of Oligochaeta, which were identified to family (see Table E.1-1). Small, early-instar or damaged specimens were identified to the lowest level possible, generally to family.

Table E.1-1 Level of taxonomic identification.

Group	Level
Nematoda	Phylum
Oligochaeta	Family
Gastropoda	Genus/Species
Turbellaria	Family
Hirudinea	Species
Mollusca	Genus/Species
Hydracarina	Left at this level
Cladocera	Left at this level
Copepoda	Order
Ostracoda	Leave at this level
Amphipoda	Genus
Insecta	Genus/Species
Terrestrial	Left at this level

Organisms that require detailed microscopic examination for identification (e.g., Chironomidae and Oligochaeta) were mounted onto microscope slides using an appropriate mounting media (e.g., Canada balsam, Permount, Hohers's). The most common species that were distinguishable on the basis of gross morphology were mounted less frequently as double checks. All rare or less commonly occurring species are mounted for identification.

E.1.2 Calculating *Baseline* Ranges

Though rigorous analyses of variance can be used to test for changes related to oil sands operations by comparison of *test* watercourses to those that are not, the RAMP design has considerable statistical power, and thus the potential to detect changes that are negligible. The variability observed in regional *baseline* locations can be used to set observed changes into context, as per Kilgour *et al.* (1998). Watercourses were classified as either erosional or depositional river reaches, or a lake, and the "*baseline* range of variability" for *baseline* watercourses were calculated within each of those habitat types. Observed variations in *test* watercourses were then compared to the observed range of variability for *baseline* watercourses.

As in the main report, the following measurement endpoints were calculated:

- Total abundance (No. individuals/m²);
- Richness (number of distinct taxa);
- Simpson's Diversity;
- Evenness; and
- % EPT (percent of the fauna as Ephemeroptera, Plecoptera and Trichoptera).

Baseline ranges for abundance, richness, diversity, evenness, and percent EPT were derived based on habitat type (erosional, depositional, lake) and are provided in the relevant figures for each reach or lake in the main body of the report.

Correspondence Analysis (CA), a multivariate ordination procedure was also used. CA ordines the data such that the biplots of reach scores represents the similarities among reaches. Reaches close together in the biplots have similar fauna, while reaches far apart tend to have fewer similarities in their fauna. CA also orders the taxa, and biplots of taxa can be overlain over the biplots of reaches. The position of taxa in the biplots indicates, roughly, the samples in which taxa are their most abundant. The CA was generated using data from both *baseline* and *test* watercourses. Separate analyses were performed for depositional river reaches, erosional river reaches, and for lakes, on the basis that those three habitat classes contained very different types of benthic invertebrates as determined from analyses from previous years. Differences in composition among those three basic habitat types were borne out again this year.

With CA, the configuration of ordination diagrams tends to be sensitive to rare taxa (Gauch 1982). Therefore, the taxonomy was summarized to family level identifications and only those taxa (i.e., families) found in at least 10% of samples from a system were retained for the analysis. Taxa abundances were log₁₀-transformed prior to analysis. The CA was conducted using an MS Excel® add-in (Biplot 1.1; Lipkovich and Smith 2002).

The ordination was carried out using data for all available samples. Average CA axis scores were then computed for each reach (or lake) – year combination. CA annual-average axis scores were illustrated in a biplot, with a 95% confidence ellipse around the *baseline* data. Reaches that fall outside the ellipse for the *baseline* watercourses could be considered to be unusual, and that may be considered evidence of an effect (Kilgour *et al.* 1998).

Baseline data were identified for lake and river habitats. The *baseline* range of variation was non-parametrically computed as the range of values that included the 5th and 95th percentiles for each of abundance, number of taxa, diversity, evenness and percent EPT for each of lake, erosional river and depositional river habitats (similar to what is done with the water quality data; and see Figure E.3-1). The ordination axis scores were treated somewhat differently. The normal range of variation was depicted as an ellipse in a biplot of the first two CA axes with the *baseline* range being defined parametrically as the region enclosing the 95% region, equivalent to a non-parametric estimate of the 95th percentile (Figure E.3-2). The Athabasca River delta was considered unique in the analysis because there were no true regional *baseline* reaches that provided a truly adequate comparison. In this report, the *baseline* condition for the delta habitat was considered to be all of the previous data from 1998 to 2010. This approach to estimating *baseline* conditions was roughly equivalent to control charting techniques that are designed to determine when processes are “out of control” (Shewart 1931).

Figure E.1-2 Example biplot showing time trend of benthic invertebrate CA Axis scores in relation to the baseline range of variation, in this case, for samples from the Athabasca River delta.

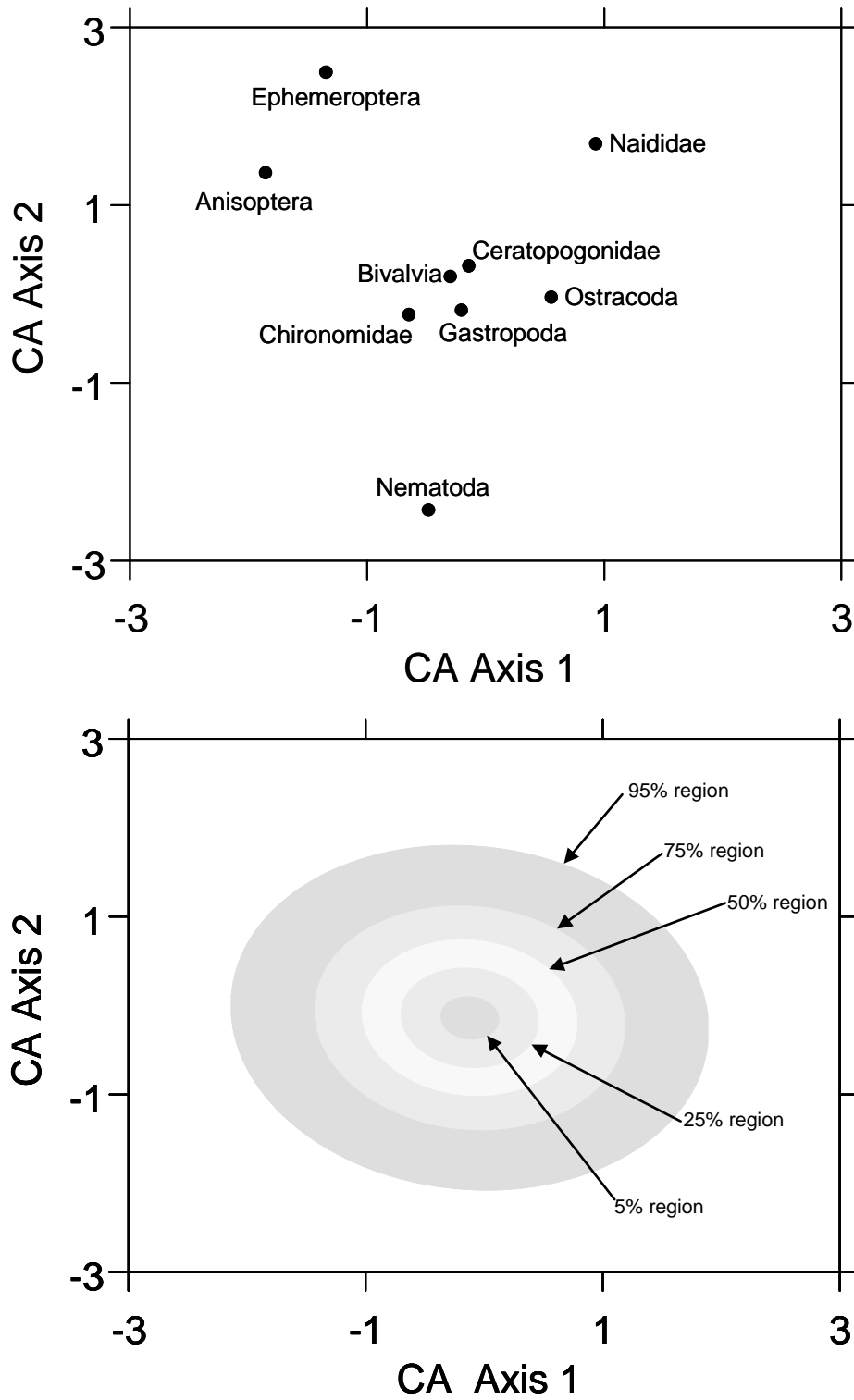
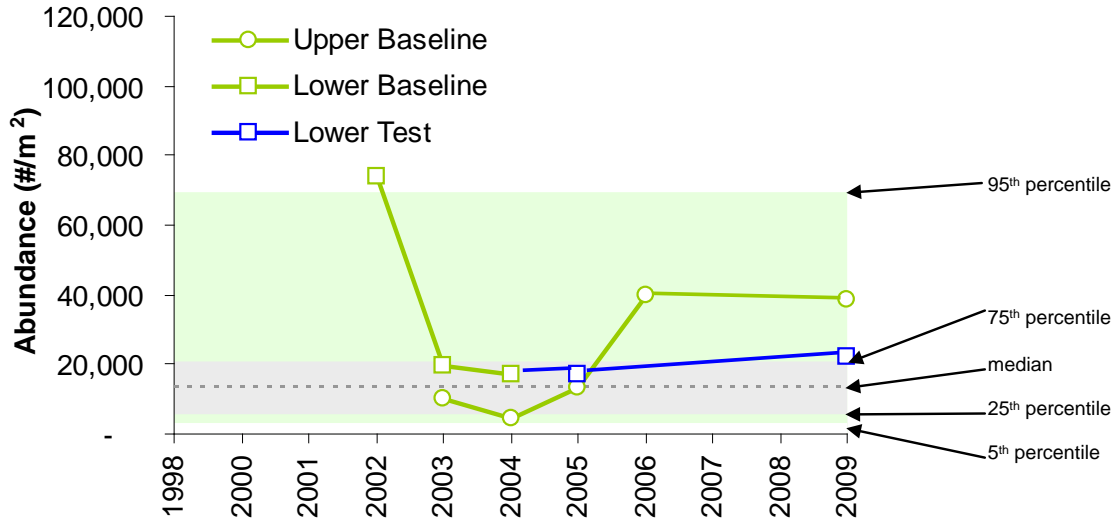


Figure E.1-3 Example time trend chart for benthic invertebrate community abundance in relation to the *baseline* range of variation, in this case, for a depositional reach.



E.2 SEDIMENT QUALITY COMPONENT

E.2.1 Analytical Methods

Analytical methods used for sediment quality analysis for RAMP in 2011, along with associated detection limits and analysis-specific Variable Method Values (VMV codes, where available and provided by the laboratories) are presented in Table E.2-1.

For PAHs specifically, AXYS Analytical Ltd. used their AXYS Method MLA021 for the determination of concentrations of PAHs, and alkylated PAHs in solid (sediment, soil) and equipment rinsate (aqueous) matrices. This method is based upon USEPA Methods 1625 and 8270, with modifications. AXYS Analytical is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) (Lab ID A2637) in Canada for the analysis of PAHs in solids.

All samples for PAH analysis were spiked with a solution of fifteen deuterated surrogate standards prior to analysis. Solid samples were extracted by soxhlet extraction. Aqueous samples were solvent-extracted. The sample extracts were fractionated on a silica gel chromatographic column and analyzed using capillary column gas chromatography with detection by low resolution mass spectrophotometry (GC/MS) for PAHs and alkylated PAHs. The GC/MS was operated at unit mass resolution. Concentrations were reported in ng/g on a dry weight basis for solids and ng/L for aqueous samples.

Detection limits for each PAH analysis varied based on surrogate and spike recoveries and other internal laboratory QA/QC measures conducted for each test. However, detection limits for individual PAH species were dependent on the species.

E.2.2 Predicted PAH Toxicity

PAH toxicity in sediments was estimated using an equilibrium-partitioning method described by Neff *et al* (2005). Hydrocarbons are present in sediments as complex mixtures of compounds with widely varying physical, chemical and toxicological properties. PAHs found in aquatic environments originate from three possible sources, and can generally be identified by the composition of the PAH mixture within the sediments (Neff *et al* 2005, USEPA 2003):

- *Pyrogenic PAHs*, which result from the incomplete but high-temperature, short duration combustion of organic matter, and are most abundant in non-alkylated (parent) form;
- *Petrogenic PAHs*, which are created by the application of relatively low temperatures over geologic time scales, and are most abundant in alkylated form; and
- *Diagenic / Biogenic PAHs*, which are formed from biological precursors such as plants, bacteria, fungi, and animals, and result in the production of compounds such as retene, perylene and derivatives of phenanthrene and chrysene.

PAHs present in the Athabasca oil sands region can be categorized as being derived from petrogenic sources, as indicated by the significantly higher concentrations of alkylated PAHs relative to parent PAHs.

During development of this report, the method employed by the US Environmental Protection Agency (USEPA) and described in USEPA (2003) for calculating potential PAH toxicity of sediments also was considered as a comparison to hazard index values obtained using the Neff *et al* method. Calculations used for both methods are similar in that they compare measured PAH concentrations to PAH-specific toxicities, estimate bioavailability, and use these individual toxicity and bioavailability estimates to produce an aggregate hazard value for the sum of all PAHs in a sample. However, the USEPA method normalizes PAHs to the total organic fraction of sediment (rather than the total non-aqueous-phase-liquids [NAPL] fraction), and uses fewer individual PAH measurements than the Neff *et al.* method. Additionally, the USEPA method focuses heavily on the contribution of parent PAHs to sediment toxicity, given it was developed for assessment of sediments containing predominantly pyrogenic PAHs. Given sediments in the Athabasca oil sands region are primarily petrogenic and dominated by alkylated PAHs rather than parent species, the USEPA method may underestimate potential toxicity of oil-sands-affected sediments. Additionally, the standard PAH package employed by RAMP does not include the entire list of PAHs required to accurately calculate toxicity using the USEPA method. For these reasons, results obtained from the USEPA method were not considered in this report.

Estimation of PAH toxicity in sediments was conducted using methods described by Neff *et al* (2005). This method incorporates 41 individual PAH compounds into the PAH toxicity calculation. PAH concentrations are distributed between three phases in sediments: dissolved (pore water), particulate (sediment and organic matter), and non-aqueous-phase-liquids (NAPL: an oil coating associated with sediment particles and comprised of hydrocarbons such as petroleum). The fraction of PAHs in solution are much more bioavailable and toxic than those complexed to sediment particles via the other two phases. Neff *et al.* (2005) state that PAHs have a higher affinity to the NAPL phase (estimated by RAMP using total recoverable hydrocarbons measured in each

sample) than to the other two phases of sediments and are; therefore, quickly deposited into sediments. Consequently, each individual PAH concentration measured in a sediment sample is first normalized to total recoverable hydrocarbons to produce an estimate of the combined PAH concentration available within the pore water and particulate fractions of sediments:

$$PAH_{(normalized)} = \frac{PAH \text{ concentration}}{\text{total recoverable hydrocarbons}}$$

where:

- PAH_(normalized) refers to the estimate of PAHs available in pore water and complexed to the particulate fraction of sediment;
- PAH concentration refers to the absolute concentration of specific PAH species; and
- Total recoverable hydrocarbons (TRH) refers to the total amount of hydrocarbons representing NAPL. TRH was measured directly by RAMP from 1997 to 2004, and replaced in 2005 by the more detailed, higher-resolution measure, CCME total hydrocarbons, with both methods overlapping in 2004. To allow long-term comparisons using data from 2005 onward, TRH in each sample was estimated using the concentration of CCME total hydrocarbons adjusted using the following equation, which was based on direct within-sample comparisons made using 2004 data:

$$TRH = \text{total CCME hydrocarbons} * 2.183$$

where,

Total CCME hydrocarbons are equal to the sum of CCME Fractions 2 to 4.

PAH_(normalized) concentrations then are divided by the octanol/water partition coefficient (K_{ow}) to estimate the concentration of each PAH that is bioavailable in the dissolved (pore water) phase of sediment. These estimates are divided by a chronic toxicity value (compiled from Mackay *et al.* 1992, Neff and Burns 1996, Ran *et al.* 2002, and references cited in Neff *et al.* 2005) to produce a hazard quotient (HQ) for each PAH measured in the sediment sample:

$$HQ = \left(\frac{PAH_{(normalized)}}{K_{ow}} \right) \div \text{Chronic Toxicity}$$

Finally, all HQs calculated using this method are summed to produce a hazard index (HI) for total PAHs in sediment pore water:

$$HI = \sum HQ$$

Sediments with a calculated hazard index value greater than 1.0 have the potential to be toxic to aquatic organisms (Neff *et al.* 2005).

Table E.2-1 Analytical methods, method detection limits, and Variable Method Values (VMV codes) for sediment quality variables measured by analytical laboratories for RAMP in 2011.

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
Hydrocarbons and Organic Compounds	2-Bromobenzotrifluoride	%	1	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	Benzene	mg/kg	0.005	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 1 (BTEX)	mg/kg	10	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 1 (C6-C10)	mg/kg	10*	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 2 (C10-C16)	mg/kg	20*	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 3 (C16-C34)	mg/kg	20*	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	CCME Fraction 4 (C34-C50)	mg/kg	20	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	Ethylbenzene	mg/kg	0.015	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	m+p-Xylene	mg/kg	0.05	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	o-Xylene	mg/kg	0.05	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	Toluene	mg/kg	0.05	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	Total Hydrocarbons (C6-C50)	mg/kg	20	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Hydrocarbons and Organic Compounds	Xylenes	mg/kg	0.1	CCME CWS-PHC Dec-2000 - Pub# 1310	-	ALS
Physical properties	% Clay	%	1	SSIR-51 Method 3.2.1	-	ALS
Physical properties	% Moisture	%	0.1	Oven dry 105C-Gravimetric	100424	ALS
Physical properties	% Sand	%	1	SSIR-51 Method 3.2.1	-	ALS
Physical properties	% Silt	%	1	SSIR-51 Method 3.2.1	-	ALS
Physical properties	CaCO ₃ Equivalent	%	0.7	SSSA (1996) P455-456	-	ALS
Physical properties	Inorganic Carbon	%	0.1	SSSA (1996) P455-456	50303	ALS
Physical properties	Texture		(Descriptive)	SSIR-51 Method 3.2.1	-	ALS
Physical properties	Total Carbon by Combustion	%	0.1	SSSA (1996) P. 973-974	6075	ALS
Physical properties	Total organic carbon	%	0.1	SSSA (1996) P455-456	6078	ALS
Total metals	Aluminum (Al)	mg/kg	50	EPA 200.2/6020A	-	ALS
Total metals	Antimony (Sb)	mg/kg	0.1	EPA 200.2/6020A	-	ALS
Total metals	Arsenic (As)	mg/kg	0.1	EPA 200.2/6020A	-	ALS
Total metals	Barium (Ba)	mg/kg	0.5	EPA 200.2/6020A	-	ALS
Total metals	Beryllium (Be)	mg/kg	0.2	EPA 200.2/6020A	-	ALS
Total metals	Bismuth (Bi)	mg/kg	0.2	EPA 200.2/6020A	-	ALS
Total metals	Cadmium (Cd)	mg/kg	0.1	EPA 200.2/6020A	-	ALS
Total metals	Calcium (Ca)	mg/kg	100	EPA 200.2/6020A	-	ALS
Total metals	Chromium (Cr)	mg/kg	0.5	EPA 200.2/6020A	-	ALS
Total metals	Cobalt (Co)	mg/kg	0.1	EPA 200.2/6020A	-	ALS
Total metals	Copper (Cu)	mg/kg	0.5	EPA 200.2/6020A	-	ALS
Total metals	Iron (Fe)	mg/kg	200	EPA 200.2/6020A	-	ALS
Total metals	Lead (Pb)	mg/kg	0.5	EPA 200.2/6020A	-	ALS
Total metals	Lithium (Li)	mg/kg	0.5	EPA 200.2/6020A	-	ALS
Total metals	Magnesium (Mg)	mg/kg	20	EPA 200.2/6020A	-	ALS
Total metals	Manganese (Mn)	mg/kg	1	EPA 200.2/6020A	-	ALS

* Detection limit varies with moisture content in sediment sample

¹ See text.

Table E.2-1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
Total metals	Mercury (Hg)	mg/kg	0.05	EPA 200.2/245.1	-	ALS
Total metals	Molybdenum (Mo)	mg/kg	0.1	EPA 200.2/6020A	-	ALS
Total metals	Nickel (Ni)	mg/kg	0.5	EPA 200.2/6020A	-	ALS
Total metals	Phosphorus (P)	mg/kg	100	EPA 200.2/6020A	-	ALS
Total metals	Potassium (K)	mg/kg	100	EPA 200.2/6020A	-	ALS
Total metals	Selenium (Se)	mg/kg	0.2	EPA 200.2/6020A	-	ALS
Total metals	Silver (Ag)	mg/kg	0.2	EPA 200.2/6020A	-	ALS
Total metals	Sodium (Na)	mg/kg	100	EPA 200.2/6020A	-	ALS
Total metals	Strontium (Sr)	mg/kg	1	EPA 200.2/6020A	-	ALS
Total metals	Thallium (Tl)	mg/kg	0.05	EPA 200.2/6020A	-	ALS
Total metals	Tin (Sn)	mg/kg	2	EPA 200.2/6020A	-	ALS
Total metals	Titanium (Ti)	mg/kg	1	EPA 200.2/6020A	-	ALS
Total metals	Uranium (U)	mg/kg	0.05	EPA 200.2/6020A	-	ALS
Total metals	Vanadium (V)	mg/kg	0.2	EPA 200.2/6020A	-	ALS
Total metals	Zinc (Zn)	mg/kg	5	EPA 200.2/6020A	-	ALS
PAHs	Acenaphthene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Acenaphthylene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Anthracene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Benz[a]anthracene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Benzo[a]pyrene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Benzo[b,j,k]fluoranthene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Benzo[g,h,i]perylene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Biphenyl	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Benzo[a]anthracenes/Chrysenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Benzofluoranthenes/Pyrenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Dibenzothiophenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Fluoranthenes/Pyrenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Fluorenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Naphthalenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C1-Phenanthrenes/Anthracenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Benzo[a]anthracenes/Chrysenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Benzofluoranthenes/Pyrenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Dibenzothiophenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Fluoranthenes/Pyrenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Fluorenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Naphthalenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C2-Phenanthrenes/Anthracenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C3-Dibenzothiophenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C3-Fluoranthenes/Pyrenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C3-Fluorenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C3-Naphthalenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS

* Detection limit varies with moisture content in sediment sample ¹ See text.

Table E.2-1 (Cont'd.)

Analyte Category	Analyte	Units	Detection Limit	Analytical Method	VMV Code	Lab
PAHs	C3-Phenanthrenes/Anthracenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C4-Dibenzothiophenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C4-Naphthalenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	C4-Phenanthrenes/Anthracenes	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Chrysene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Dibenz[a,h]anthracene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Dibenzothiophene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Dimethyl-Biphenyl	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Fluoranthene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Fluorene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Indeno[1,2,3-c,d]-pyrene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Methyl Acenaphthene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Methyl-Biphenyl	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Naphthalene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Phenanthrene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Pyrene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
PAHs	Retene	mg/kg	Varies ¹	MLA021, based on USEPA methods 1625 and 8270 ¹	-	AXYS
Toxicity	<i>Chironomus dilutus</i> - 10d growth	mg/organism	-	Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	-	HydroQual
Toxicity	<i>Chironomus dilutus</i> - 10d growth - % of Control	%	-	Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	-	HydroQual
Toxicity	<i>Chironomus dilutus</i> - 10d survival	# surviving	-	Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	-	HydroQual
Toxicity	<i>Chironomus dilutus</i> - 10d survival - % of Control	%	-	Biological test method: test for survival and growth in sediment using the larvae of freshwater midges (<i>Chironomus Dilutus</i> or <i>Chironomus riparius</i> , 1997. Environment Canada EPS 1/RM/32.	-	HydroQual
Toxicity	<i>Hyalella azteca</i> - 14d growth	mg/organism	-	Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	-	HydroQual
Toxicity	<i>Hyalella azteca</i> - 14d survival	# surviving	-	Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	-	HydroQual
Toxicity	<i>Hyalella azteca</i> - 14d growth - % of Control	%	-	Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	-	HydroQual
Toxicity	<i>Hyalella azteca</i> - 14d survival - % of Control	%	-	Biological test method: test for survival and growth in sediment using the freshwater amphipod <i>Hyalella azteca</i> , 1997. Environment Canada EPS 1/RM/33.	-	HydroQual

* Detection limit varies with moisture content in sediment sample

¹ See text.

Appendix F
Fish Populations Component

F FISH POPULATIONS COMPONENT

F.1 COMMON AND SCIENTIFIC NAMES FOR FISH SPECIES CAPTURED IN THE 2011 FISH POPULATIONS COMPONENT

Table F.1-1 Common and scientific names for fish species captured during Fish Populations component activities, 2011.

Common Name	Scientific Name	Code
Arctic grayling	<i>Thymallus arcticus</i>	ARGR
brook stickleback	<i>Culaea inconstans</i>	BRST
burbot	<i>Lota lota</i>	BURB
emerald shiner	<i>Notropis atherinoides</i>	EMSH
flathead chub	<i>Platygobio gracilis</i>	FLCH
goldeye	<i>Hiodon alosoides</i>	GOLD
lake chub	<i>Couesius plumbeus</i>	LKCH
lake whitefish	<i>Coregonus clupeaformis</i>	LKWH
longnose dace	<i>Rhinichthys cataractae</i>	LNDC
longnose sucker	<i>Catostomus catostomus</i>	LNSC
mountain whitefish	<i>Prosopium williamsoni</i>	MNWH
northern pike	<i>Esox lucius</i>	NRPK
pearl dace	<i>Semotilus margarita</i>	PRDC
slimy sculpin	<i>Cottus cognatus</i>	SLSC
spoonhead sculpin	<i>Cottus ricei</i>	SPSC
spottail shiner	<i>Notropis hudsonius</i>	SPSH
trout-perch	<i>Percopsis omiscomaycus</i>	TRPR
walleye	<i>Sander vitreus</i>	WALL
white sucker	<i>Catostomus commersoni</i>	WHSC
yellow perch	<i>Perca flavescens</i>	YLPR

F.2 EXTERNAL HEALTH ASSESSMENT INDEX CODES FOR FISH EXAMINATION

Fish body part and abnormality codes were developed to assess the health of captured fish in a rapid process to minimize the fish holding time in the field (Table F.2-1). Fish body part and abnormality codes were also developed to assess the internal health of fish captured for dissection and tissue analyses. For each abnormality that was observed, the severity of the abnormality was recorded (1-mild; 2-moderate; 3-severe) as well as the location of the abnormality (Table F.2-2).

Table F.2-1 External and internal health assessment codes for fish examinations.

Variable	Variable Code	Variable Condition	Variable Condition Code
eyes	EYE	no aberrations; good "clear" eye	N
		exophthalmia (popeye)	EX
		blind; an opaque eye (one or both)	BL
		cloudy cornea	CC
		lens deformed	LD
		lens parasites	LP
		lens cataract	LC
		hemorrhaging or bleeding in the eye (one or both)	HM
		missing one or both eyes	MI
		other; any condition not covered above	OT
gills	GIL	normal; no apparent aberrations	N
		frayed; erosion of tips of gill lamellae resulting in "ragged" gills	FR
		clubbed; swelling of the tips of gill lamellae	CL
		marginate; gills with light, discoloured margin along tips of the lamellae	MA
		pale; very light in colour	DI
		parasites	PA
		gas bubbles	GB
pseudobranchs	PSD	normal; flat, containing no aberrations	N
		swollen; convex in aspect	SW
		lithic; mineral deposits, white, somewhat amorphous spots	LI
thymus	THY	no hemorrhage	0
		hemorrhagic	HM

Table F.2-1 (Cont'd.)

Variable	Variable Code	Variable Condition	Variable Condition Code
skin	BOS	normal; no skin aberrations	N
		lesion	LE
		raised or missing scales	RM
		reoriented scales	RS
		swollen	SW
		exceeds mucus	EX
		growths and/or tumours	GR
		parasites	PA
		wounds and/or scars	WO
		other; any condition not covered above	OT
fins	FIN	no active erosion	N
		frayed-eroded	FE
		parasites	PA
		hemorrhagic	HM
		gas bubbles	GB
		other; any condition not covered above	OT
opercle	OPR	no shortening	N
		incomplete	IN
		other; any condition not covered above	OT
hindgut	ANU	normal; no inflammation or reddening	N
		inflamed	IN
		other; any condition not covered above	OT
body deformities	BOF	none	N
		emaciated	EM
		truncate	TR
		scoliosis	SC
		lordosis	LO
		other; any condition not covered above	OT
mesenteric fat	MF	none	0
		< 50 % coverage of mesentery	1
		50 % coverage of mesentery	2
		> 50 % coverage of mesentery	3
		100% of mesentery covered	4

Table F.2-1 (Cont'd.)

Variable	Variable Code	Variable Condition	Variable Condition Code
liver	LI	normal; solid red or light red colour	A
		"fatty" liver; "coffee with cream" colour	C
		nodules in the liver; cysts or nodules	D
		focal discolouration; distinct localized colour changes	E
		general discolouration; colour change in whole liver	F
		other; any condition not covered above	OT
spleen	SP	normal; black, very dark red, or red	B
		granular; rough appearance of spleen	G
		nodular; containing fistulas or nodules of varying sizes	D
		enlarged; noticeable enlarged	E
		other; any condition not covered above	OT
gall bladder	GA	normal	0
		enlarged	1
		parasites	2
kidney	KI	normal; firm dark red colour, lying relatively flat along vertebral column	N
		swollen; enlarged or swollen wholly or in part	S
		mottled; gray discolouration	M
		granular; granular appearance and texture	G
		urolithiasis/nephrocalcinosis; white/cream mineral material in tubules	U
		other; any condition not covered above	OT
parasites	PA	no observed parasites	0
		few observed parasites	1
		moderate parasite infestation	2
		numerous parasites	3

Table F.2-2 Codes for the location of external fish abnormalities.

Variable	Location	Code
Body surface	fins	1
	head	2
	eyes	3
	mouth	4
	peduncle	5
	ventral	6
	dorsal	7
	lateral	8
Fins	dorsal	1
	pectoral	2
	pelvic	3
	anal	4
	adipose	5
	caudal	6
Eyes	right	1
	left	2

Appendix G
Acid-Sensitive Lakes Component

G ACID-SENSITIVE LAKES COMPONENT

Appendix H presents the descriptive portions of the Acid-Sensitive Lakes (ASL) component for 2011. Summary statistics on the chemistry of the ASL component lakes (RAMP lakes), results of between-year comparisons of measurement endpoints, calculations of critical loads of acidity for each lake, and trend analyses on the measurement endpoints can be found in Section 5.12. Appendix H includes the following:

- Water yields and runoff estimates for the individual RAMP lakes;
- A test of the assumption that current base cation concentrations are the same as historical base cation concentrations in the RAMP lakes for the critical load calculations;
- Origin of the use of an ANC_{lim} of 75 $\mu\text{eq/L}$ in the critical load calculations;
- The chemistry of the 50 RAMP lakes in 2011 compared to the 450 lakes within the oil sands region reported by the NO_xSO_x Management Working Group (NSMWG);
- The characterization of the ion chemistry of the RAMP lakes in 2011 using Piper plots; and
- A summary of the trace metal concentrations in the RAMP lakes and the relationships between metal concentrations, lake location and water chemistry.

Estimates of the seasonal variability in measurement endpoints were not presented this year as in previous years given that the five-year seasonal sampling program, sponsored by CEMA and conducted by Alberta Environment and Water (AEW), ended in 2008. For estimates of seasonal variability in the measurement endpoints in the RAMP lakes, see Appendix H in the 2008 Technical Report (RAMP 2009a).

G.1 RUNOFF CALCULATIONS FOR EACH RAMP LAKE

The runoff (Q) to each lake, was calculated from analyses of heavy isotopes of oxygen (^{18}O) and (^2H) in each lake conducted by John Gibson (University of Victoria). With this technique, the natural evaporative enrichment of ^{18}O and ^2H in each lake is used to partition water losses between evaporation and liquid outflow to derive an estimate of runoff (Gibson 2002, Gibson *et al.* 2002, Gibson and Edwards 2002, Gibson *et al.* 2010). This isotopic mass balance technique (IMB) utilizes a different set of assumptions from traditional hydrometric methods, which extrapolate water yields from one or more gauged catchments to the ungauged lake catchments.

The water yields for each lake catchment and the runoff to each lake are provided in Tables G.1-1 and G.1-2. The runoff is calculated from the water yield by incorporating the lake catchment areas and represents the discharge that would be measured at the lake outlet. In 2011, the runoff values using the IMB method were unavailable. The average yield and runoff values from 2002 to 2010 were; therefore, applied in calculating the critical loads for 2011. The runoff estimates for the ASL lakes ranged from 0.001 m^3/s to 2.431 m^3/s (median: 0.077 m^3/s). As noted in the Tables G.1-1 and G.1-2, the runoff for an individual lake can vary considerably between years. The median coefficient of variation of the runoff over all 50 ASL lakes over the years 2002 to 2010 was 36.4 %. As noted by Gibson *et al.* (2010), yearly variations in the yield and runoff to a lake will have a direct effect on its critical load and acid sensitivity.

Table G.1-1 Water Yields to the RAMP lakes, 2002 to 2011¹.

Lake ID No.	AEW Label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Lake Area (km ²)	Catchment Area (km ²)
		Water Yields (mm/y)											
168	SM10	95	124	136	135	149	90	195	197	154	142	1.4	18.18
169	SM9	156	205	204	412	259	225	289	266	256	253	1.1	8.28
170	SM6	39	51	60	84	69	53	86	84	74	67	0.7	13.06
167	SM5	241	258	260	347	274	218	587	525	506	357	1.1	3.67
166	SM7	56	117	142	193	171	116	295	338	263	188	1.5	6.94
287	SM8	144	213	230	323	256	70	326	314	278	239	1.9	9.63
289	SM3	182	260	236	433	296	211	359	428	374	309	1.9	7.39
290	SM4	29	73	57	72	69	58	88	97	86	70	0.5	11.74
342	SM2	31	33	72	126	65	10	129	141	118	80	2	15.36
354	SM1	132	181	230	277	143	49	387	383	314	233	2.4	9.61
165	WF1	98	235	252	305	218	200	523	427	311	285	3.2	10.43
171	WF2	46	96	81	182	69		232	161	119	123	0.8	4.30
172	WF3	19	35	51	91	43	34	101	88	44	56	2.2	51.55
223	WF4	9	8	10	78	17	9	29	28	16	23	0	1.79
225	WF5	14	38	30	156	49	34	62	68	81	59	0.2	5.04
226	WF6	27	99	77	196	81	61	78	133	121	97	0.2	4.19
227	WF7	34	138	73	214	105	62	115	174	173	121	0.1	1.59
267	WF8	20	42	38	93	61	25		95	39	52	2	23.08
452	NE1	197	194	133	265	180	98	383	201	88	193	0.7	16.75
470	NE2	153	111	79	152	161	66	146	130	94	121	0.3	15.13
471	NE3	88	132	112	232	248	58	140	136	104	139	0.6	23.98
400	NE4	606	503	449	869	409	260	587	708	369	529	1.2	3.17
268	NE5	267	488	379	480	303	101	410	560	426	379	1.9	7.32
182	NE6	156	148	91	260	101	192	42	155	282	159	0.4	8.34
185	NE7	166	125	101	162	126	132	172	121	140	138	0.1	5.91
209	NE8	753	586	373	861	461	349	985	669	831	652	0.1	0.82
270	NE9	176	245	255	339	319	106	279	491	354	285	3.2	11.21
271	NE10	132	128	230	373	246	189	245	426	240	246	4.2	17.09
418	NE11		167	140	239	112	47	129	144	96	134	5.8	77.17
436	BM2	353	536	472	410	487	263	551	577	518	463	44	165.55
442	BM9	179	288	246	295	326	239	278	311	248	268	3.5	33.26
444	BM1	431	660	595	435	607	343	703	697	615	565	17	58.72
447	BM6	393	455	285	733	407	284	429	570	520	453	1.3	13.67
448	BM7	430	444	531	514	287	245	351	509	365	408	0.7	4.66
454	BM8	121	168	101	289	151	69	115	213	114	149	1.2	32.49
455	BM4	167	232	119	455	274	112	303	422	270	262	4.3	37.33
457	BM5	141	244	118	455	232	92	262	322	162	225	2.6	30.59
464	BM3	77	141	87	168	112	59	134	182	97	117	1	29.75
175	BM10	30	25	27	92	51	33	76	192	50	64	0.4	5.15
199	BM11	75	117	121	133	116	69	79	130	87	103	0.1	0.57
473	S4	23	30	24	57	38	38	42	39	28	35	1.4	114.65
118	S1	425	482	387	389	452	349	502	438	424	428	3.4	13.40
84	S2	43	51	42	65	39		54	71	33	50	1	112.59
88	S5	113	122	108	116	127		118	144	81	116	0.3	4.48
90	S3	112	159	130	140	148	139	150	187	115	142	1.4	37.89
146	CM1	240	310	235	378	455	551	728	603	545	449	1.6	24.11
152	CM2	304	328	234	447	404	328	401	485	452	376	9.6	46.77
89	CM3	189	162	111	331	275	249	220	346	285	241	2.3	27.95
97	CM4	242	275	182	219	228	308	394	503	383	304	2.6	38.05
91	CM5	225	212	136	697	704	175	212	391	408	351	0.6	2.78
	Min	8.6	7.5	9.5	56.6	16.7	9.0	28.9	28.4	16.0	23		
	Max	753	660	595	869	704	551	985	708	831	652		
	Mean	171	209	177	295	220	150	276	300	243	226		
	Median	141	165	131	263	176	106	232	240	207	191		

¹ Data provided by Dr. John Gibson.

² Water yields were not available in 2011; therefore, the mean value from 2002 to 2010 was used for each lake.

Table G.1-2 Runoff to the RAMP lakes, 2002 to 2011.

Lake ID No.	AEW Label	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011 ¹
		Runoff (m ³ /s)									
168	SM10	0.055	0.071	0.078	0.078	0.086	0.052	0.112	0.114	0.089	0.082
169	SM9	0.041	0.054	0.054	0.108	0.068	0.059	0.076	0.070	0.067	0.066
170	SM6	0.016	0.021	0.025	0.035	0.029	0.022	0.036	0.035	0.031	0.028
167	SM5	0.028	0.030	0.030	0.040	0.032	0.025	0.068	0.061	0.059	0.042
166	SM7	0.012	0.026	0.031	0.042	0.038	0.025	0.065	0.074	0.058	0.041
287	SM8	0.044	0.065	0.070	0.099	0.078	0.021	0.100	0.096	0.085	0.073
289	SM3	0.043	0.061	0.055	0.101	0.069	0.049	0.084	0.100	0.088	0.072
290	SM4	0.011	0.027	0.021	0.027	0.026	0.022	0.033	0.036	0.032	0.026
342	SM2	0.015	0.016	0.035	0.062	0.032	0.005	0.063	0.069	0.057	0.039
354	SM1	0.040	0.055	0.070	0.084	0.044	0.015	0.118	0.117	0.096	0.071
165	WF1	0.032	0.078	0.083	0.101	0.072	0.066	0.173	0.141	0.103	0.094
171	WF2	0.006	0.013	0.011	0.025	0.009		0.032	0.022	0.016	0.017
172	WF3	0.031	0.057	0.083	0.149	0.070	0.056	0.165	0.144	0.072	0.092
223	WF4	0.0005	0.0004	0.0005	0.0044	0.0009	0.0005	0.0016	0.0016	0.0009	0.001
225	WF5	0.002	0.006	0.005	0.025	0.008	0.005	0.010	0.011	0.013	0.009
226	WF6	0.004	0.013	0.010	0.026	0.011	0.008	0.010	0.018	0.016	0.013
227	WF7	0.002	0.007	0.004	0.011	0.005	0.003	0.006	0.009	0.009	0.006
267	WF8	0.015	0.031	0.028	0.068	0.045	0.018		0.070	0.029	0.038
452	NE1	0.105	0.103	0.070	0.141	0.096	0.052	0.204	0.107	0.047	0.103
470	NE2	0.073	0.053	0.038	0.073	0.077	0.032	0.070	0.062	0.045	0.058
471	NE3	0.067	0.100	0.085	0.176	0.188	0.044	0.107	0.103	0.079	0.106
400	NE4	0.061	0.051	0.045	0.087	0.041	0.026	0.059	0.071	0.037	0.053
268	NE5	0.062	0.113	0.088	0.112	0.070	0.024	0.095	0.130	0.099	0.088
182	NE6	0.041	0.039	0.024	0.069	0.027	0.051	0.011	0.041	0.075	0.042
185	NE7	0.031	0.023	0.019	0.030	0.024	0.025	0.032	0.023	0.026	0.026
209	NE8	0.020	0.015	0.010	0.022	0.012	0.009	0.026	0.017	0.022	0.017
270	NE9	0.062	0.087	0.090	0.121	0.113	0.038	0.099	0.174	0.126	0.101
271	NE10	0.072	0.069	0.125	0.202	0.133	0.103	0.133	0.231	0.130	0.133
418	NE11		0.409	0.342	0.584	0.273	0.115	0.315	0.353	0.235	0.328
436	BM2	1.851	2.815	2.476	2.155	2.557	1.383	2.890	3.029	2.719	2.431
442	BM9	0.189	0.304	0.259	0.311	0.344	0.253	0.294	0.328	0.262	0.282
444	BM1	0.803	1.229	1.107	0.810	1.130	0.638	1.309	1.297	1.145	1.052
447	BM6	0.170	0.197	0.123	0.318	0.177	0.123	0.186	0.247	0.225	0.196
448	BM7	0.064	0.066	0.078	0.076	0.042	0.036	0.052	0.075	0.054	0.060
454	BM8	0.125	0.174	0.104	0.298	0.155	0.071	0.119	0.220	0.117	0.154
455	BM4	0.198	0.274	0.141	0.538	0.324	0.133	0.358	0.500	0.320	0.310
457	BM5	0.137	0.237	0.115	0.441	0.225	0.089	0.254	0.312	0.157	0.219
464	BM3	0.072	0.133	0.082	0.159	0.105	0.055	0.127	0.172	0.092	0.111
175	BM10	0.005	0.004	0.004	0.015	0.008	0.005	0.012	0.031	0.008	0.010
199	BM11	0.001	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.002
473	S4	0.082	0.110	0.089	0.206	0.138	0.139	0.152	0.143	0.102	0.129
118	S1	0.180	0.205	0.165	0.165	0.192	0.148	0.213	0.186	0.180	0.182
84	S2	0.153	0.182	0.149	0.232	0.139		0.191	0.253	0.118	0.177
88	S5	0.016	0.017	0.015	0.016	0.018		0.017	0.020	0.012	0.016
90	S3	0.135	0.191	0.156	0.169	0.178	0.167	0.180	0.225	0.138	0.171
146	CM1	0.184	0.237	0.180	0.289	0.348	0.421	0.556	0.461	0.417	0.344
152	CM2	0.452	0.487	0.347	0.662	0.599	0.487	0.594	0.720	0.670	0.558
89	CM3	0.168	0.144	0.099	0.293	0.244	0.220	0.195	0.307	0.253	0.214
97	CM4	0.292	0.332	0.220	0.264	0.275	0.371	0.476	0.607	0.462	0.366
91	CM5	0.020	0.019	0.012	0.061	0.062	0.015	0.019	0.034	0.036	0.031
	Min	0.0005	0.0004	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
	Max	1.851	2.815	2.476	2.155	2.557	1.383	2.890	3.029	2.719	2.431
	Mean	0.128	0.181	0.151	0.204	0.181	0.122	0.214	0.233	0.187	0.178
	Median	0.055	0.065	0.074	0.101	0.071	0.049	0.100	0.105	0.082	0.077

¹ Water yields were not available in 2011, therefore, the mean value from 2002 to 2010 was used for each lake.

G.2 TEST OF THE ASSUMPTION THAT CURRENT BASE CATIONS ARE SIMILAR TO HISTORIC BASE CATIONS IN THE RAMP LAKES

During the process of acidification of a catchment, base cations are released from the soils to lake waters. In applying the Henriksen model, it was assumed that base cations have not increased in the RAMP lakes as a result of acidic deposition; that is, the current base cation concentrations (BC_T) are equivalent to the original base cation concentrations (BC_0).

The discrepancy between the original and the current base cation concentrations in a lake is normally calculated using an equation from Braake *et al.* (1990) based on increases in concentrations of sulphur in a lake resulting from aerial deposition. The study by Henriksen *et al.* (2002) on lakes in Ontario gives an example on the use of this equation. To test the assumption that the base cations have not changed significantly in the RAMP lakes, BC_0 was calculated for each lake using the equation in Braake *et al.* (1990). A value of S (one of the terms in the equation) equal to 400 $\mu\text{eq/L}$ and an original sulphate concentration of 1.67 $\mu\text{eq/L}$ (corresponding to the 5th percentile of sulphate concentrations) were used in the calculations. As in the Henriksen *et al.* (2002) study, an F value of 1 was applied when the base cation concentrations were greater than 400 $\mu\text{eq/L}$. Table G.2-1 showed that the discrepancy between BC_0 and BC_T over the 50 lakes was small although greater than observed in 2010. The mean discrepancy between the calculated original base cation concentration and measured base cation concentration was 8.3%. The largest discrepancies were found in four lakes located in the Birch Mountain subregion (lakes 454, 455, 457, 464). When these four lakes were eliminated, the mean discrepancy between the two estimates was 5.7%. The four lakes in the Birch Mountain subregion were relatively high in sulphate. The high sulphate levels in these lakes are likely natural in origin rather than from acid deposition given that the Birch Mountain subregion is remote from major sources of acidic emission. The assumption of using the current base cation concentrations for the original base cation concentrations appears to be valid. The assumption is further supported by a recent study by Whitfield *et al.* (2010) in which the Magic Model was applied to soils in the oil sands region. This study concluded that, to date, sulphate deposition levels in the oil sands region have resulted in only a limited removal of base cations from the soil.

Table G.2-1 Comparison of the calculated BC₀ to the current BC_T in the RAMP lakes.

Lake	AEW Name	S	SO ₄ mg/L	SO ₄ (µeq/L)	F	BC _T µeq/L	BC ₀ (µeq/L)	% Difference
168	SM 10	400	1.03	21.5	0.520	139	129	7.4
169	SM9	400	0.71	14.8	0.239	61	58	5.1
170	SM 6	400	1.19	24.8	0.520	139	127	8.6
167	SM5	400	0.46	9.6	0.536	144	140	2.9
166	SM 7	400	1.35	28.1	0.904	287	263	8.3
287	SM 8	400	1.25	26.0	0.399	104	95	9.3
289	SM3	400	0.65	13.5	0.608	166	159	4.3
290	SM4	400	0.56	11.7	0.674	188	182	3.6
342	SM 2	400	0.02	0.4	0.925	301	302	-0.4
354	SM 1	400	0.08	1.7	1	447	447	0.0
165	WF 1	400	0.10	2.1	1	662	662	0.1
171	WF 2	400	1.30	27.1	0.992447	369	343	6.8
172	WF 3	400	2.64	55.0	0.942	313	263	16.1
223	WF4	400	15.05	313.5	1	1404	1092	22.2
225	WF5	400	3.30	68.8	1	1586	1519	4.2
226	WF6	400	0.28	5.8	1	585	581	0.7
227	WF7	400	0.08	1.7	1	1151	1151	0.0
267	WF8	400	0.38	7.9	1	1073	1066	0.6
452	NE1	400	1.29	26.9	0.954	323	299	7.5
470	NE2	400	1.13	23.5	1.000	416	394	5.3
471	NE3	400	1.29	26.9	1	594	569	4.2
400	NE4	400	1.35	28.1	1.000	398	371	6.6
268	NE5	400	0.16	3.3	1	748	746	0.2
182	NE6	400	0.06	1.3	1	1481	1481	0.0
185	NE7	400	1.10	22.9	0.918	296	277	6.6
209	NE8	400	0.30	6.3	0.966	334	329	1.3
270	NE9	400	0.27	5.6	1	1654	1650	0.2
271	NE10	400	0.13	2.7	1	1489	1488	0.1
418	NE11	400	2.39	49.8	1	2305	2256	2.1
436	BM 2	400	7.98	166.3	1	708	543	23.2
442	BM 9	400	1.10	22.9	0.649	180	166	7.7
444	BM 1	400	3.11	64.8	0.954	323	262	18.7
447	BM 6	400	1.17	24.4	0.807	239	221	7.7
448	BM 7	400	0.10	2.1	0.634	175	175	0.1
454	BM 8	400	9.63	200.6	1	588	389	33.8
455	BM 4	400	10.75	224.0	1	746	524	29.8
457	BM 5	400	14.68	305.8	1	518	214	58.7
464	BM 3	400	8.90	185.4	1	672	488	27.3
175	BM10	400	2.23	46.5	1	1421	1376	3.2
199	BM11	400	1.18	24.6	0.944	314	293	6.9
473	S4	400	1.61	33.5	1	670	638	4.8
118	S1	400	1.06	22.1	1	665	644	3.1
84	S2	400	0.66	13.8	1	693	681	1.7
88	S5	400	0.66	13.8	1	465	453	2.6
90	S3	400	0.54	11.3	1	509	499	1.9
146	CM1	400	4.28	89.2	1	865	778	10.1
152	CM2	400	1.29	26.9	0.997	379	354	6.6
89	CM3	400	3.24	67.5	1.000	446	380	14.8
97	CM4	400	1.54	32.1	1.000	416	385	7.3
91	CM5	400	1.49	31.0	0.938	310	283	8.9

BC_T : current base cation concentration; BC₀: original base cation concentration.

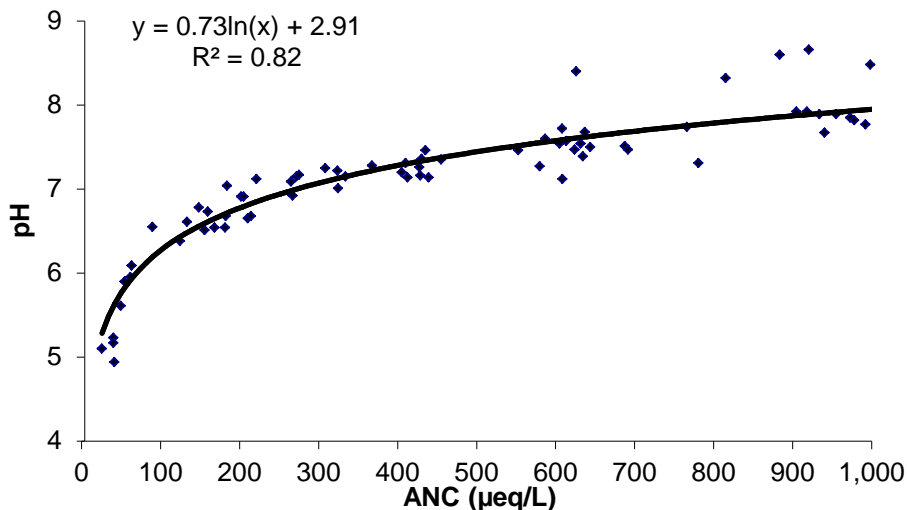
G.3 ORIGIN OF THE USE OF $ANC_{LIM} = 75 \mu EQ/L$ IN THE CRITICAL LOAD CALCULATIONS

The limiting critical load (ANC_{lim}) of $75 \mu eq/L$ used in calculating the critical loads was derived in a study by WRS (2001) using regional data from 180 lakes and relates to Environment Canada's assumption that a $pH > 6$ is required to maintain a healthy aquatic ecosystem.

The critical load concept assumes a dose-response relationship between a water quality variable and an aquatic indicator organism. In this case, the water quality variable is the acid neutralizing capacity (alkalinity) required to maintain a healthy fish population. In applying the Henriksen model in Europe, a critical threshold ANC (ANC_{lim}) was set to protect brown trout, the most common European salmonid and ensure that no toxic acidic episodes occur to this species during the year. The ANC_{lim} was derived from a survey of water chemistry data, critical load exceedances and fish population status in 1000 lakes in Norway in 1986 (Henriksen *et al.* 1988, Lien *et al.* 1992). A value of $20 \mu eq/L$ seemed to be the most appropriate for evaluating critical loads in Norway and this value has been adapted by most of the Scandinavian countries (Henriksen *et al.* 1992).

In North America, the effects of acidification on fish have been historically related to pH rather than ANC. Research on pH tolerance of a wide range of aquatic organisms has shown that a $pH > 6$ is required to maintain aquatic ecosystem function and protect both fish and other organisms (RMCC 1990, Environment Canada 1997, Jeffries and Lam 1993). Within a given region, lake pH has been empirically and theoretically related to ANC (alkalinity) as an inverse hyperbolic sine function (Small and Sutton 1986) and this relationship has been used to equate the two variables for the purpose of critical load modelling (e.g., Jeffries and Lam 1993). A similar approach was taken in the WRS study to estimate ANC_{lim} (WRS 2001). The relationship between pH and alkalinity was derived for 180 lakes surveyed by ALPAC in 1998 (Figure G.3-1). For simplicity, a logarithmic function was fitted to the data. Interpolation indicated that over the given population of lakes, a pH of 6.0 was associated with an alkalinity of $\sim 75 \mu eq/L$. This value was therefore chosen for ANC_{lim} .

Figure G.3-1 Lake pH vs. alkalinity for 180 regional lakes.



G.4 COMPARISON OF RAMP LAKE CHEMISTRY IN 2011 TO REGIONAL LAKES

In order to determine how representative the RAMP lakes are of regional lake chemistry, water chemistry in 2011 in the RAMP lakes was compared to a database of 450 lakes within the oil sands region reported by the NO_xSO_x Management Working Group (NSMWG). The two populations are compared statistically in Table G.4-1 and selected variables are presented graphically in box plots (Figure G.4-1). Key results are as follows:

- The RAMP lakes covered a slightly narrower pH range (4.40 to 9.42), with a lower median value (6.80 vs. 6.93). The median pH of the RAMP lakes was significantly less than that of the NSMWG regional database ($p < 0.05$);
- Total alkalinity in the RAMP lakes ranged from 0 µeq/L to 1,894 µeq/L with a median of 258 µeq/L, which was much lower than the regional median of 1,020 µeq/L. The median total alkalinity across the RAMP lakes in 2011 was significantly lower than that in the NSMWG database ($p < 0.05$);
- Conductivity was relatively low in the RAMP lakes, ranging from 11 µS/cm to 183 µS/cm (median: 36 µS/cm). The median for conductivity in the regional database was 125 µS/cm. The median conductivity of the RAMP lakes in 2011 was significantly lower than that of the regional lakes ($p < 0.05$);
- Consistent with the lower conductivity in the RAMP lakes, the mean and median concentrations of the principal cations (calcium, magnesium, sodium and potassium) and the sum of base cations (SBC) were all less than the values in the NSMWG database. Median SBC in the RAMP lakes in 2011 was 446.8 µeq/L compared to 1,247 µeq/L in the regional lakes. The median values of these variables were all significantly less in the RAMP lakes ($p < 0.05$);
- The mean and median concentrations of the major anions (chloride, sulphate and titration bicarbonate) were all less than those in the regional database;
- Total phosphorus was quite variable in the RAMP and regional lake database with individual lakes attaining concentrations that would classify them as eutrophic or hypereutrophic (Wetzel 2001). The highest concentration of phosphorus observed in the RAMP lakes in 2011 was 208 µg/L in Lake 457/BM 5 in the Birch Mountains subregion. The highest concentration of phosphorus in the regional lake database was 495 µg/L. The median concentration of phosphorus in the RAMP lakes was 41.0 µg/L compared to 49.0 µg/L in the regional lakes database. There was no significant difference in the median concentration of total phosphorus between the RAMP lakes in 2011 and the regional lakes; and
- Concentrations of nitrate in the RAMP lakes were generally low (median: 8.14 µg/L), although several lakes had values two orders of magnitude greater than the median (e.g., 223 µg/L in Lake 457/BM 5 in the Birch Mountains). Concentrations of nitrate in the regional lakes database were similarly variable with a median of only 2 µg/L, with some lakes having concentrations as high as 1,860 µg/L. Unlike previous years, the median concentration of nitrate was significantly greater in the RAMP lakes than in the regional lake database ($p < 0.05$).

The chemical differences between the RAMP lakes and the regional lakes reflect the bias in the selection process for lakes in the RAMP ASL component. In the initial stages of the program, The RAMP lakes were selected for their acid-sensitivity which, in practice, meant selecting lakes with the lowest pH, alkalinity and conductivity. These types of lakes are often the smallest lakes and are often located in the upland regions where catchments are dominated by fens and organic soils.

Table G.4-1 Comparison between RAMP lakes in 2011 and 450 regional lakes in the NSMWG database.

Variable	Units	RAMP Lakes (2011)				Regional Lakes				
		Min	Max	Median	Mean	No.	Min	Max	Median	Mean
Lake Area	km ²	0.031	43.4	1.30	2.86	431	0.01	214	1.60	6.26
Catchment Area	km ²	0.700	224	15.3	28.1	432	0.08	1769	17.4	89.3
Drainage Ratio		0.220	88.6	10.1	15.7	431	1.43	1178	13.0	26.2
Runoff	m ³ /s	0.00	8.57	0.04	0.300	432	0.00	5.00	0.00	0.258
Lab pH		4.40	9.42	6.93	6.82	432	4.20	10.0	7.70	7.66
Total Alkalinity	µeq/L	0	1894	258	394	432	0.00	4797	1020	1241
Specific Conductivity	µS/cm	11	183	36	49	399	11.0	481	125	144
Dissolved Organic Carbon	mg/L	7.5	49.2	22.7	23.3	383	0.2	60.0	19.4	20.4
Sodium	mg/L	0.44	12.34	1.54	2.20	432	0.28	49.0	2.00	4.07
Potassium	mg/L	0.110	2.130	0.475	0.570	432	0.05	14.0	0.620	0.943
Calcium	mg/L	0.005	21.8	6.47	6.47	432	0.25	64.0	14.3	17.0
Magnesium	mg/L	0.005	8.030	1.610	2.141	432	0.05	28.0	4.3	5.34
Sum of Base Cations	µeq/L	61.4	2305	446.8	609	432	46.0	5770	1247	1487
Chloride	mg/L	0.015	2.50	0.140	0.312	429	0.01	18.0	0.490	1.09
Sulphate	mg/L	0.020	15.1	1.18	2.34	431	0.025	99.0	2.50	6.73
Nitrate + Nitrite	µg/L	1.00	223.0	8.14	22.1	445	0.02	1860	2.00	21.0
Ammonia	µg/L	2.5	487.0	26.5	44.4	320	0.22	650	11.4	31.8
Total Nitrogen	µg/L	366	5960	960	1299	292	183	1904	861	869
Total Phosphorus	µg/L	9.0	208	41.0	60.9	426	3.00	495	49.0	66.6

Note: Shading denotes significantly different median concentrations using a non-parametric Wilcoxon rank test ($p < 0.05$).

Figure G.4-1 Box-plots of selected chemical variables for the RAMP lakes in 2011 versus 432 regional lakes reported by the NSMWG (WRS 2004).

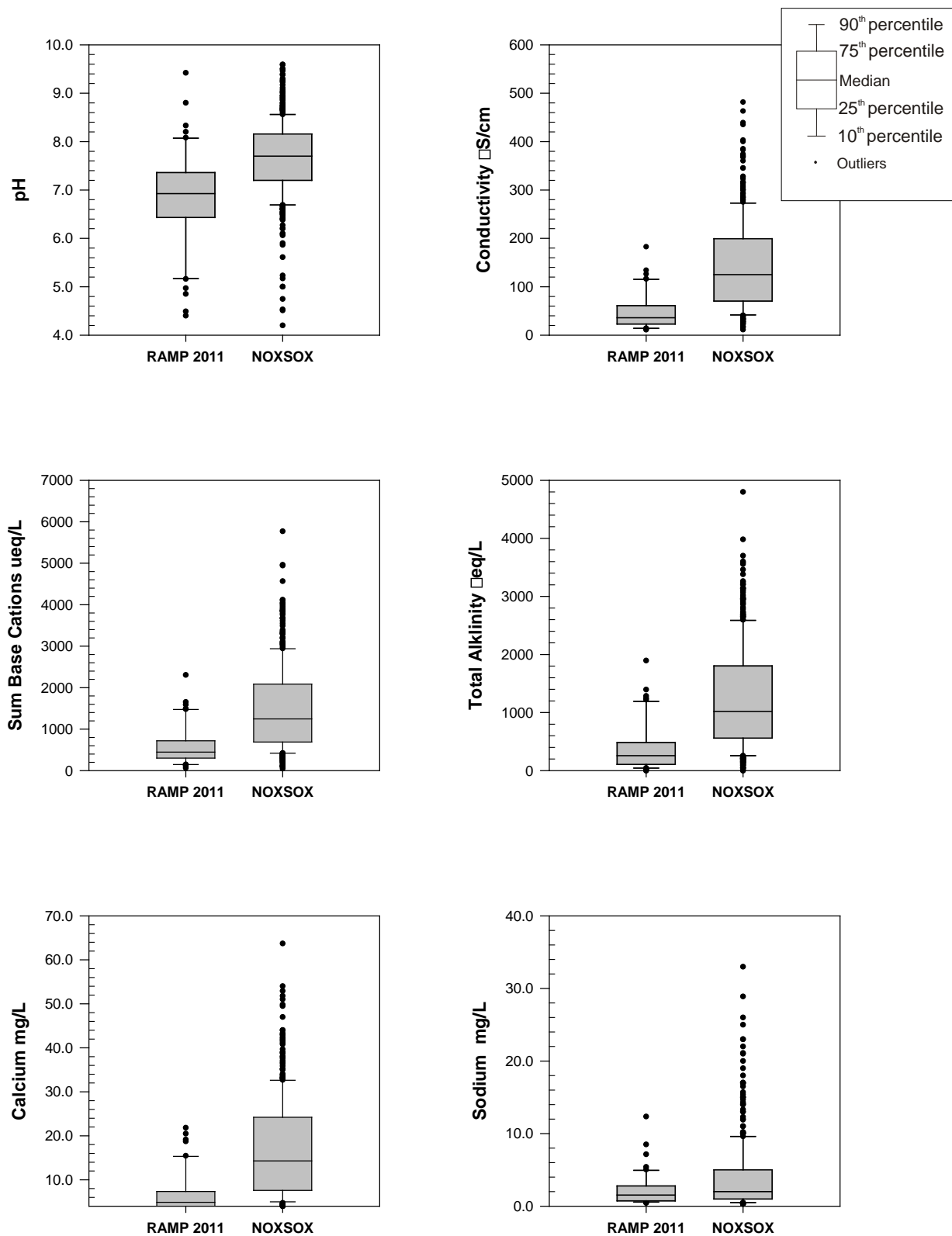
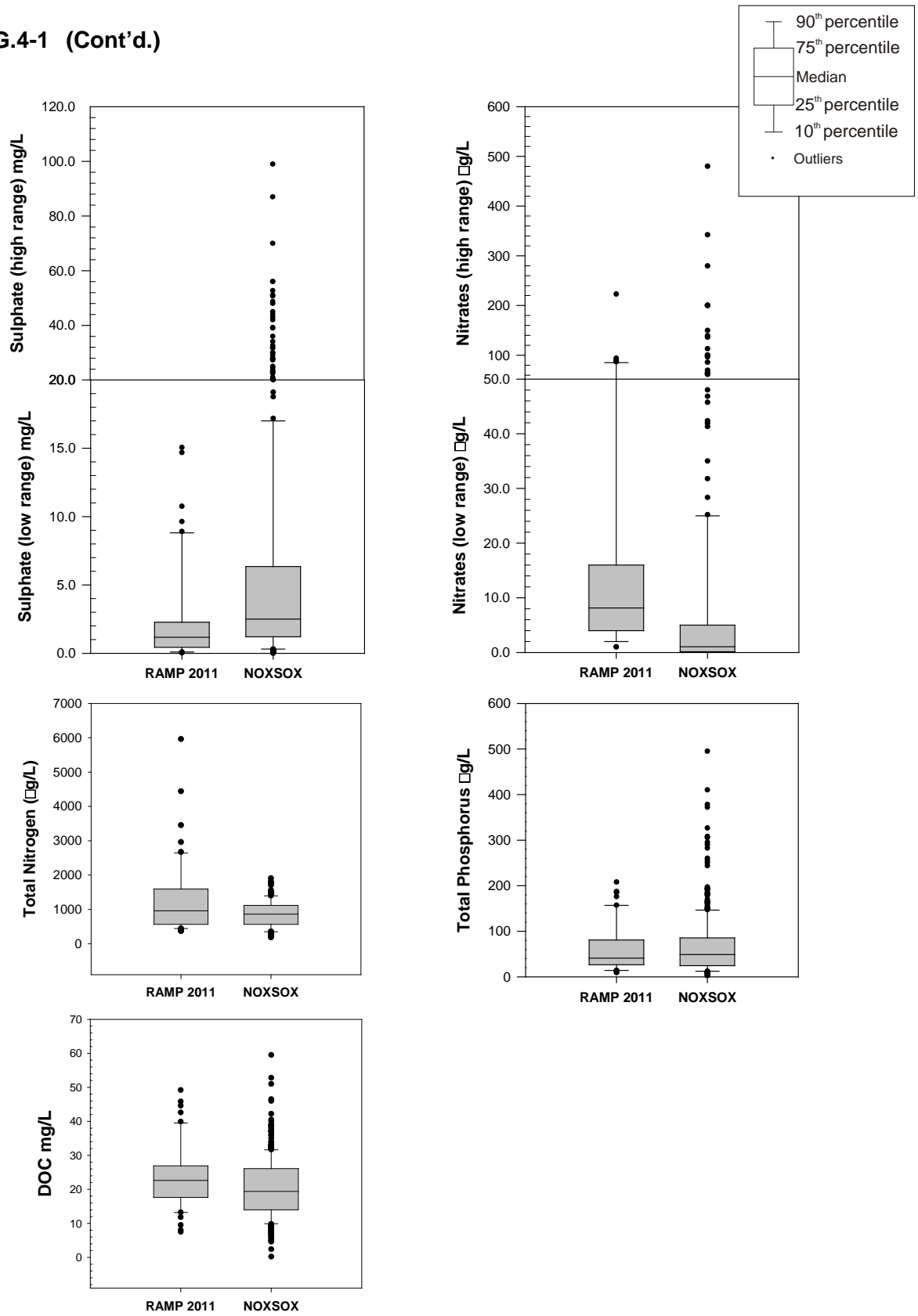


Figure G.4-1 (Cont'd.)



G.5 CHARACTERIZATION OF ION CHEMISTRY IN THE RAMP LAKES

In order to characterize water in RAMP lakes, the major anions and cations were displayed in Piper plots (Figure G.5-1). A Piper diagram is a multivariate graphical technique that is used to divide the lakes into four water types on the basis of major cation constituents (Guler *et al.* 2002, Freeze and Cherry 1979, Back and Hanshaw 1965):

- Type I Ca²⁺ - Mg²⁺ - HCO₃⁻;
- Type II Na⁺ - K⁺ - HCO₃⁻;
- Type III Na⁺ - K⁺ - Cl⁻ - SO₄²⁻; and
- Type IV Ca²⁺ - Mg²⁺ - Cl⁻ - SO₄²⁻.

In 2011, the Piper diagrams showed that the majority of the lakes were of the Ca-Mg-Bicarbonate type (Type I). In 2011, eight lakes had greater than 40% of the anion charge attributable to sulphate and chloride rather than bicarbonate and carbonate and tended towards the Type IV water type (Table G.5-1). Most of these lakes are found in the Birch Mountains and Stony Mountains subregions and are small (in both area and volume), low in Gran alkalinity (poorly buffered), pH, conductivity and relatively high in DOC. Three lakes, located in the Birch Mountains, Canadian Shield and Northeast of Fort McMurray subregions, in 2011 had over 40% of the cationic charge attributable to sodium and potassium (Table G.5-2).

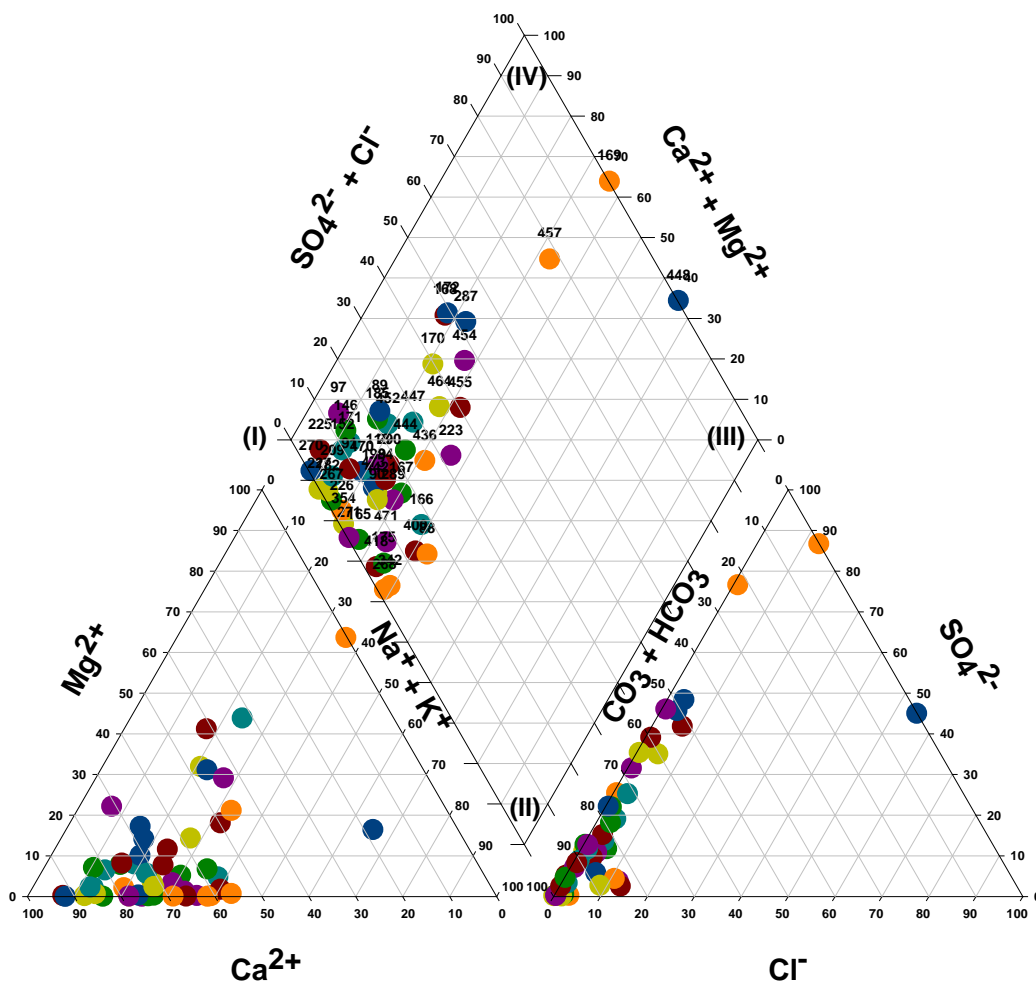
Table G.5-1 Key chemical characteristics of RAMP lakes having greater than 40% of anion charge attributable to sulphate and chloride.

Lake	AEW Name	pH	Gran Alkalinity (µeq/L)	Conductivity (µS/cm)	DOC (mg/L)	Lake Area (km ²)
Stony Mountains Subregion						
168	SM 10	4.85	-3.80	14.85	22.9	1.38
169	SM 9	4.49	-22.80	15.85	23.1	1.45
287	SM 8	4.97	-2.20	11.65	16.2	2.18
West of Fort McMurray Subregion						
172	WF 3	5.16	35.00	27.50	36.0	2.06
Birch Mountains Subregion						
448	BM 7	4.40	-34.00	13.72	27.0	0.65
454	BM 8	6.85	200.20	50.90	23.8	1.20
455	BM 4	6.78	319.00	65.50	23.0	4.37
457	BM 5	6.06	63.60	52.60	20.8	2.61

Table G.5-2 Key chemical characteristics of RAMP lakes having greater than 40% of cation charge attributable to sodium and potassium.

Lake	AEW Name	pH	Gran Alkalinity (µeq/L)	Conductivity (µS/cm)	DOC (mg/L)	Lake Area (km ²)
Northeast of Fort McMurray Subregion						
400	NE 4	6.85	240.00	30.00	14.6	1.12
Birch Mountains Subregion						
448	BM 7	4.40	-34.00	13.72	27.0	0.65
Canadian Shield Subregion						
88	S 5	6.83	256.00	36.30	26.2	0.70

Figure G.5-1 Piper plots showing the proportion of major cations and anions in the RAMP lakes, 2011.



G.6 ANALYSIS OF METALS IN THE RAMP LAKES

Elevated metals concentrations, in particular aluminum, have served as important indicators of lake acidification. Concentrations of metals in the RAMP lakes for the past 10 years are in the RAMP database and summarized in Table G.6-1 and Table G.6-2 for the total and dissolved fractions, respectively. Table G.6-3 presents the mean concentration of each trace metal for the lakes in each subregion.

In general, concentrations of trace metals were quite low and many were less than the detection limit. Table G.6-3 shows that the highest concentrations of trace metals were found in the upland regions, particularly in the Birch Mountains and the Stony Mountains subregions. In the Birch Mountains, 60 individual metals in 11 lakes had mean concentrations greater than the 95th percentile for all lakes (Table G.6-3). The regional distribution of dissolved aluminum, iron and cobalt in the RAMP lakes clearly showed the higher concentrations of trace metals in these upland regions (Figure G.6-1 to Figure G.6-3). The lakes with the highest concentrations of metals included those identified in the Piper plots as having more than 40% of the anionic charge attributable to chloride and sulphate rather than bicarbonates (Figure G.5-1, Table G.5-1).

The reasons for the higher concentrations of metals in the upland regions are unclear but may be related to the relatively low mean pH in these lakes (Table G.6-4). The high concentrations of chlorides/sulphates, as well as high concentrations of barium in the Birch Mountain lakes, also suggested a potential groundwater source for these metals. The relatively high concentrations of metals in these lakes are natural in origin rather than the result of emissions from regional industry.

The number of exceedances of CCME surface water quality guidelines for the protection of aquatic life in 2011 and the associated lakes are provided in Table G.6-5. Exceedances were observed for aluminum, iron and cadmium, copper and lead. The guideline exceedances were scattered throughout the various subregions, with a large number from lakes in the Birch Mountains subregion, which was consistent with the high concentrations of metals found in this subregion. Concentrations of cadmium exceeded the water quality guideline in ten lakes. As the CCME guideline for cadmium (0.018 µg/L; hardness of 50 mg/L) is extremely low, exceedances of this metal occur occasionally in surface waters in the Athabasca oil sands region. The exceedances in Table G.6-5 were considered to be natural occurrences.

Table G.6-1 Statistical summary of total trace metals in the RAMP lakes, 2011 to 2011.

Metal (µg/L)	All Years (2001-2011)						2011					
	Maximum	Minimum	Mean	Median	95 th %tile	N	Maximum	Minimum	Mean	Median	95 th %tile	% Non-Detects
Ag	0.103	0.00025	0.00604	0.0025	0.0223	469	0.103	0.00025	0.0169	0.0092	0.0619	4
Al	8694	0.25	200.3	63.5	726	469	2880	5	189	48.15	812	0
As	2.9	0.13	0.508	0.394	1.25	469	1.93	1.93	0.511	0.374	1.449	0
Ba	83.2	1.24	14.7	11.8	34.6	469	61.8	3.82	15.2	12.0	32.8	0
Be	55.7	0.0015	1.29	0.013	9.36	469	0.151	0.0015	0.0171	0.0103	0.0536	26
Bi	0.359	0.0005	0.00704	0.0032	0.021	469	0.033	0.0005	0.006484	0.00495	0.0139	14
B	62	0.0005	10.8	7.4	28.3	469	48.7	2.87	11.873	8.3	29.765	0
Cd	9.94	0.001	0.0409	0.01	0.0629	469	0.112	0.001	0.0122	0.0069	0.0365	12
Co	2.2	0.0005	0.165	0.0877	0.525	469	1.08	0.0122	0.165	0.0965	0.495	0
Cr	7.3	0.015	0.405	0.242	1.38	469	3.66	0.0453	0.368	0.212	1.23	0
Cu	16.7	0.025	0.634	0.322	1.9	469	2.68	0.0837	0.494	0.332	1.39	0
Fe	6528	2.37	617	365	2225	469	3060	17.3	612	282	2682	0
Hg	0.074	0.005	0.00692	0.005	0.0133	118						
Li	16.9	0.01	2.59	1.77	8.14	469	12	0.01	2.97	2.24	8.93	14
Mn	260	3.24	42.7	30.1	119	469	163	5	46.3	32.5	120	0
Mo	1.1	0.0019	0.121	0.0866	0.37	469	0.521	0.0046	0.117	0.0794	0.397	0
Ni	46	0.0025	0.757	0.32	3.29	469	5.31	0.0025	0.610	0.273	2.36	4
Pb	95.3	0.0079	0.43	0.13	0.712	469	1.21	0.0098	0.151	0.0879	0.541	0
Sb	0.2	0.002	0.0294	0.02	0.0898	469	0.181	0.0075	0.0304	0.0209	0.0735	0
Se	0.9	0.02	0.123	0.05	0.25	469	0.32	0.05	0.0792	0.05	0.172	72
Sn	3.02	0.015	0.101	0.015	0.217	469	0.0557	0.015	0.0170	0.015	0.0258	94
Sr	109	2.61	23.7	19.2	57.28	469	82.8	3.42	25.201	20.7	57.055	0
Th	0.72	0.00015	0.0346	0.0114	0.137	469	0.479	0.00015	0.048	0.02005	0.192	18
Ti	79	0.1	3.13	1.1	13.7	469	48.7	0.182	3.10	1.01	14.8	0
Tl	0.077	0.00015	0.00389	0.0021	0.0133	469	0.0463	0.00015	0.00402	0.0021	0.0136	4
U	0.432	0.0004	0.0426	0.0141	0.18	469	0.384	0.0011	0.0417	0.011	0.137	0
V	15.5	0.0025	0.784	0.371	3.11	469	10.3	0.0701	0.804	0.375	3.11	0
Zn	34.4	0.131	3.67	2.88	9.05	469	14.6	0.181	2.43	1.41	6.74	0

For the purposes of calculating statistics, non-detectable metal concentrations were assumed to be one-half of the detection limit reported by the laboratory. Shaded values are non-detectable with the value in each cell equivalent to one-half of the detection limit.

Table G.6-2 Statistical summary of dissolved trace metals in the RAMP lakes, 2003 to 2011.

Metal (µg/L)	2003-2011						2011					
	Maximum	Minimum	Mean	Median	95 th %tile	N	Maximum	Minimum	Mean	Median	95 th %tile	% Non-Detects
Ag	0.102	0.00025	0.00285	0.000375	0.01	366	0.102	0.00025	0.0123	0.00535	0.0592	8
Al	734	0.1	71.4	25.5	331.5	366	734	1.36	75.2	19.8	317	0
As	2	0.08	0.432	0.331	1.038	366	1.6	0.105	0.416	0.315	1.06	0
Ba	35.8	0.982	11.3	9.6	25	366	35.8	2.92	11.5	9.63	24.4	0
Be	0.3	0.0015	0.0152	0.0071	0.0558	366	0.0674	0.0015	0.00948	0.0041	0.0287	42
Bi	0.1	0.0005	0.0045	0.0025	0.014	366	0.0326	0.0005	0.00480	0.00305	0.0138	24
B	62.3	1.8	10.8	7.11	26.45	366	48.5	2.55	10.5	6.75	25.6	0
Cd	5.82	0.001	0.0282	0.00575	0.04	366	0.0778	0.001	0.0083	0.00355	0.0299	36
Co	1.27	0.0005	0.11	0.042	0.414	366	0.495	0.0035	0.098	0.0418	0.418	0
Cr	1.88	0.02	0.233	0.17	0.663	366	1.13	0.0448	0.239	0.164	0.638	0
Cu	2.13	0.005	0.427	0.276	1.35	366	2	0.0828	0.474	0.328	1.35	0
Fe	3130	0.01	368	115.5	1598	366	2340	3.71	361	108.5	1528	0
Li	16.4	0.01	2.4	1.58	7.53	322	11.9	0.01	2.61	1.835	7.81	16
Mn	248	0.07	17.3	3.38	64.8	366	105	0.139	15.1	4.51	59.7	0
Mo	1.43	0.0005	0.102	0.07	0.324	366	0.498	0.0005	0.0879	0.0601	0.267	4
Ni	3.79	0.0025	0.495	0.214	2.53	366	3.42	0.0025	0.449	0.187	1.93	10
Pb	16.3	0.0005	0.147	0.049	0.391	366	0.58	0.0097	0.108	0.0626	0.42	0
Sb	0.179	0.002	0.0284	0.0197	0.0838	366	0.179	0.0075	0.0301	0.0207	0.0727	0
Se	0.9	0.005	0.0944	0.05	0.25	366	0.222	0.05	0.0673	0.05	0.152	82
Sn	0.065	0.015	0.021	0.015	0.05	366	0.015	0.015	0.015	0.015	0.015	100
Sr	101	2.4	22.3	18	54.7	366	80.4	2.61	22.8	17.7	54.6	0
Th	0.438	0.00015	0.028	0.011	0.12	366	0.438	0.00015	0.04	0.01175	0.1578	20
Ti	14.5	0.02	1.24	0.466	6.12	366	14.5	0.02	1.25	0.326	6.6	4
Tl	0.043	0.00015	0.00285	0.0017	0.0083	366	0.0123	0.00015	0.00189	0.00135	0.00526	10
U	0.365	0.0002	0.03	0.00875	0.128	366	0.291	0.0004	0.0302	0.00835	0.12	0
V	3.34	0.011	0.389	0.211	1.55	366	3.25	0.0375	0.377	0.188	1.36	0
Zn	29.5	0.13	2.9	2.265	6.77	366	8.15	0.179	1.95	1.24	5.779	0

For the purposes of calculating statistics, non-detectable metal concentrations were assumed to be one-half of the detection limit reported by the laboratory. Shaded values are non-detectable with the value in each cell equivalent to one-half of the detection limit.

Table G.6-3 Mean concentrations of total and dissolved trace metals in the RAMP lakes in each subregion, 2001 to 2011.

Metal	Mean Concentrations µg/L - Dissolved Metals						Mean Concentrations µg/L - Total Metals					
	SM	WFM	NEFM	BM	CS	CM	SM	WFM	NEFM	BM	CS	CM
Ag	0.00141	0.005583	0.0048	0.00906	0.00511	0.0052	0.00513	0.005583	0.0048	0.00906	0.00511	0.0052
Al	79	47.5	63.5	468	38.3	147.9	261.3	47.5	63.5	468.4	38.3	147.9
As	0.331	0.397	0.412	0.865	0.198	0.592	0.393	0.397	0.412	0.865	0.198	0.592
Ba	7.86	14.0	12.9	22.8	7.22	17.7	10.1	14.0	12.9	22.8	7.22	17.7
B	6.44	1.66	1.46	1.86	0.712	0.646	0.813	1.66	1.46	1.86	0.712	0.646
Be	0.0156	0.00576	0.00747	0.00934	0.003	0.00602	0.00745	0.00576	0.00747	0.00934	0.003	0.00602
Bi	0.00517	12.9	10.7	17.1	6.38	5.81	6.81	12.9	10.7	17.1	6.38	5.81
Cd	0.0169	0.0198	0.1118	0.0269	0.00686	0.0185	0.0254	0.0198	0.1118	0.0269	0.00686	0.0185
Co	0.158	0.0845	0.0913	0.314	0.0385	0.123	0.217	0.0845	0.0913	0.314	0.0385	0.123
Cr	0.209	0.2052	0.277	0.797	0.249	0.366	0.338	0.2052	0.277	0.797	0.249	0.366
Cu	0.369	0.5191	0.512	0.89	0.372	0.898	0.55	0.5191	0.512	0.89	0.372	0.898
Fe	268	289	395	1256	335	742	442.9	289	395	1256	335.1	742
Hg		0.005	0.0066	0.005	0.005	0.0179	0.005	0.005	0.0066	0.005	0.005	0.0179
Li	0.818	2.89	2.1	5.31	1.31	1.69	0.874	2.89	2.1	5.31	1.31	1.69
Mn	26.9	67.25	42.2	46.8	25.2	17.5	42	67.25	42.2	46.8	25.2	17.5
Mo	0.096	0.062	0.0623	0.196	0.178	0.141	0.103	0.062	0.0623	0.196	0.178	0.141
Ni	0.331	0.260	0.215	1.65	0.147	0.786	0.968	0.260	0.215	1.65	0.147	0.786
Pb	0.104	0.158	1.1	0.384	0.173	0.207	0.214	0.158	1.1	0.384	0.173	0.207
Sb	0.0224	0.0209	0.0181	0.057	0.0117	0.0325	0.023	0.0209	0.0181	0.057	0.0117	0.0325
Se	0.0892	0.0969	0.107	0.165	0.125	0.112	0.116	0.0969	0.107	0.165	0.125	0.112
Sn	0.0196	0.0250	0.0591	0.138	0.166	0.187	0.0844	0.0250	0.0591	0.138	0.166	0.187
Sr	9.11	34.9	25.2	28.3	31.9	13.3	9.75	34.9	25.2	28.3	31.9	13.3
Th	0.0224	0.0107	0.0113	0.0859	0.0166	0.037	0.026	0.0107	0.0113	0.0859	0.0166	0.037
Ti	1.07	1.09	1.17	7.91	0.846	2.42	2.8	1.09	1.17	7.91	0.846	2.417
Tl	0.00422	0.00240	0.00171	0.00731	0.00238	0.00297	0.00466	0.00240	0.00171	0.00731	0.00238	0.00297
U	0.0123	0.00833	0.00825	0.065	0.136	0.0646	0.0215	0.00833	0.00825	0.065	0.136	0.0646
V	0.34	0.358	0.486	1.8	0.173	0.605	0.65	0.358	0.486	1.8	0.173	0.605
Zn	3.3	3.15	3.35	5.23	1.21	3.4	3.97	3.15	3.35	5.23	1.21	3.4

SM = Stony Mountains, WFM = west of Fort McMurray, NEFM = north east of Fort McMurray, BM = Birch Mountains, CS = Canadian Shield, CM = Caribou Mountains
 For purposes of calculating statistics, non-detectable metal concentrations were assumed to be one-half of the detection limit reported by the laboratory.

Figure G.6-1 Concentrations of dissolved aluminum in the RAMP lakes.

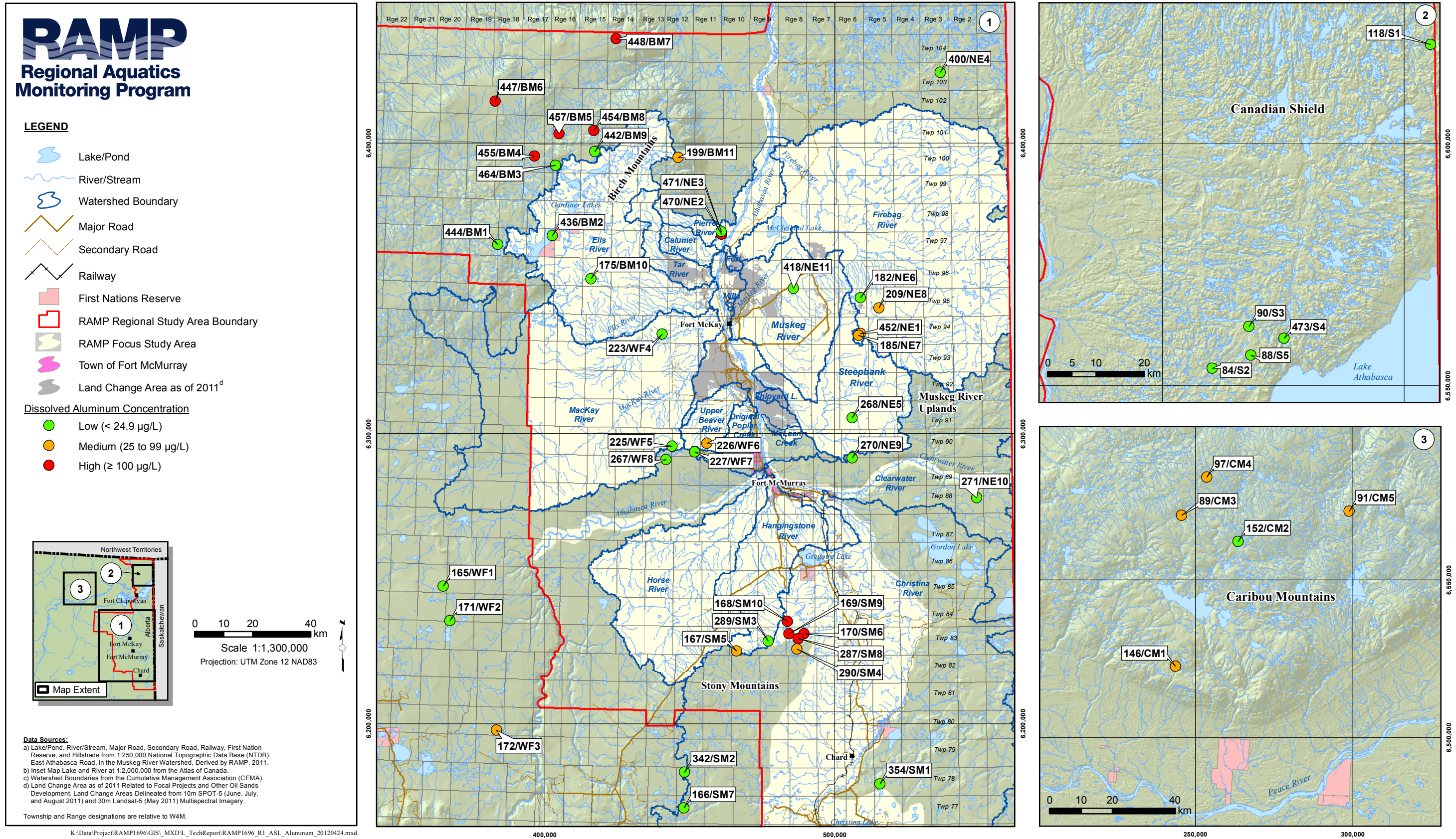


Figure G.6-2 Concentrations of dissolved iron in the RAMP lakes.

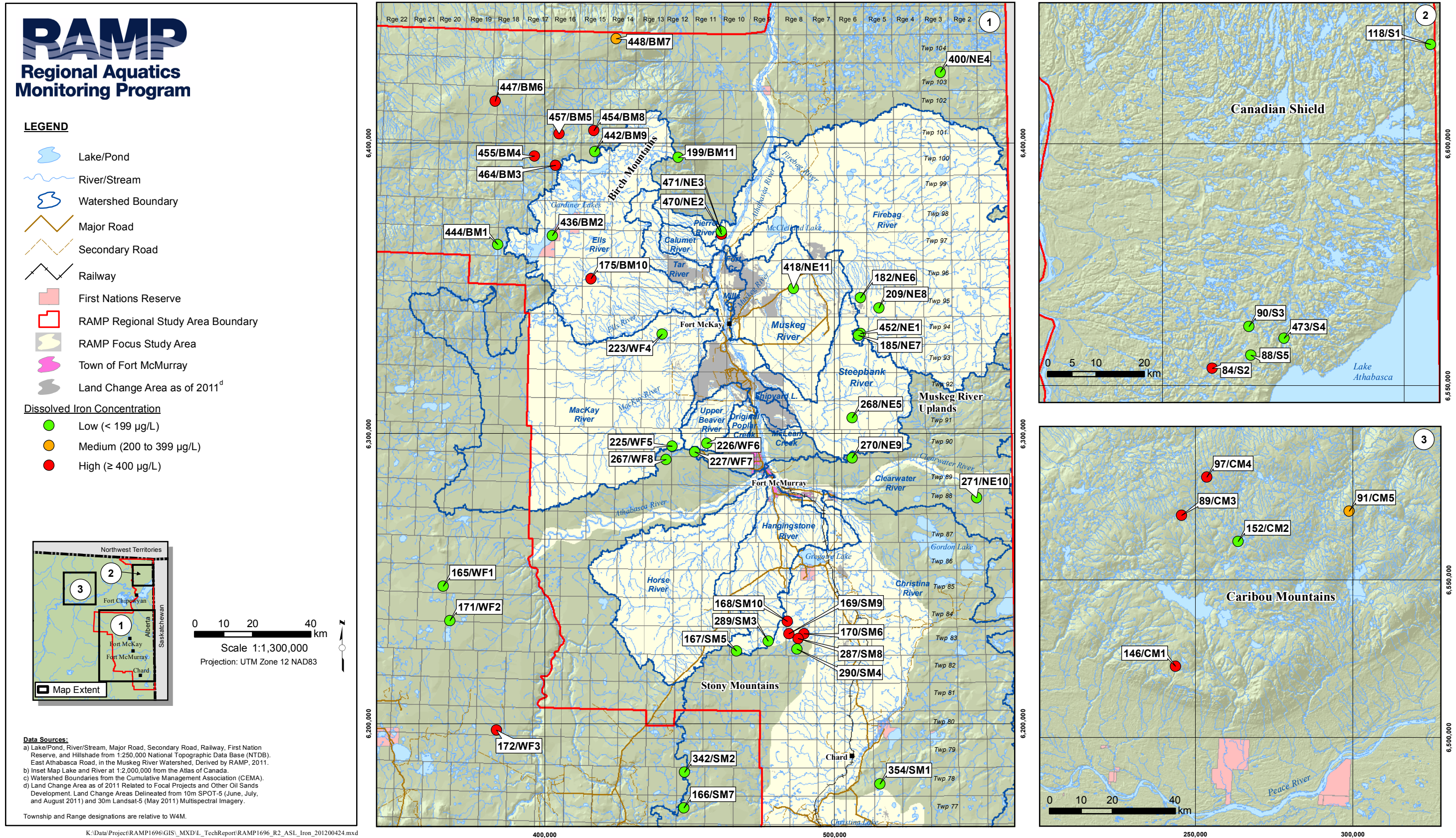


Figure G.6-3 Concentrations of dissolved cobalt in the RAMP lakes.

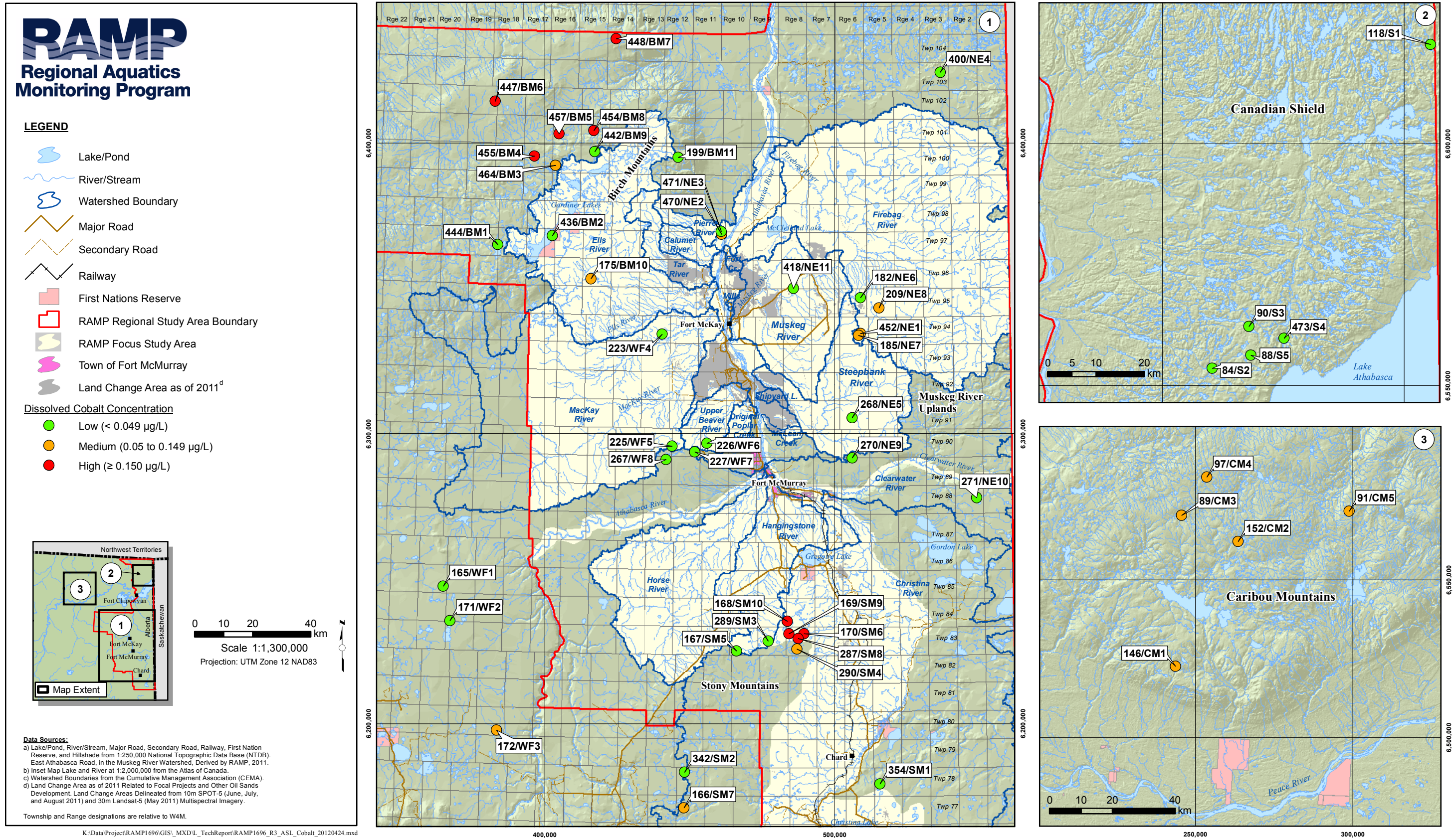


Table G.6-4 Number of lakes in each region having mean individual trace metal concentrations greater than the 95th percentile.

Sub-Region	No. of Lakes in Region	No. of Trace Metals Where Mean > 95th Percentile ¹	Ratio of No. of Trace Metals > 95th Percentile to No. of Lakes ²	Mean pH in Sub-Region (2011)
Stony Mountains	10	5	0.5	5.83
West of Fort McMurray	8	6	0.75	7.01
North-East of Fort McMurray	11	13	1.18	7.32
Birch Mountains	11	60	5.45	6.66
Canadian Shield	5	3	0.6	7.21
Caribou Mountains	5	5	1	7.36
Sum	50	92		41.39

¹ Mean metal concentration for each lake calculated across years.

² 95th percentile calculated for each metal over all lakes and years.

Table G.6-5 List of exceedances of CCME surface water quality guidelines for metals in 2011.

Metal	Number of Exceedances	Lakes with Exceedances
Al	15	88, 89, 91, 165, 168, 169, 170, 287, 289, 447, 448, 454, 455, 457, 470
Fe	24	84, 88, 89, 91, 97, 146, 152, 165, 168, 169, 170, 172, 175, 182, 199, 287, 400, 447, 448, 454, 455, 457, 464, 470
Cd	15	88, 89, 91, 97, 146, 152, 165, 171, 227, 267, 444, 454, 455, 464, 471
Cu	1	457
Pb	1	457