APPENDIX 9

Hatfield CONSULTANTS

MEMO

Date: March 12, 2015 HCP Ref No.: CZN6788

From: John Wilcockson

To: David Harpley – Canadian Zinc Corporation

Subject: **Prairie Creek Proposed All Season Road - Stream Crossing Habitat Assessments, August and September, 2014**

1.0 INTRODUCTION

In 2014 Hatfield participated in two field programs to assess habitat at and near potential stream crossings associated with a proposed all-season road from the Prairie Creek mine (Km 0) to the Nahanni Butte connector road (Km 175]. Between July 27 and 29, 2014, John Wilcockson (Hatfield) and David Harpley (Canadian Zinc) visited or assessed from the air several locations from Km 36 to Km 173 on the proposed all-season road. Mr. Johnathan Tsetso and Dr. Garry Scrimgeour accompanied John and Dave on July 27 and 28 in order to assess crossings within the Park. Results of these site visits were summarized in two technical memos produced by Hatfield in 2014[1,2].

Chris Jaeggle (Hatfield Consultants) and David Harpley (Canadian Zinc) returned to the proposed road crossings between September 21 and 26, 2014. Fish habitat data were collected during both field programs; hydrological data also were collected in September. Data were intended to be used to support the selection of appropriate stream crossing structures at crossing locations selected by Canadian Zinc and engineers from Allnorth Consultants (Prince George, BC).

A summary of sites assessed and the type of assessment done is provided in Table 1. Results of a bathymetric study conducted on the Liard River at the proposed Liard River crossing on September 25, 2014 were provided in a separate document[3].

1 Hatfield Consultants. 2014. Habitat Assessment of Sundog Creek Channels for Realignment - Draft, Memo written for Canadian Zinc Corp, September 9, 2014.

2 Hatfield Consultants. 2014. All Season Road – Review of Stream Crossings in NNPR - Draft, Memo written for Canadian Zinc Corp, September 4, 2014.

3 Hatfield Consultants. 2014. September 25, 2014 Liard River Bathymetry and Bank Survey - Draft, Memo written for Canadian Zinc Corp, January 16, 2015.

Table 1 Matrix of stream data collected for assessment of a proposed all-season road to Prairie Creek Mine, August and September 2014.

Location	Coordinates	Date	Assessment from air only	Site Visit	Habitat Sheet filled out	hydrometric data recorded	Discussed in memos to Parks
July/August Program							
Sundog Location 2	10 V 426324 6829305	27-Jul	-	X	X	-	X
Sundog Location 1	10 V 427040 6829338	27-Jul	-	X	X	-	X
KP43.5 Tributary to Sundog	10 V 431394 6830360	27-Jul	-	X	-	-	X
KP45-53 Small Tribs to Polje Ck	10 V 434623 6829284	28-Jul	X	-	-	-	X
Polje Creek	10 V 440688 6830794	28-Jul	-	X	X	-	X
Trib to Polje Ck	10 V 440509 6830759	28-Jul	-	X	X	-	X
KP55-63 Creeks draining to Poljes	--	28-Jul	X	-	-	-	X
Inlet to Mosquito Lake	10 V 446766 6825508	28-Jul	X	-	-	-	X
KP87.7 Tetcela River	10 V 461330 6815569	28-Jul	X	-	-	-	X
Fishtrap Creek	10 V 465062 6813912	28-Jul	-	X	-	-	X
Various tribs to Liard River			X	-	-	-	-
September Program							
KP27.1 Sundog Creek	10 6828332 418911	22-Sep		X	X	-	-
KP27.5 Sundog Creek	10 6828089 419225	22-Sep		X	X	-	-
KP28.4 Sundog Creek	--	22-Sep		X	X	X	-
KP29.2 Sundog Creek	10 V 420601 6827089	22-Sep		X	X	-	-
KP39.8 Sundog Creek	11 6830273 428369	21-Sep		X	X	X	-
KP47.0 Polje Trib	10 6829338 434240	21-Sep		X	X	X	-
KP50.2 Polje Trib	10 6829737 436944	21-Sep		X	X	X	-
KP54.3	10 V 440622 6830769	26-Sep		X	X	X	-
KP87.7 Tetcela mainstem	10 V 460241 6812386	24-Sep		X	X	X	-
Tetcela trib - at old road	10 V 460369 6813941	24-Sep		X	X	X	-
Tetcela main - at old road	10 V 461369 6815670	24-Sep		X	X	X	-
KP122.8 Granger Trib	10 V 477151 6798715	23-Sep		X	X	X	-
KP123.7 Granger Main	10 V 478319 6799043	23-Sep		X	X	X	-
KP125.1 Granger Main	10 V 479157 6799517	23-Sep		X	X	X	-
KP131.3 Granger Trib	10 V 481988 6794966	26-Sep		X	X	X	-
KP133.7 Granger Trib	10 V 482671 6793161	24-Sep		X	X	X	-
KP135.6 Granger Trib	10 V 482380 6791274	25-Sep		X	X	X	-
KP136.7 Granger Trib	10 V 483132 6790094	26-Sep		X	X	X	-
KP154.4 Liard Trib	10 V 486500 6774900	22-Sep		X	X	X	-

2.0 PROCEDURES

2.1 GENERAL

Sites were accessed primarily by helicopter. The exception was Sun Dog Creek sites between Km 27.1 and 28, which were accessed by quads on September 22, 2014.

At all sites, photographs (Attachment A), field data (Attachment B and C) and field notes (Attachment D) were collected.

2.2 HABITAT DATA

Habitat data was collected using a fish habitat data sheet modeled after the RISC fish habitat datasheets[4]. Data collected at each site included stream width, depth, velocity, stream morphology, presence of cover for fish, substrate composition, instream vegetation, riparian vegetation and in-situ water quality variables (i.e. dissolved oxygen, temperature, pH and conductivity). An annotated site sketch was also made at each location. Stream flow measurements were recorded using a March-McBirney Flo-Mate Model 2000 at 60% of measured water depth and at several locations across a single transect perpendicular to flow, water depth was measured using a wading rod. Stream width was measured using an Eslon tape. DO was measured using a Lamotte dissolved oxygen titration kit, while conductivity, pH and temperature were measured using an Hanna HI 98129 pH EC TDS conductivity pen.

2.3 HYDROLOGIAL DATA

Hydrological data were collected at each of the sites visited in September 2014. At the preferred crossing location, Hatfield staff conducted surveys of the channel cross-section (from bank top to bank top), longitudinal stream-reach surveys (for channel slope), and flow and depth data along a single stream cross-section.

Channel cross-section and longitudinal surveys were conducted using a level survey kit, consisting of an engineer's level mounted onto a tripod, and a stadia rod. After setting up and levelling the tripod and engineer's level near the top of the bank, several points along the cross-section, including top of bank, high water mark, water level surface, stream bed, and several points between the top of bank and water surface, were surveyed. The top of bank survey point was given an arbitrary datum of 100.000 m, which was used to calculate relative elevations of the other survey points. The channel bed was also surveyed at several points upstream and downstream of the crossing area (longitudinal survey). This survey used the same arbitrary datum as the cross-section survey. Horizontal distance between each survey point was measured using an Eslon tape or a laser rangefinder. Longitudinal survey data was used to calculate an average channel reach slope.

Flow measurements were performed using an Eslon tape, a 2.0-m top-setting wading rod, and a Sontek Flowtracker Acoustic Doppler Velocimeter (ADV). Measurements consisted of horizontal distance (perpendicular to the flow direction, measured with an Eslon tape), depth of water (measured with the

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[4] BC Fisheries Information Services Branc, 2001, Reconnaissance (1:20 000) fish and fish habitat inventory standards and procedures, prepared for Resources Inventory Committee, April 2001 Ver 2.0.

wading rod), and average water velocity (measured with the ADV, positioned at 60% of the measured water depth, for forty seconds) at all measured at several points (panels) along the channel cross-section. Flow measurements typically consisted of at least twenty measurement panels per cross-section; however, channel size and morphology (i.e., roughness) dictated the number of panels that could be measured at each cross-section. Using the area-velocity method, instantaneous streamflow was then calculated from the data collected (Attachment E and F).

3.0 DATA

All data are attached to this memo as attachments:

- Attachment A - photographs;
- Attachment B - fish habitat field datasheets;
- Attachment C - hydrology field datasheets;
- Attachment D - scanned field note book;
- Attachment E - Hydrometric station cross–section/reach survey field record; and
- Attachment F - hydrometric measurement/site visit record.

For additional information, please contact either Chris Jaeggle or John Wilcockson at (604) 926-3261.

ATTACHMENTS

Attachment A

Photographs

Photograph 1 **Sundog Creek at Km 27.1, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 2 **Sundog Creek at Km 27.1, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 3 **Sundog Creek at Km 27.1, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 4 **Sundog Creek at Km 27.1, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 5 **Sundog Creek at KP27.2 facing north (upstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 6 **Sundog Creek at KP27.4 facing north-northeast (cross-steam), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 7 **Sundog Creek at Km 27.5, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 8 **Sundog Creek at Km 27.5, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 9 **Sundog Creek at Km 27.5, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 10 **Sundog Creek at Km 27.5, Prairie Creek all season road stream crossing study, September 22, 2014.**

Photograph 11 Tributary to Sundog Creek at Km 27.5, Prairie Creek all season road stream crossing study, September 22, 2014.

Photograph 12 Sundog Creek at Km 28.4, Prairie Creek all season road stream crossing study, September 22, 2014.

Photograph 13 Sundog Creek at Km 28.4, Prairie Creek all season road stream crossing study, September 22, 2014.

Photograph 14 Sundog Creek at Km 28.4, Prairie Creek all season road stream crossing study, September 22, 2014.

Photograph 15 Sundog Creek at Km 28.4, Prairie Creek all season road stream crossing study, September 22, 2014.

Photograph 16 Sundog Creek at KP29 facing east-southeast (downstream), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 17 Sundog Creek at Km 29.2, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 18 Sundog Creek at Km 29.2, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 19 **Sundog Creek at Km 29.2, Prairie Creek all season road stream crossing study, September 23, 2014.**

Photograph 20 **Sundog Creek at KP30.5 facing east-southeast (downstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 21 **Sundog Creek at KP 30.5 facing north-northwest (upstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 22 **Sundog Creek at KP30.7 facing west-northwest (upstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 23 Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 24 Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 25 Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 26 Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 27 Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 28 Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 29 **Sundog Creek at Km 37.5, Prairie Creek all season road stream crossing study, July 27, 2014.**

Photograph 30 **Sundog Creek at KP37.8 facing east (downstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

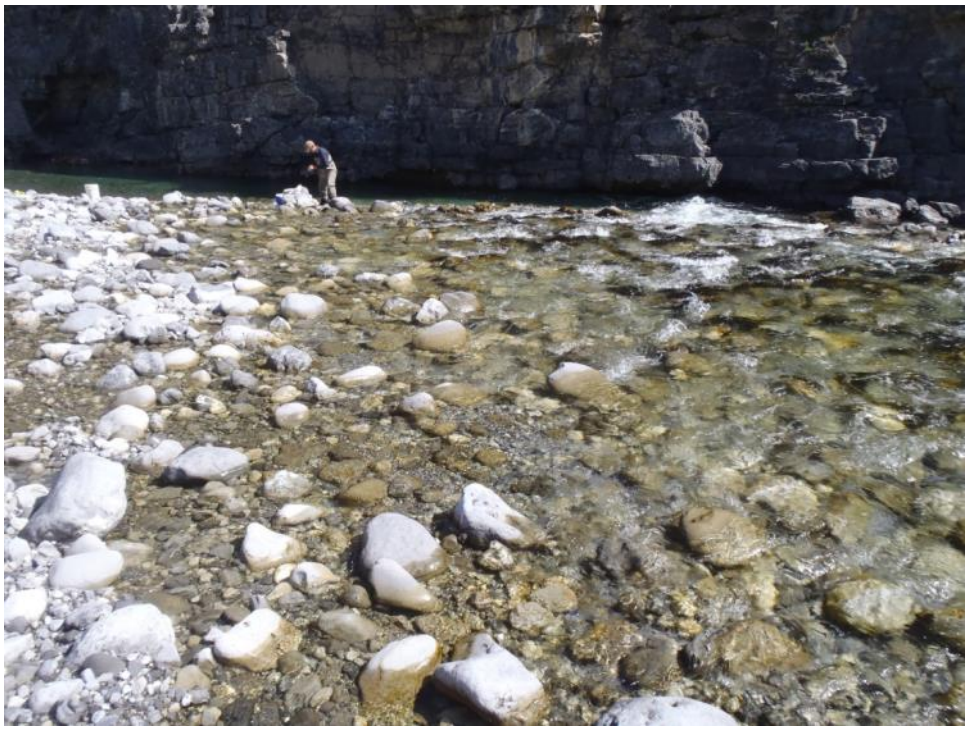
Photograph 31 Sundog Creek at Km 38 facing northeast (downstream), Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 32 Sundog Creek at Km 38.1, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 33 Sundog Creek at Km 38.1, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 34 Sundog Creek at Km 38.1, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 35 Sundog Creek at Km 38.1, Prairie Creek all season road stream crossing study, July 27, 2014.



Photograph 36 Sundog Creek at Km 38.1, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 37 **Sundog Creek at KP38.2 facing southwest (upstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 38 **Sundog Creek at KP38.2 facing northeast (downstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 39 **Sundog Creek at KP38.8 facing northeast (downstream), Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 40 **Sundog Creek at KP39.3 facing northeast (downstream), Cat Camp shown in top quarter of photo, Prairie Creek all season road stream crossing study, July 28, 2014.**

Photograph 41 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 42 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 43 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 44 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 45 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 46 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 47 Sundog Creek at Km 39.9, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 48 Tributary to Sundog Creek downstream of Km 43.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 49 Tributary to Sundog Creek downstream of Km 43.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 50 Tributary to Sundog Creek downstream of Km 43.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 51 Tributary to Sundog Creek downstream of Km 43.5, Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 52 Tributary to Sundog Creek downstream of Km 43.5 looking east (upstream), Prairie Creek all season road stream crossing study, July 27, 2014.

Photograph 53 Tributary to Poljie Creek at Km 46, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 54 Tributary to Poljie Creek at Km 46, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 55 Tributary to Poljie Creek at Km 46, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 56 Tributary to Poljie Creek at Km 47, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 57 **Tributary to Poljie Creek at Km 47, Prairie Creek all season road stream crossing study, September 21, 2014.**

Photograph 58 **Tributary to Poljie Creek at Km 47, Prairie Creek all season road stream crossing study, September 21, 2014.**

Photograph 59 Tributary to Poljie Creek at Km 47, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 60 Tributary to Poljie Creek at Km 47, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 61 Tributary to Poljie Creek at Km 49.1, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 62 Tributary to Poljie Creek at Km 49.1, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 63 Tributary to Poljie Creek at Km 49.1, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 64 Poljie Creek at Km 49.4, no tributary found, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 65 **Poljie Creek at Km 49.4, no tributary found, Prairie Creek all season road stream crossing study, September 21, 2014.**

Photograph 66 **Km 49.4, no tributary found, Prairie Creek all season road stream crossing study, September 21, 2014.**

Photograph 67 Tributary to Poljie Creek at Km 50.2, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 68 Tributary to Poljie Creek at Km 50.2, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 69 Tributary to Poljie Creek at Km 50.2, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 70 Tributary to Poljie Creek at Km 54.2, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 71 Tributary to Poljie Creek at Km 54.2, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 72 Tributary to Poljie Creek at Km 54.2, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 73 Tributary to Poljie Creek at Km 54.2, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 74 Tributary to Poljie Creek at Km 54.3, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 75 Tributary to Poljie Creek at Km 54.3, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 76 Tributary to Poljie Creek at Km 54.3, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 77 Tributary to Poljie Creek at Km 54.3, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 78 Tributary to Poljie Creek at Km 54.3, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 79 Tributary to Poljie Creek at Km 54.3, Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 80 Poljie Creek at Km 54.4, Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 81 Poljie Creek (Km 54.4), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 82 Poljie Creek (Km 54.4), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 83 Poljie Creek (Km 54.4), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 84 Poljie Creek (Km 54.4), Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 85 Poljie Creek (Km 54.4), Prairie Creek all season road stream crossing study, September 21, 2014.

Photograph 86 Poljie Creek (Km 54.5), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 87 Mosquito Lake (Km 64.6), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 88 Mosquito Lake inlet (Km 64.6), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 89 Mosquito Lake inlet (Km 64.6), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 90 Small Tributary to Tetcela River - Helicopter Recon (Km 86.7), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 91 **Small Tributary to Tetcela River - Helicopter Recon (Km 86.7), Prairie Creek all season road stream crossing study, September 24, 2014.**

Photograph 92 **Small Tributary to Tetcela River - Helicopter Recon (Km 86.7), Prairie Creek all season road stream crossing study, September 24, 2014.**

Photograph 93 Small Tributary to Tetcela River - Helicopter Recon (Km 86.8), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 94 Large Tributary to Tetcela River (first Tetcela crossing, Km 87.7), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 95 Large Tributary to Tetcela River (first Tetcela crossing, Km 87.7), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 96 Large Tributary to Tetcela River (first Tetcela crossing, Km 87.7), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 97 **Large Tributary to Tetcela River (first Tetcela crossing, Km 87.7), Prairie Creek all season road stream crossing study, September 24, 2014.**

Photograph 98 **Tetsela River Mainstem (second Tetcela crossing, Km 90.1), Prairie Creek all season road stream crossing study, September 24, 2014.**

Photograph 99 Tetsela River Mainstem (second Tetcela crossing, Km 90.1), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 100 Tetsela River Mainstem (second Tetcela crossing, Km 90.1), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 101 Tetsela River Mainstem (second Tetcela crossing, Km 90.1), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 102 Tetsela River Mainstem (second Tetcela crossing, Km 90.1), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 103 Mainstem Tetsela River (second Tetcela crossing, Km 90.1), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 104 Fish Trap Creek (Km 95), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 105 Fish Trap Creek (Km 95), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 106 Fish Trap Creek (Km 95), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 107 Fish Trap Creek (Km 95), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 108 Fish Trap Creek (Km 95), Prairie Creek all season road stream crossing study, July 28, 2014.

Photograph 109 Fish Trap Creek (Km 95), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 110 Unnamed Creek (KP 105), Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 111 Tributary of Gap Lake at Km 122.8, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 112 Tributary of Gap Lake at Km 122.8, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 113 Tributary to Gap Lake (200 m south of Km 122.8), Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 114 Tributary to Gap Lake (approx. 500 m north of Km 122.8), Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 115 South End of Gap Lake at Km 123.1, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 116 Flow out of Gap Lake (Km 123.1), Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 117 Gap Lake flowing in to Granger River (Km 123.2), Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 118 Gap Lake flowing in to Granger River (Km 123.2), Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 119 Gap Lake flowing in to Granger River (Km 123.3), Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 120 Tributary to Granger River at Km 123.3, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 121 Granger River at Km 123.3, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 122 Granger River at Km 123.3, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 123 Granger River at Km 123.3, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 124 Granger River at Km 123.3, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 125 Granger River at Km 123.5, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 126 Debris fan some flow to Granger River at Km 123.5, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 127 Granger River at Km 123.5, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 128 Granger River at Km 123.7, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 129 Granger River at Km 123.7, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 130 Granger River at Km 123.7, Prairie Creek all season road stream crossing study, July 29, 2014.

Photograph 131 Granger River at Km 127.7, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 132 Granger River at Km 123.7, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 133 Granger River at Km 123.7, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 134 Granger River at Km 123.7, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 135 Granger River at Km 125.1, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 136 Granger River at Km 125.1, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 137 Granger River at Km 125.1, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 138 Granger River at Km 125.1, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 139 Granger River at Km 125.1, Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 140 Tributary to Granger River at Km 131.3, Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 141 Tributary to Granger River at Km 131.3, Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 142 Tributary to Granger River at Km 131.3, Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 143 Tributary to Granger River at Km 133.7, Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 144 Tributary to Granger River at Km 133.7, Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 145 Tributary to Granger River at Km 133.7, Prairie Creek all season road stream crossing study, September 24, 2014.

Photograph 146 Creek at Km 135.6, Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 147 Creek at Km 135.6, Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 148 Creek at Km 135.6, Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 149 Creek at Km 135.6, Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 150 Creek at Km 136.7, Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 151 Creek at Km 136.7, Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 152 Creek at Km 136.7, Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 153 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 154 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 155 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 156 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 157 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 158 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 159 Creek draining Triangle Lake (Km 144.7), Prairie Creek all season road stream crossing study, September 25, 2014.

Photograph 160 Bluefish Creek near Blurefish Lake (~7 km west of 146 km), Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 161 Bluefish Creek (~7 km west of 146 km), Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 162 Bluefish Creek (~7 km west of 146 km), Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 163 Bluefish Creek (~7 km west of 146 km), Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 164 Bluefish Creek (~7 km west of 146 km), Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 165 Bluefish Creek (~7 km west of 146 km), Prairie Creek all season road stream crossing study, September 26, 2014.

Photograph 166 Tributary to Liard River (Km 154.4), Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 167 Tributary to Liard River (Km 154.4), Prairie Creek all season road stream crossing study, September 23, 2014.

Photograph 168 Tributary to Liard River (Km 154.4), Prairie Creek all season road stream crossing study, September 23, 2014.

Attachment B

Fish Habitat Field Datasheets

Stream Habitat Information

Data Collectors John W / Jon T	**Date** 27 July '14	**Time (24 H)** 1330
Site Pool	**Station** Sundog 1 (200m U/S of Km 37)	**Project** CEN - all season road
UTM NAD	**Upstream Northing** 0427064	**Upstream Easting** 6829319
Access	**Downstream Northing** 0427078	**Downstream Easting** 6829372

Morphology

Stream Morphology Types (%)		Length (m)				Velocity (60% depth or surface)		
Run / Riffle / (Pool)		Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall / Other:		1	44cm	1200cm	1400cm	0	0	0.32
Depth/Pool (m)	1.4	2	18 cm	42cm	72 cm	0.14	0.41	0.24
Channel Slope (°)	0.5°	3	24cm	20cm	46 cm	0.24	0.25	0.24
Wetted Width	.6 / 13 / 17 / m	Channel Width (m)	1621	1621	157	Unstable Banks (5%)		
Meander Frequency	~~4~~ / / / m	Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	0 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	5% %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)			cliff	all one side	

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics		-
% Clay		-
% Silt		-
% Sand	15	-
% Gravel	40	0
% Cobble	40	50
% Boulder	5	50
% Bedrock	—	-

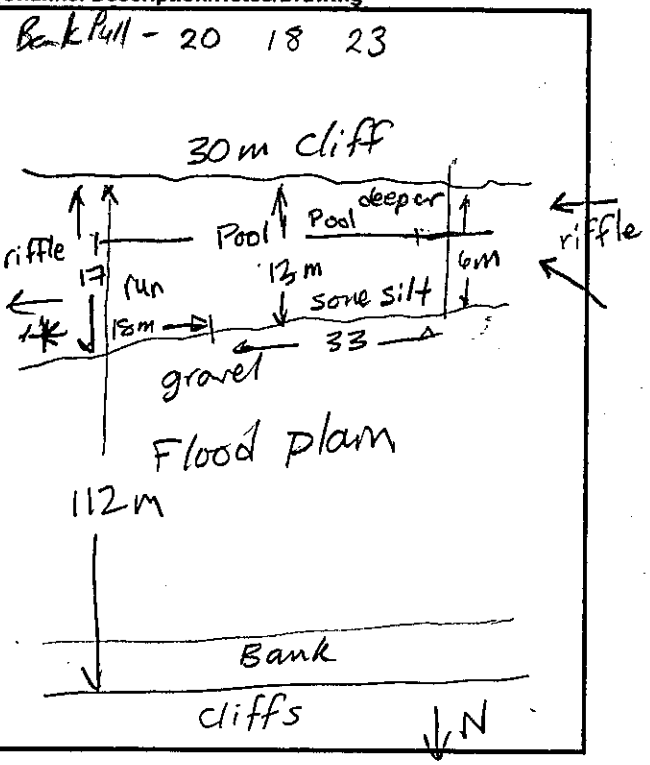
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	<1 %
Periphyton	%
Filamentous	0 %
Aquatic Moss	<5 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	(Coniferous Forest)
Grasses	Deciduous Forest
Re-growth forest	(Shrubs)
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	5 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

High water mark	1.5 m	Weather: previous 24 H
Flood Evidence (Debris on plants, etc)	— m	Cloudy
Air Temperature	21 °C	dry
Cloud Cover (5%)	8/10	
Wind Direction + speed (km/h)	NE 5	

In situ Water Parameters

Sample Depth (m)	0			
Dissolved Oxygen (%)	99.8			
Dissolved Oxygen (mg/L)	11.2			
Secchi Depth (m)	—			
Temperature (°C)	8.6			
pH	8.60			
Turbidity (TCU)	—			
Conductivity (uS/cm)	260			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	(Coniferous Forest)	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	(Hills)	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos canyon

		Channel Features	#	Dimensions
		Islands		
		Bars		

Notes

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Stream Habitat Information

Data Collectors	Date	Time (24 H)
John W	27 July '14	0416
Site	**Station**	**Project**
Riffle (US of pool)	Sundog 1 (200 m US of Km 37)	CEN6788
UTM NAD	**Upstream Northing**	**Upstream Easting**
WP 20	427033	6829328
Access	**Downstream Northing**	**Downstream Easting**
WP 21	427055	6829544

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	(Riffle)	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1	22	40	26	.29	.75	.61
Depth/Pool (m)	NA		2	32	46	22	.59	.97	.27
Channel Slope (°)	2°		3	28	32	42	.92	1.20	1.06
Wetted Width	10 / 9 / 11 m		Channel Width (m)	23 / 28 / 29 / *			Unstable Banks (5%)		
Meander Frequency	/ / / / m		Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	0 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	—	-
% Clay	—	-
% Silt	—	-
% Sand	20	-
% Gravel	20	
% Cobble	20	
% Boulder	20	
% Bedrock		-

Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	<1 %
Periphyton	%
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	(Coniferous Forest)
Grasses	Deciduous Forest
Re-growth forest	(Shrubs)
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

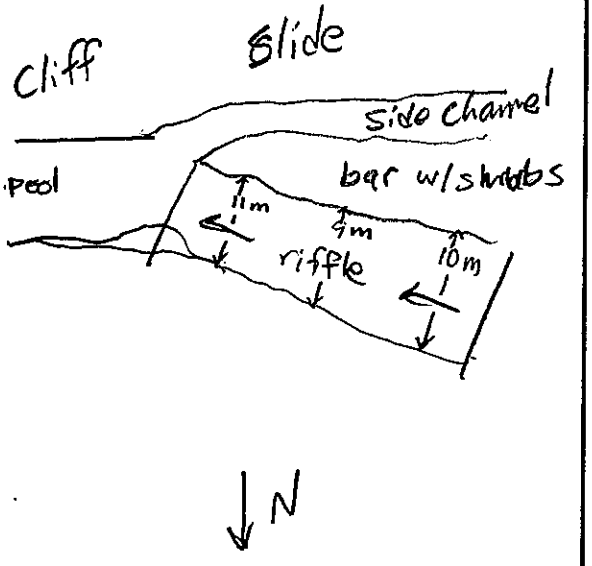
			Weather
High water mark	1.3	m	previous 24 H
Flood Evidence (Debris on plants, etc)		m	cloudy
Air Temperature	23	°C	dry
Cloud Cover (5%)	5		getting sunny
Wind Direction + speed (km/h)	NE 5		

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)	—	Side pond	1.0	
Temperature (°C)				
pH				
Turbidity (TCU)	—			
Conductivity (uS/cm)				

Channel Description/Notes/Drawing

Bankfull 23 28 29 * of active channel, not flood plain.



Landscape (Beyond 25 m Buffer) circle

Mixed Forest	(Coniferous Forest)	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	(Hills)	Canyon

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes Some fairly thick brown algae growing on some boulders.

Stream Habitat Information

Data Collectors	Date	Time (24 H)
John.W / Jon.T	27-July-2014	15:26,
Site ~~1 (lower)~~ Sundog 2	**Station** ~~Sundog 2-1~~ A	**Project** CZN6788
UTM NAD	**Upstream Northing** 4263156	**Upstream Easting** 6829278
Access	**Downstream Northing** 426418	**Downstream Easting** 6829265

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	(Riffle)	(Pool) close to wall	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1	8	11	10	0.13	0.34	0.26
Depth/Pool (m)			2	6	14	15	0.36	0.40	0.52
Channel Slope (°)	3°		3	11	22	44	0.08	0.27	0.31
Wetted Width	/ 27 / 15* / 9	m	Channel Width (m)	/ . /	/		Unstable Banks (5%)		
Meander Frequency	/ / / /	m	Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	2 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc): boulders

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	—	-
% Clay	—	-
% Silt	—	-
% Sand	—	-
% Gravel	20	0
% Cobble	55 60	0
% Boulder	20	25
% Bedrock	5	-

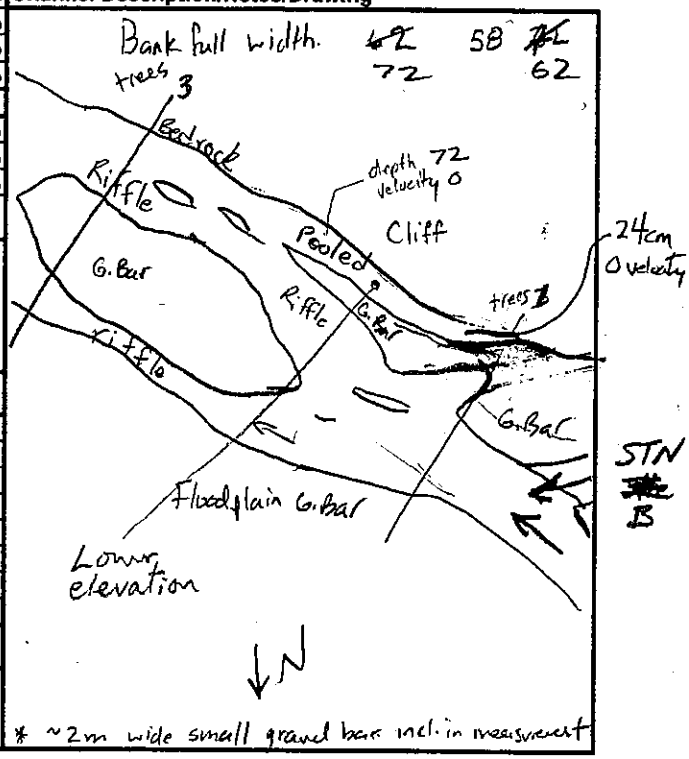
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	0 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	(Coniferous Forest)
Grasses	(Deciduous Forest)
Re-growth forest	(Shrubs)
Flooded	(Sedges)
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

			Weather
High water mark	1.4	m	previous 24 H
Flood Evidence (Debris on plants, etc)	—	m	cloudy
Air Temperature	22	°C	dry.
Cloud Cover (5%)	5		
Wind Direction + speed (km/h)	NE 5		

In situ Water Parameters

Sample Depth (m)	0			
Dissolved Oxygen (%)	101.7			
Dissolved Oxygen (mg/L)	12.19			
Secchi Depth (m)	—			
Temperature (°C)	7.4			
pH	8.63			
Turbidity (TCU)	—			
Conductivity (uS/cm)	233			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features	#	Dimensions
Islands		
Bars		

Notes

Slope = total slope of reach - slopes of individual channels will be lower.
Slope = 3%. Slightly more periphyton than Prairie.

Stream Habitat Information

Data Collectors	Date	Time (24 H)
JW, GS	27 July '14	1610 h
Site	**Station**	**Project**
Sundog realign 2	B	CEN6788
UTM NAD	**Upstream Northing**	**Upstream Easting**
	426255	6829318
Access	**Downstream Northing**	**Downstream Easting**
	426323	6829305

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1	15	18	14	0.27	0.79	0.1
Depth/Pool (m)			2	80	75	68	0.12	0.14	0.05
Channel Slope (°)	3°		3	9	18	18	0.29	0.25	0.06
Wetted Width	3 / 4 / 5 /	m	Channel Width (m)	163 / 75 / 79			Unstable Banks (5%)		
Meander Frequency	/ / / /	m	Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	— %	Instream Cover (Twigs/Sticks, etc)	— %	Substrate (as cover)	— %
Instream Cover (logs, etc)	2 %	Instream vegetation	— %	Undercut Bank	2 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)	Tree + cliff face				

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics		-
% Clay	—	-
% Silt	—	-
% Sand	—	-
% Gravel	60	60
% Cobble	25	25
% Boulder	15	25
% Bedrock	—	-

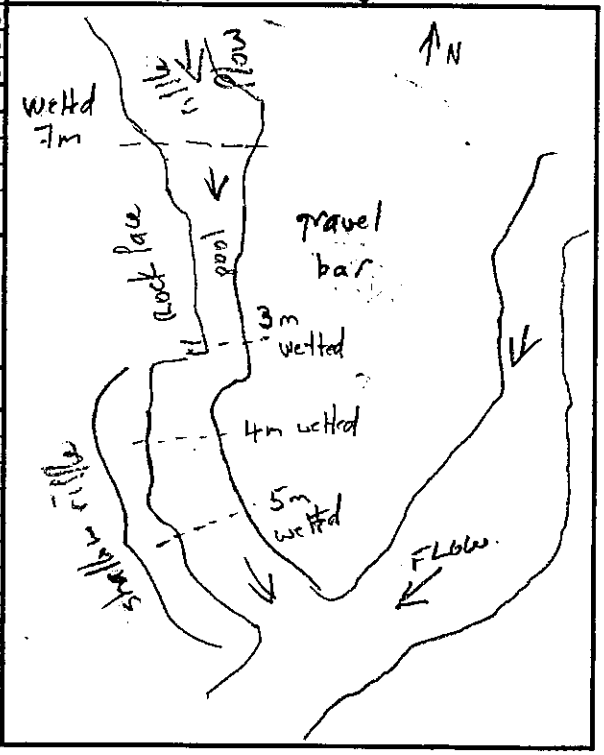
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	0 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) — circle

Mixed Forest	(Coniferous Forest)
Grasses	(Deciduous Forest)
Re-growth forest	(Shrubs)
Flooded	(Sedges)
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	— %	Overhead Litter >150 mm (%)	— %
Overhead Undercut Banks	— %	Overhanging Trees	— %
Overhanging Grasses	— %	Overhanging Shrubs	— %

Miscellaneous

High water mark	1.2 m	Weather: previous 24 H
Flood Evidence (Debris on plants, etc)	— m	
Air Temperature	22 °C	
Cloud Cover (5%)	5	
Wind Direction + speed (km/h)	WS	

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)	See Site A			
Secchi Depth (m)				
Temperature (°C)	See Site A			
pH				
Turbidity (TCU)				
Conductivity (uS/cm)				

Landscape (Beyond 25 m Buffer) — circle

Mixed Forest	(Coniferous Forest)	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	(Hills)	Canyon

Visible Disturbance — circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes 3° slope

Stream Habitat Information

Data Collectors: JW, DH, Garry, Jon	Date: 28 July '14	Time (24 H): 0942
Site: Polge Ck Crossing	Station: Main Creek (E of landing)	Project: CEN6788
UTM NAD: WP 31	Upstream Northing: 10V 440688 (centre)	Upstream Easting: 6830794
Access: Helicopter	Downstream Northing:	Downstream Easting:

Morphology

Stream Morphology Types (%): Run / (Riffle) / Pool / Fall / Other:

Depth/Pool (m)	Channel Slope (°)	Wetted Width	Meander Frequency
		8 / 8 / 8 m	/ / / / m

Length (m)				Velocity (60% depth or surface)		
Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
1						
2						
3						

Channel Width (m): 10 / 11 / 11

Unstable Banks (5%)

Bank slope (5°): L 30 R 70

Instream Cover

Instream Cover (Detritus)	8 %	Instream Cover (Twigs/Sticks, etc)	1 %	Substrate (as cover)	— %
Instream Cover (logs, etc)	1 %	Instream vegetation	— %	Undercut Bank	2 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	—	-
% Clay	—	-
% Silt	—	-
% Sand	20	-
% Gravel	60	0
% Cobble	20	50
% Boulder	—	—
% Bedrock	—	-

Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	0 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	1 grass %

Riprian Zone (25 m Buffer) circle

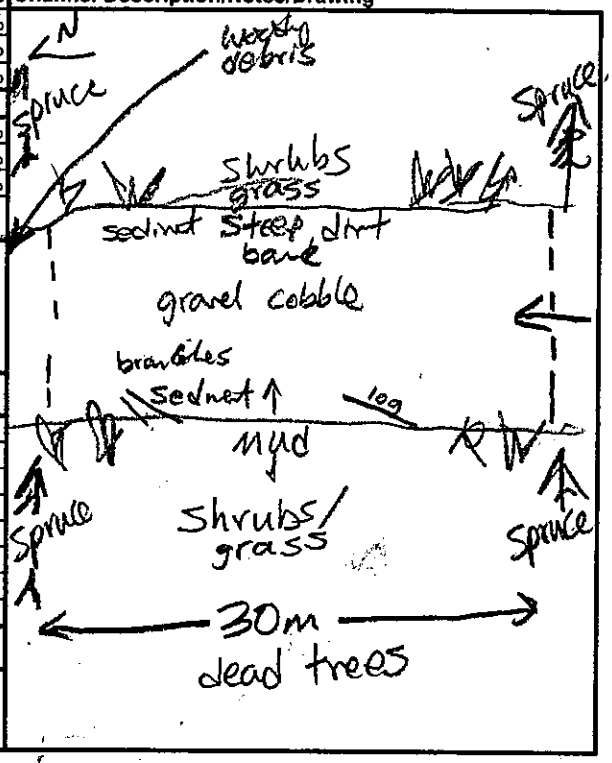
Mixed Forest	(Coniferous Forest)
Grasses	Deciduous Forest
Re-growth forest	(Shrubs)
Flooded	Sedges
(Roads)	Cutlines

evidence of old winter road

Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	2 %	Overhanging Trees	1 %
Overhanging Grasses	1 %	Overhanging Shrubs	1 %

Channel Description/Notes/Drawing



Miscellaneous

High water mark	1m m	previous 24 H
Flood Evidence (Debris on plants, etc)	— m	clear
Air Temperature	°C	
Cloud Cover (5%)	60 thin cirrus	
Wind Direction + speed (km/h)	N 2	

Weather

In situ Water Parameters / YSI / Titration

Sample Depth (m)		/		
Dissolved Oxygen (%)	(97.6)	/		
Dissolved Oxygen (mg/L)	(12.21)	10.8		
Secchi Depth (m)				
Temperature (°C)	6.2			
pH	8.39			
Turbidity (TCU)				
Conductivity (uS/cm)	355			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	(Coniferous Forest)	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	(Shrubs)	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	NO

Photos dead trees

U/S D/S CC

Channel Features

Channel Features	#	Dimensions
Islands		
Bars		

Notes

- Flat ~~75%~~ 50% embedded stones
- Moose ~~feet~~ prints.

Stream Habitat Information

Data Collectors: Pelage Ck Crossing	Date: Small trib (west)	Time (24 H): 10:09
Site: JW, DH, Gerry, Jon	Station: 28 July '14	Project: CEN6788
UTM NAD: WP032	Upstream Northing: 10V 440615 (centre)	Upstream Easting: 6850774
Access: Helecoptor	Downstream Northing:	Downstream Easting:

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width 1.4 / 1.4 / 1.9 / m			Channel Width (m) 1.6 / 1.6 / 2.0			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L 60 R 60			

Instream Cover

Instream Cover (Detritus)	— %	Instream Cover (Twigs/Sticks, etc)	20 %	Substrate (as cover)	— %
Instream Cover (logs, etc)	5 %	Instream vegetation	5 %	Undercut Bank	10 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	—	-
% Clay	—	-
% Silt	—	-
% Sand	—	-
% Gravel	60	0
% Cobble	40	0
% Boulder	—	—
% Bedrock	—	-

Instream Vegetaion (Sum 100%)

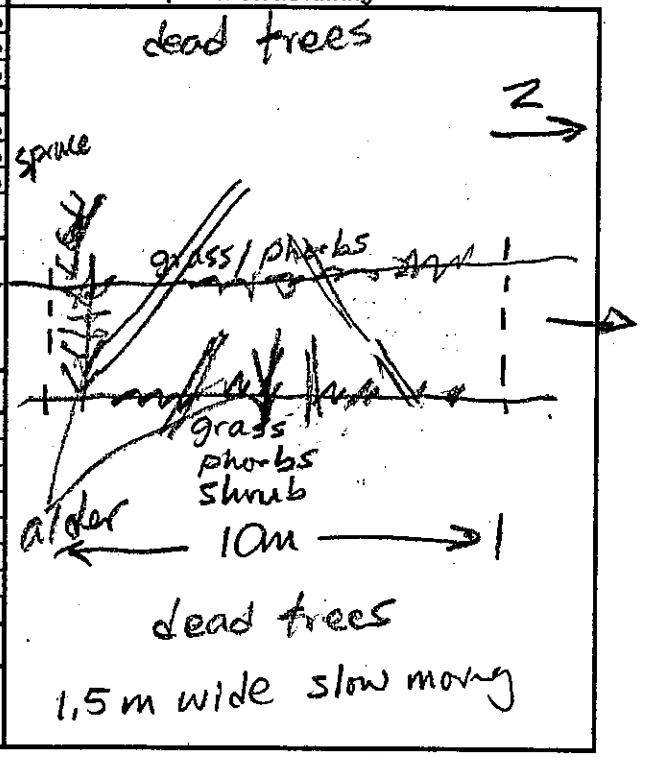
Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	0 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

old road r.o.w.

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	%	Overhead Litter >150 mm (%)	%
Overhead Undercut Banks	%	Overhanging Trees	%
Overhanging Grasses	%	Overhanging Shrubs	%

Miscellaneous

		Weather
High water mark	.6 m	previous 24 H
Flood Evidence (Debris on plants, etc)	.6 m	clear
Air Temperature	°C	
Cloud Cover (5%)	Cirrus 60%	
Wind Direction + speed (km/h)	0	

In situ Water Parameters

pen probe titration

Sample Depth (m)			
Dissolved Oxygen (%)		60.5	
Dissolved Oxygen (mg/L)		8.45	7.2
Secchi Depth (m)			
Temperature (°C)	9.5		
pH	7.1	8.6	
Turbidity (TCU)			
Conductivity (uS/cm)	480		

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos Dead trees (forest fire)

Channel Features	#	Dimensions
Islands		
Bars		

Notes 4.8

Stream Habitat Information

Data Collectors CJ, DH	**Date** 21-Sep-2014	**Time (24 H)** 9:50
Site KP 50.2 (Pdjie Trib.)	**Station** KP 50.2	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6829737	**Upstream Easting** 436944
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 0.50 m			Channel Width (m) / / /			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L R			

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	20 %	Substrate (as cover)	%
Instream Cover (logs, etc)	10 %	Instream vegetation	0 %	Undercut Bank	5 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Some fallen logs in channel, some causing steps, smaller sticks also

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics		-
% Clay		-
% Silt	90	-
% Sand	10	-
% Gravel		
% Cobble		
% Boulder		
% Bedrock		-

Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	80 %	Overhead Litter >150 mm (%)	20 %
Overhead Undercut Banks	5 %	Overhanging Trees	5 %
Overhanging Grasses	10 %	Overhanging Shrubs	10 %

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	10 °C	
Cloud Cover (5%)	95%	
Wind Direction + speed (km/h)	calm	

In situ Water Parameters

Sample Depth (m)	0.15			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	11.4			
Secchi Depth (m)	—			
Temperature (°C)	3.6			
pH	7.8			
Turbidity (TCU)	—			
Conductivity (uS/cm)	500			

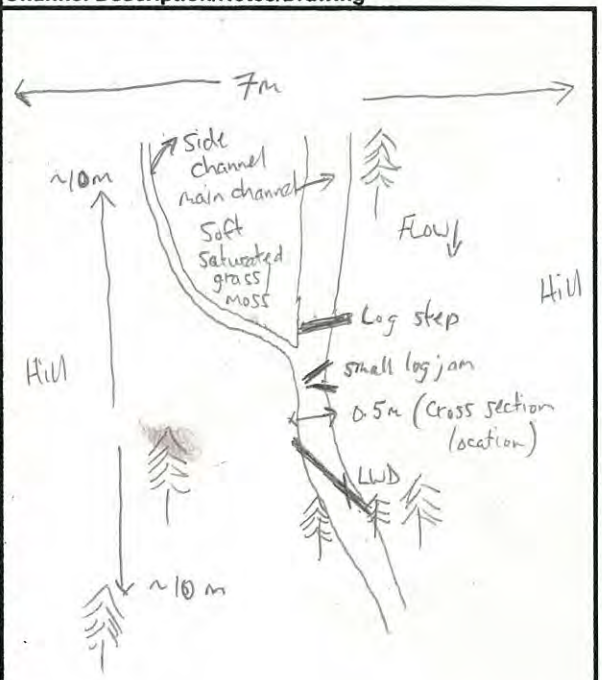
Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Channel Description/Notes/Drawing



Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes Side channel partially flowing, but mostly standing water on marshy ground.

Stream Habitat Information

Data Collectors CJ, DH	**Date** 21-Sep-14	**Time (24 H)** 14:15
Site KP 47.0	**Station**	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6829338	**Upstream Easting** 434240
Access Heli / Hiking	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 0.55 m			Channel Width (m) / / /				Unstable Banks (5%)		
Meander Frequency / / / / m			Regular / Irregular meanders				Bank slope (5°) L R		

Instream Cover

Instream Cover (Detritus)	40 %	Instream Cover (Twigs/Sticks, etc)	10 %	Substrate (as cover)	~~5~~ % 40
Instream Cover (logs, etc)	5 %	Instream vegetation	0 %	Undercut Bank	5 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics		-
% Clay		-
% Silt	20	-
% Sand	80	-
% Gravel		
% Cobble		
% Boulder		
Bedrock		-

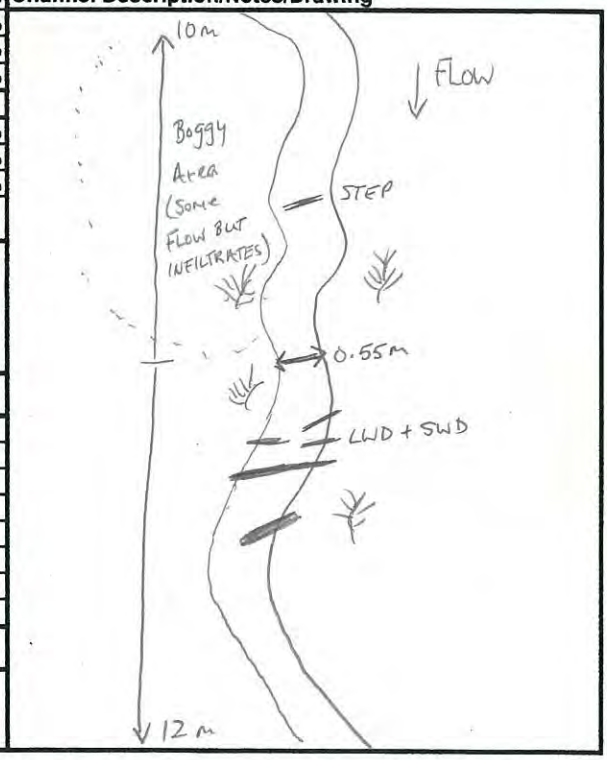
Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	%	Overhead Litter >150 mm (%)	5 %
Overhead Undercut Banks	60 %	Overhanging Trees	0 %
Overhanging Grasses	5 %	Overhanging Shrubs	30 %

Miscellaneous

High water mark	m	Weather
Flood Evidence (Debris on plants, etc)	– m	previous 24 H
Air Temperature	15 °C	
Cloud Cover (5%)	10%	
Wind Direction + speed (km/h)	calm	

In situ Water Parameters

Sample Depth (m)	~~0.2~~ 0.15			
Dissolved Oxygen (%)	–			
Dissolved Oxygen (mg/L)	10.2			
Secchi Depth (m)	–			
Temperature (°C)	3.7			
pH	7.2			
Turbidity (TCU)	–			
Conductivity (uS/cm)	305			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors	Date	Time (24 H)
CJ, DH	21-SEP-14	17:00
Site KP 39.8 SUNDOG	Station	Project
UTM NAD	~~Upstream~~ Northing 6830273	~~Upstream~~ Easting 428369
Access Heli	Downstream Northing	Downstream Easting

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)	0.0		2						
Channel Slope (°)			3						
Wetted Width / / / 0.0 m			Channel Width (m) 0.0 / / /			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L R			

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	95 %
Instream Cover (logs, etc)	0 %	Instream vegetation	5 %	Undercut Bank	0 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics		-
% Clay		-
% Silt	5	-
% Sand	~~30~~ CJ	-
% Gravel	30	
% Cobble	50	5
% Boulder	15	20
% Bedrock		-

Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	5 %

Miscellaneous

		Weather
High water mark	m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	°C	
Cloud Cover (5%)		
Wind Direction + speed (km/h)		

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)				
Temperature (°C)				
pH				
Turbidity (TCU)				
Conductivity (uS/cm)				

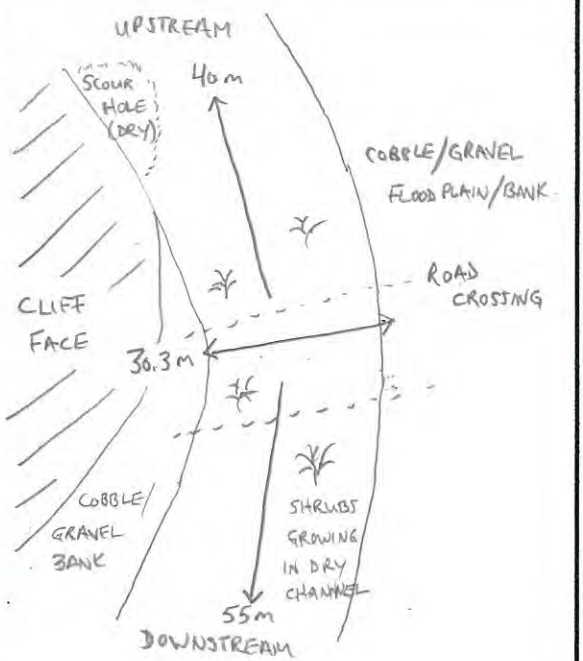
Landscape (Beyond 25 m Buffer) circle

~~Mixed Forest~~	~~Coniferous Forest~~	~~Roads~~
~~Grasses~~	~~Deciduous Forest~~	~~Cutlines~~
~~Re-growth forest~~	~~Shrubs~~	~~Hills~~

Visible Disturbance circle

~~Surface Debris~~	~~Culvert~~
~~Beaver Dam~~	~~Weir~~
~~Collapsed Bank~~	

Channel Description/Notes/Drawing



Photos

Channel Features	#	Dimensions
Islands		
Bars		

Notes Stream is dry. No riparian buffer: only a few shrubs and a cobble/gravel floodplain.

Stream Habitat Information

Data Collectors	**Date** 22-Sep-14	**Time (24 H)** 16:30
Site Sunday Creek	**Station** Kp 27.1	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6828332	**Upstream Easting** 418911
Access ATV / Hiking	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 20	Riffle 80	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1	0.15	0.20	0.21	5 sec / 4m	6.5 sec / 4m	6 sec / 4m
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 8.5 m			Channel Width (m) 14.5 / / /				Unstable Banks (5%)		
Meander Frequency / / / / m			Regular / Irregular meanders				Bank slope (5°) L		R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	100 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	~~30~~	-
% Gravel	30	
% Cobble	40	
% Boulder	30	
% Bedrock	0	-

Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

High water mark	m	Weather: previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	°C	
Cloud Cover (5%)	5	
Wind Direction + speed (km/h)	40 km/h E	

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)				
Temperature (°C)				
pH				
Turbidity (TCU)				
Conductivity (uS/cm)				

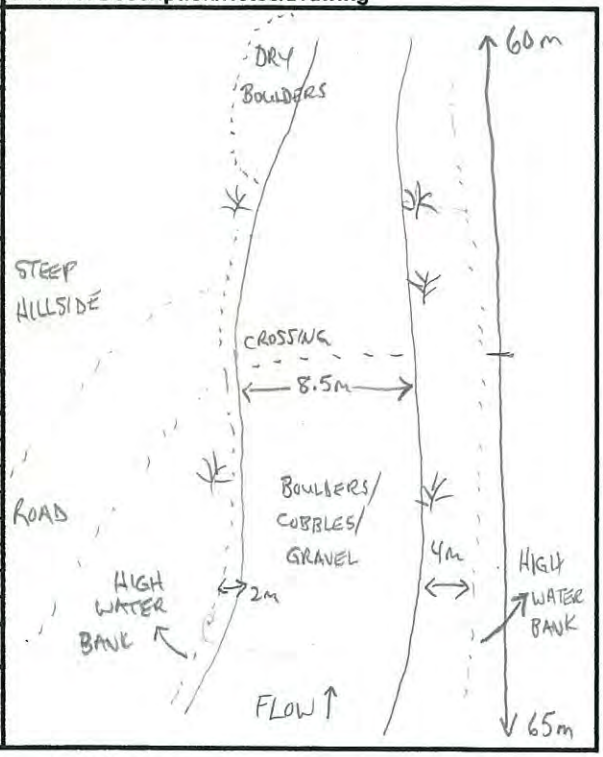
Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Channel Description/Notes/Drawing



Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors	Date	Time (24 H)
CJ, DH	22-Sep-14	17:00
Site: Sundog Creek	Station: KP 27.5	Project: CZN 6788
UTM NAD	Upstream Northing: 6828089	Upstream Easting: 419225
Access: Hiking / ATV	Downstream Northing	Downstream Easting

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle 50	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall 50	Other:		1	0.10	0.19	0.32	5 sec/ 3m	5 sec/ 3m	6 sec/ 3m
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 13.2 m			Channel Width (m) 19.51 / /				Unstable Banks (5%)		
Meander Frequency / / / / m			Regular / Irregular meanders				Bank slope (5°) L		R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	100 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	5	-
% Gravel	20	
% Cobble	45	
% Boulder	30	
% Bedrock	0	-

Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

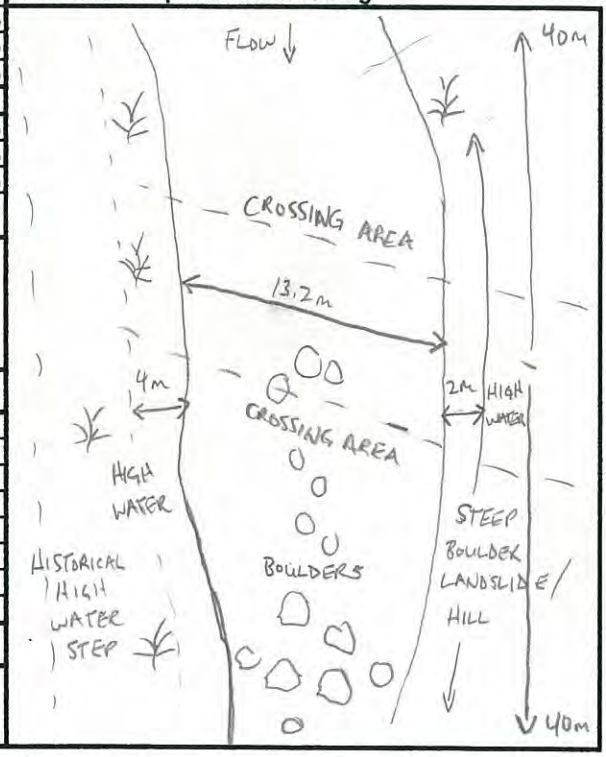
Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Channel Description/Notes/Drawing



Miscellaneous

High water mark	m	Weather: previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	10 °C	
Cloud Cover (5%)	5%	
Wind Direction + speed (km/h)	40 km/h E	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)				
Temperature (°C)	7.5			
pH	7.8			
Turbidity (TCU)				
Conductivity (uS/cm)	448			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	Date 22-Sep-14	Time (24 H) 17:50
Sundog Creek	Station KP 28.4	Project CZN 6788
UTM NAD	Upstream Northing	Upstream Easting
Access Hiking / ATV	Downstream Northing	Downstream Easting

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle 50	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall 50	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 5 m			Channel Width (m) 20.6 / / /				Unstable Banks (5%)		
Meander Frequency / / / / m			Regular / Irregular meanders				Bank slope (5°) L		R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	100 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	0	-
% Gravel	20	
% Cobble	40	
% Boulder	40	
% Bedrock	0	-

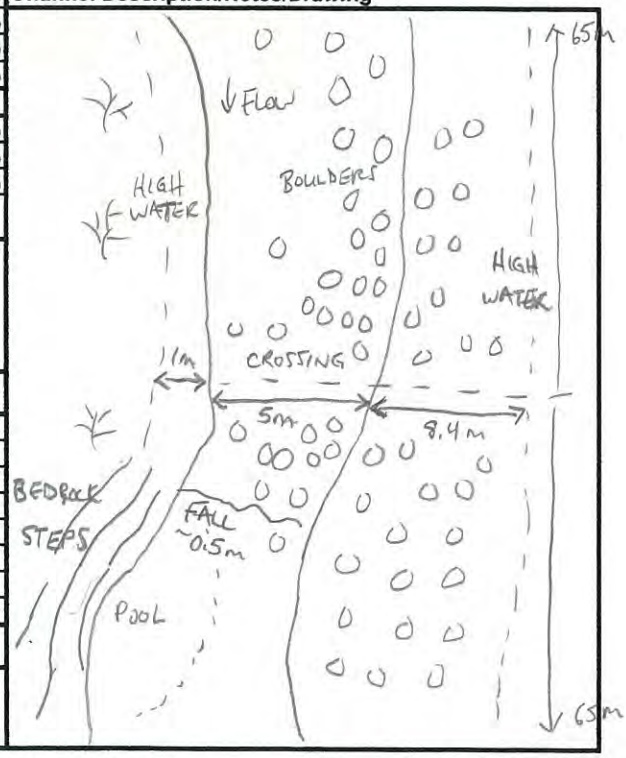
Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

		Weather
High water mark	m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	10 °C	
Cloud Cover (5%)	5 %	
Wind Direction + speed (km/h)	20 km/h NE	

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)				
Temperature (°C)	7.1			
pH	7.7			
Turbidity (TCU)				
Conductivity (uS/cm)	440			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	**Date** 23-Sep-14	**Time (24 H)** 9:45
Site Sunday Creek	**Station** KP 29.2	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6827089	**Upstream Easting** 420601
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m) 2.5 m				Velocity (60% depth or surface)		
Run	Riffle 20	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall 80	Other:		1	0.6	0.8	0.8	5	6.5	7.5
Depth/Pool (m)			2	~~0.8~~					
Channel Slope (°)			3	~~0.8~~					
Wetted Width / / / 8.0 m			Channel Width (m) 19.5 / / /			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L		R	

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	100 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	5	-
% Gravel	10	
% Cobble	15	
% Boulder	70	
% Bedrock	0	-

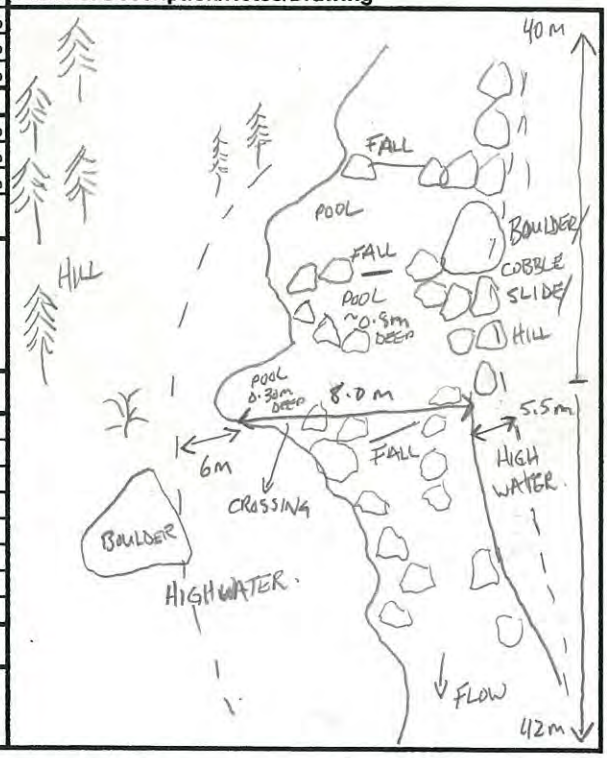
Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

		Weather
High water mark	m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	7 °C	
Cloud Cover (5%)	0 %	
Wind Direction + speed (km/h)	5 km/h E	

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)				
Temperature (°C)	3.9			
pH	8.0			
Turbidity (TCU)				
Conductivity (uS/cm)	447			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

0.5 6.5 14.5 20

Stream Habitat Information

Data Collectors	Date	Time (24 H)
CJ, DH	23-Sep-14	13:40
Site Liard Trib.	**Station** Kp 154.4	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6774900	**Upstream Easting** 486500
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m) Measured with ADV Flow meter				Velocity (60% depth or surface)		
Run 90	Riffle 10	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1		0.10			0.053 m/s	
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 0.75 m			Channel Width (m) 1.15 / . / /				Unstable Banks (5%)		
Meander Frequency / / / / m			Regular / Irregular meanders				Bank slope (5°) . L		R

Instream Cover

Instream Cover (Detritus)	20 %	Instream Cover (Twigs/Sticks, etc)	10 %	Substrate (as cover)	60 %
Instream Cover (logs, etc)	5 %	Instream vegetation	5 %	Undercut Bank	5 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	10	-
% Sand	30	-
% Gravel	45	
% Cobble	15	
% Boulder	0	
Bedrock	0	-

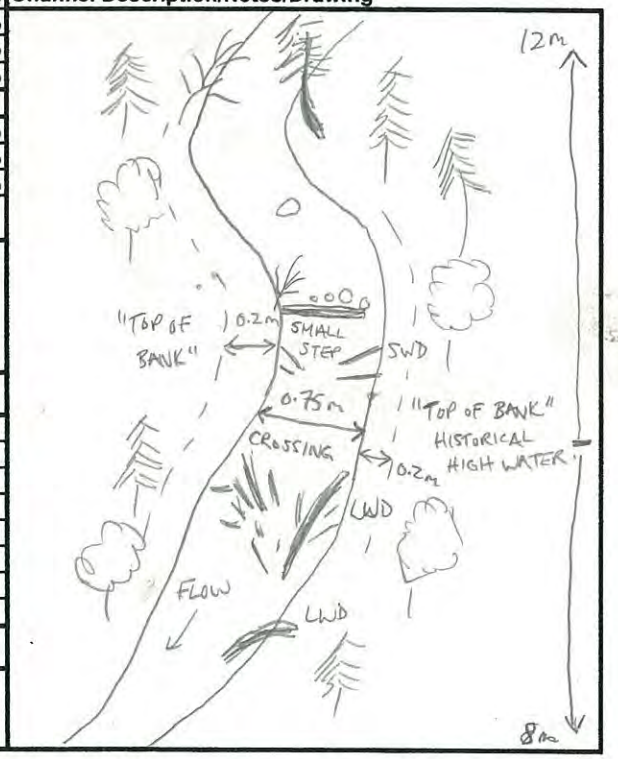
Instream Vegetaion (Sum 100%)

Rooted Emergent	0	%
Rooted Submergent	0	%
Rooted Floating	0	%
Free-floating	0	%
Floating Algae	0	%
Attached Algae	0	%
Periphyton	100	%
Filamentous	0	%
Aquatic Moss	0	%
Flooded Terrestrial Plants	0	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	15 %
Overhead Undercut Banks	10 %	Overhanging Trees	60 %
Overhanging Grasses	5 %	Overhanging Shrubs	10 %

Miscellaneous

High water mark	0.25 m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	10 °C	
Cloud Cover (5%)	2%	
Wind Direction + speed (km/h)	calm	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	11.2			
Secchi Depth (m)	—			
Temperature (°C)	8.4			
pH	7.7			
Turbidity (TCU)	—			
Conductivity (uS/cm)	515			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes Channel too shallow for more velocity mmts

Stream Habitat Information

Data Collectors CJ, DH	**Date** 23-Sep-14	**Time (24 H)** 15:20
Site Grainger Trib.	**Station** KP 122.8	**Project** CEN 6788
UTM NAD	**Upstream Northing** 6798715	**Upstream Easting** 477151
Access Heli.	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 60	Riffle 40	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 1.6 m			Channel Width (m) / / / 1.75			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L		R	

Instream Cover

Instream Cover (Detritus)	5 %	Instream Cover (Twigs/Sticks, etc)	15 %	Substrate (as cover)	55 %
Instream Cover (logs, etc)	15 %	Instream vegetation	0 %	Undercut Bank	10 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	5	-
% Clay	0	-
% Silt	5	-
% Sand	30	-
% Gravel	5	
% Cobble	20	
% Boulder	35	
Bedrock		-

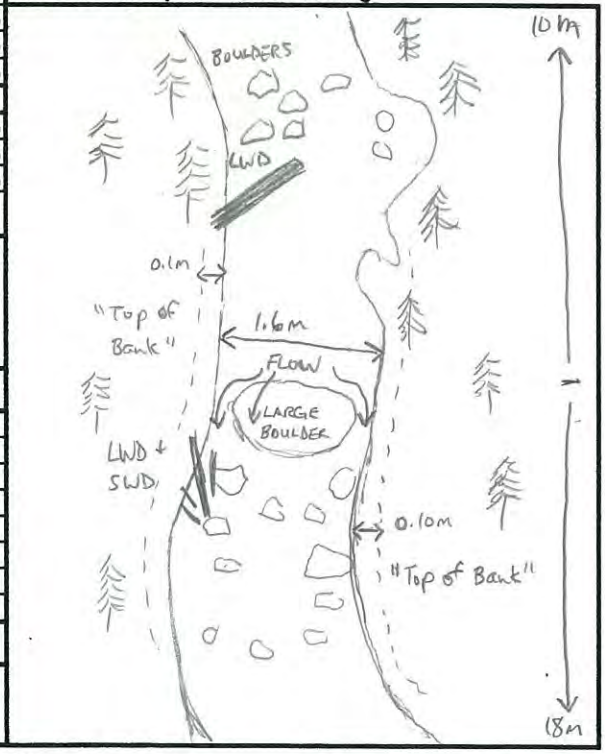
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	100 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	(Coniferous Forest)
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	5 %	Overhead Litter >150 mm (%)	15 %
Overhead Undercut Banks	20 %	Overhanging Trees	40 %
Overhanging Grasses	5 %	Overhanging Shrubs	15 %

Miscellaneous

		Weather
High water mark	m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	10 °C	
Cloud Cover (5%)	30%	
Wind Direction + speed (km/h)	calm	

In situ Water Parameters

Sample Depth (m)	0.15			
Dissolved Oxygen (%)	-			
Dissolved Oxygen (mg/L)	10.4			
Secchi Depth (m)	-			
Temperature (°C)	8.0			
pH	7.4			
Turbidity (TCU)	—			
Conductivity (uS/cm)	421			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	(Coniferous Forest)	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	**Date** 23-Sep-14	**Time (24 H)** 17:10
Site Grainger main channel	**Station** KP 123.7	**Project** 6788
UTM NAD	**Upstream Northing** 6799643	**Upstream Easting** 478319
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 40	Riffle 60	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 5.85 m			Channel Width (m) 15.3 / . / /			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) . L R			

Instream Cover

Instream Cover (Detritus)	15 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	60 %
Instream Cover (logs, etc)	0 %	Instream vegetation	25 %	Undercut Bank	0 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	6	-
% Clay	0	-
% Silt	5	-
% Sand	10	-
% Gravel	10	
% Cobble	35	
% Boulder	40	
% Bedrock	0	-

Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	60 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	%
Periphyton	10 %
Filamentous	10 %
Aquatic Moss	20 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	60 %	Overhead Litter >150 mm (%)	25 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	15 %

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	12 °C	
Cloud Cover (5%)	30%	
Wind Direction + speed (km/h)	25 kph W	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	10.6			
Secchi Depth (m)	—			
Temperature (°C)	6.4			
pH	7.4			
Turbidity (TCU)	—			
Conductivity (uS/cm)	370			

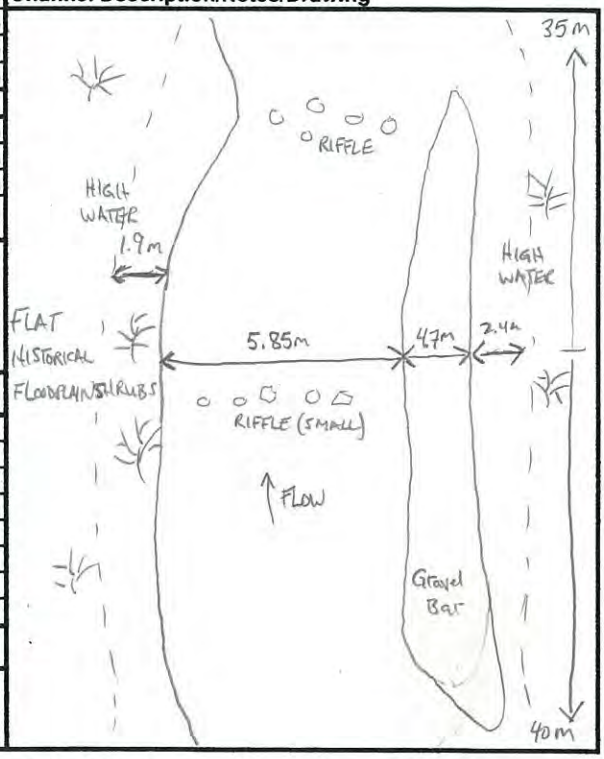
Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Channel Description/Notes/Drawing



Photos

Channel Features

	#	Dimensions
Islands		
Bars	1	4.7 m wide 35m long

Notes Dry side channel (2.4m wide) on RB — separated from main channel by gravel bar noted above.

Stream Habitat Information

Data Collectors CJ, DH	**Date** 23-Sept-14	**Time (24 H)**
e Grainger mainstem	**Station** KP 125.1	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6799517	**Upstream Easting** 479156
Access Heli / Hiking	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 50	Riffle 50	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / m			Channel Width (m) / / /			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L R			

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	100 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	0 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	~~10~~ 0	-
% Clay	0	-
% Silt	0	-
% Sand	0	-
% Gravel	20	
% Cobble	50	
% Boulder	20	
Bedrock	10	-

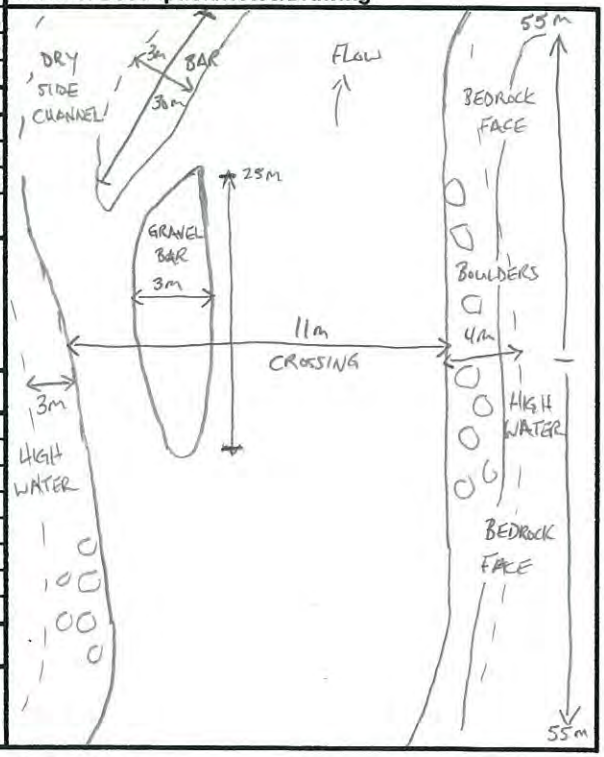
Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	0 %
Overhanging Grasses	0 %	Overhanging Shrubs	0 %

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	16.0 °C	
Cloud Cover (5%)	none	
Wind Direction + speed (km/h)	20 kph W	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	12.2			
Secchi Depth (m)	—			
Temperature (°C)	5.7			
pH	7.7			
Turbidity (TCU)	—			
Conductivity (uS/cm)	395			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	Date 24-Sep-14	Time (24 H) 9:00
e ~~KP~~ Grainger ~~[illegible]~~ Trib.	Station KP 133.7	Project
UTM NAD	Upstream Northing 6793161	Upstream Easting 482671
Access Heli	Downstream Northing	Downstream Easting

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle 100	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 1.7 m			Channel Width (m) / / / 2.6 m				Unstable Banks (5%)		
Meander Frequency / / / / ~~2.6~~ m			Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	5 %	Instream Cover (Twigs/Sticks, etc)	5 %	Substrate (as cover)	80 %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	10 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

	%	Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	20	-
% Gravel	0	
% Cobble	40	20
% Boulder	40	30
Bedrock	0	-

Instream Vegetaion (Sum 100%)

	%
Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	100 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	(Coniferous Forest)
(Grasses)	Deciduous Forest
Re-growth forest	(Shrubs)
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	5 %	Overhead Litter >150 mm (%)	5 %
Overhead Undercut Banks	10 %	Overhanging Trees	15 %
Overhanging Grasses	5 %	Overhanging Shrubs	60 %

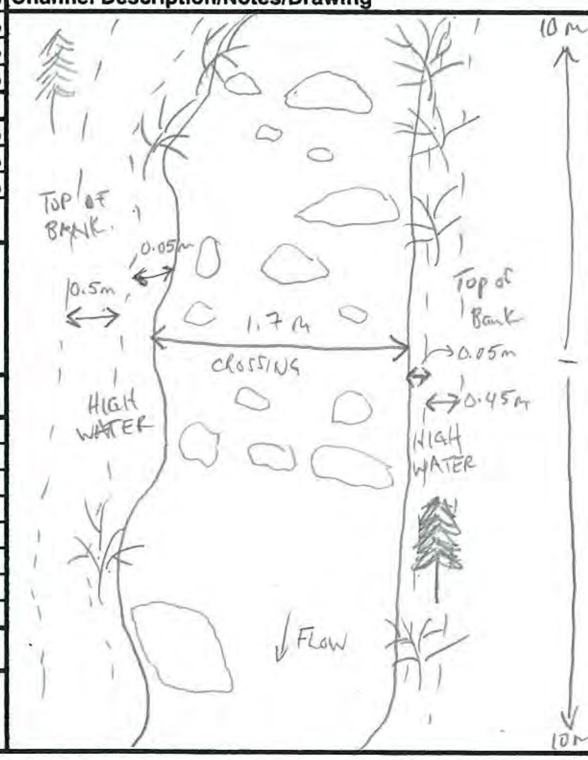
Miscellaneous

		Weather
High water mark	m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	8 °C	
Cloud Cover (5%)	80 %	
Wind Direction + speed (km/h)	5 kph E	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	12.6			
Secchi Depth (m)	—			
Temperature (°C)	4.4			
pH	7.7			
Turbidity (TCU)	—			
Conductivity (uS/cm)	429			

Channel Description/Notes/Drawing



Landscape (Beyond 25 m Buffer) circle

Mixed Forest	(Coniferous Forest)	Roads
(Grasses)	Deciduous Forest	Cutlines
Re-growth forest	(Shrubs)	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	**Date** 24-Sep-14	**Time (24 H)** 14:00
e Tetcela mainstem	**Station** KP ~~86.8~~ 87.7	**Project** CZN C788
UTM NAD	**Upstream Northing** ~~679~~ 6812386	**Upstream Easting** ~~482668~~ 460241
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run ~~60~~ 90	Riffle 10	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / 16.3 / ~~42.7~~ m			Channel Width (m) 22.1 / / /				Unstable Banks (5%)		
Meander Frequency / / / / m			Regular / Irregular meanders				Bank slope (5°) L		R

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	5 %	Substrate (as cover)	85 %
Instream Cover (logs, etc)	5 %	Instream vegetation	5 %	Undercut Bank	5 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	10	-
% Clay	0	-
% Silt	0	-
% Sand	5	-
% Gravel	~~45~~	
% Cobble	40	
% Boulder	0	
Bedrock	0	-

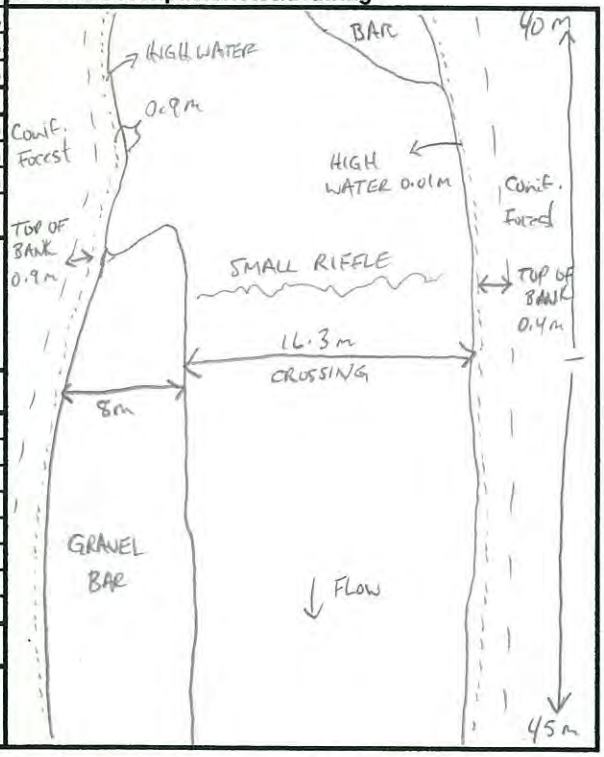
Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	10 %	Overhanging Trees	25 %
Overhanging Grasses	15 %	Overhanging Shrubs	25 %

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	8 °C	
Cloud Cover (5%)	100%	
Wind Direction + speed (km/h)	Calm	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	-			
Dissolved Oxygen (mg/L)	12.8			
Secchi Depth (m)	-			
Temperature (°C)	5.7			
pH	7.8			
Turbidity (TCU)	-			
Conductivity (uS/cm)	177			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	**Date** 24-Sep-14	**Time (24 H)** 16:30
Site Tetcela Trib.	**Station** At Old Road	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6813941	**Upstream Easting** 460369
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 50	Riffle 50	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 4.9 m			Channel Width (m) / . / 17.2			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) . L		R	

Instream Cover

Instream Cover (Detritus)	5 %	Instream Cover (Twigs/Sticks, etc)	5 %	Substrate (as cover)	80 %
Instream Cover (logs, etc)	5 %	Instream vegetation	0 %	Undercut Bank	5 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	5	-
% Clay	0	-
% Silt	0	-
% Sand	20	-
% Gravel	0	
% Cobble	40	
% Boulder	35	
% Bedrock	0	-

Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Overhead Cover

Overhead Litter <150 mm	5 %	Overhead Litter >150 mm (%)	5 %
Overhead Undercut Banks	10 %	Overhanging Trees	30 %
Overhanging Grasses	0 %	Overhanging Shrubs	10 %

Miscellaneous

High water mark	m	previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	8 °C	
Cloud Cover (5%)	90%	
Wind Direction + speed (km/h)	Calm	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	–			
Dissolved Oxygen (mg/L)	12.1			
Secchi Depth (m)	–			
Temperature (°C)	7.7			
pH	7.81			
Turbidity (TCU)	–			
Conductivity (uS/cm)	575			

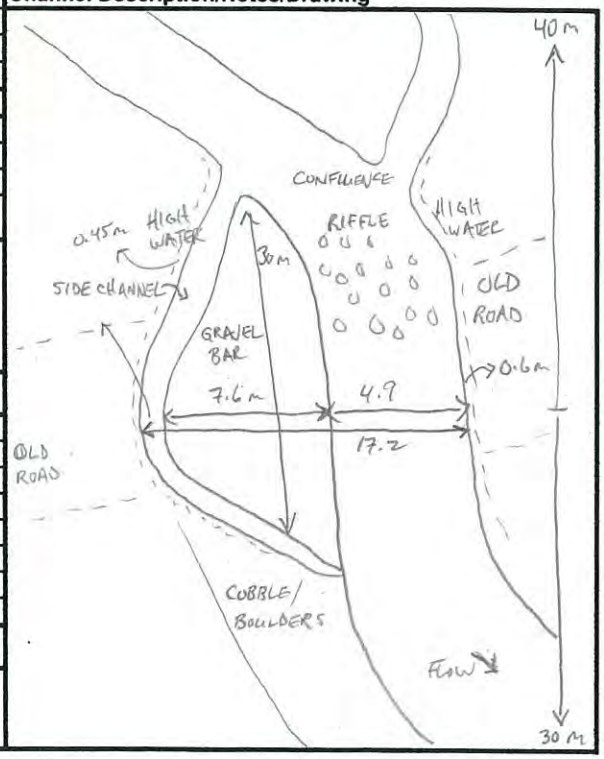
Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Channel Description/Notes/Drawing



Photos

Channel Features

	#	Dimensions
Islands		30m long x 7.6m wide
Bars	1	

Notes Lots of LWD washed up on LB, evidence of past flooding
Very little flow in side channel

Stream Habitat Information

Data Collectors CJ, DH	**Date** 24-Sep-14	**Time (24 H)** 17:15
te Tetcela mainstem	**Station** Old Road Crossing	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6815670	**Upstream Easting** 461370
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 90	Riffle 10	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 15.4 m			Channel Width (m) 25.4 / / /			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L R			

Instream Cover

Instream Cover (Detritus)	0 %	Instream Cover (Twigs/Sticks, etc)	0 %	Substrate (as cover)	0 %
Instream Cover (logs, etc)	2 %	Instream vegetation	10 %	Undercut Bank	0 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	5	-
% Clay	0	-
% Silt	0	-
% Sand	15	-
% Gravel	35	20
% Cobble	40	30
% Boulder	5	
% Bedrock	0	-

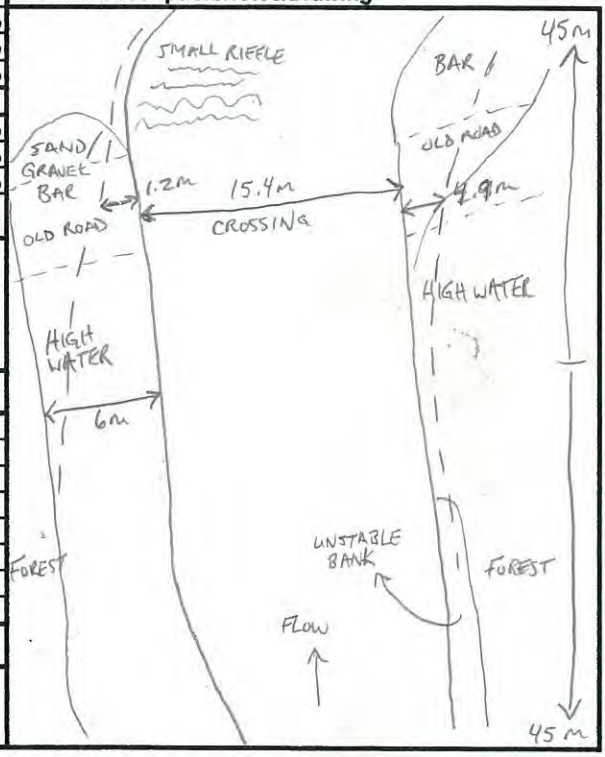
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	100 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	0 %	Overhead Litter >150 mm (%)	0 %
Overhead Undercut Banks	0 %	Overhanging Trees	10 %
Overhanging Grasses	0 %	Overhanging Shrubs	5 %

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	8 °C	
Cloud Cover (5%)	70%	
Wind Direction + speed (km/h)	Calm	

In situ Water Parameters

Sample Depth (m)	0.10			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	11.2			
Secchi Depth (m)	—			
Temperature (°C)	5.9			
pH	7.9			
Turbidity (TCU)	—			
Conductivity (uS/cm)	786			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	**Date** 25-Sep-14	**Time (24 H)** 18:45
Site GRAINGER TRIB.	**Station** KP 135.6	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6791279	**Upstream Easting** 482380
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run 50	Riffle 50	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width / / / 0.9 m			Channel Width (m) / / / 2.8			Unstable Banks (5%)			
Meander Frequency / / / / m			Regular / Irregular meanders			Bank slope (5°) L R			

Instream Cover

Instream Cover (Detritus)	40 %	Instream Cover (Twigs/Sticks, etc)	~~10~~ 5 %	Substrate (as cover)	~~20~~ 15 ~~20~~ %
Instream Cover (logs, etc)	0 %	Instream vegetation	0 %	Undercut Bank	~~10~~ 5 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	10	-
% Clay	0	-
% Silt	20	-
% Sand	10	-
% Gravel	50	
% Cobble	0	
% Boulder	20	
% Bedrock	0	-

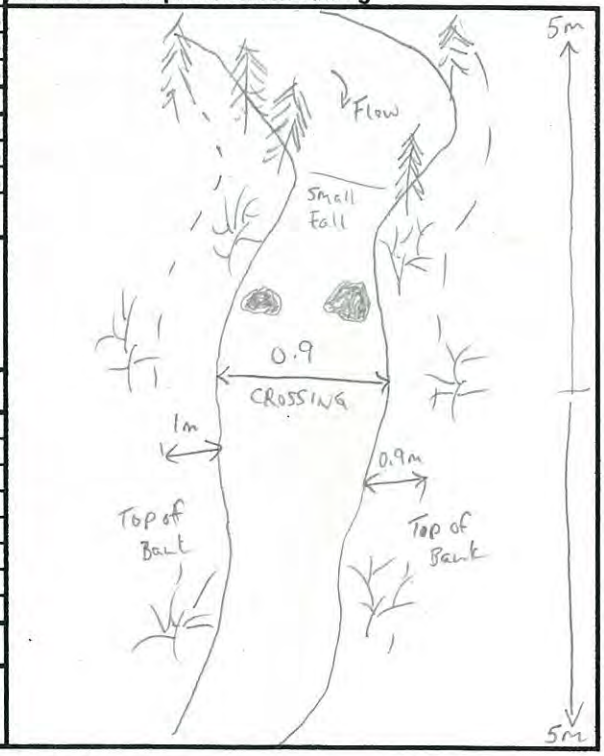
Instream Vegetaion (Sum 100%)

Rooted Emergent	%
Rooted Submergent	%
Rooted Floating	%
Free-floating	%
Floating Algae	%
Attached Algae	%
Periphyton	%
Filamentous	%
Aquatic Moss	%
Flooded Terrestrial Plants	%

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	%	Overhead Litter >150 mm (%)	%
Overhead Undercut Banks	%	Overhanging Trees	%
Overhanging Grasses	%	Overhanging Shrubs	%

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	5 °C	
Cloud Cover (5%)	100	
Wind Direction + speed (km/h)	calm	

In situ Water Parameters

Sample Depth (m)	0.05			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	12.6			
Secchi Depth (m)	—			
Temperature (°C)	4.5			
pH	8.2			
Turbidity (TCU)	—			
Conductivity (uS/cm)	490			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads	
Grasses	Deciduous Forest	Cutlines	
Re-growth forest	Shrubs	Hills	

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ DH	**Date** 26-Sep-14	**Time (24 H)** 11:00
Site Grainger Trib.	**Station** KP 136.7	**Project** CZN 6788
UTM NAD	**Upstream Northing** 6790094	**Upstream Easting** 483132
Access Heli.	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle 100	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width	/ / / 0.7 m		Channel Width (m)	/ . / 1.4			Unstable Banks (5%)		
Meander Frequency	/ / / / m		Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	5 %	Instream Cover (Twigs/Sticks, etc)	5 %	Substrate (as cover)	10 %
Instream Cover (logs, etc)	0 %	Instream vegetation	5 %	Undercut Bank	2 %

Woody Debris Description (log jams, fallen trees, beaver activity, etc)

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	10	-
% Gravel	0	—
% Cobble	80	30
% Boulder	10	50
% Bedrock	0	-

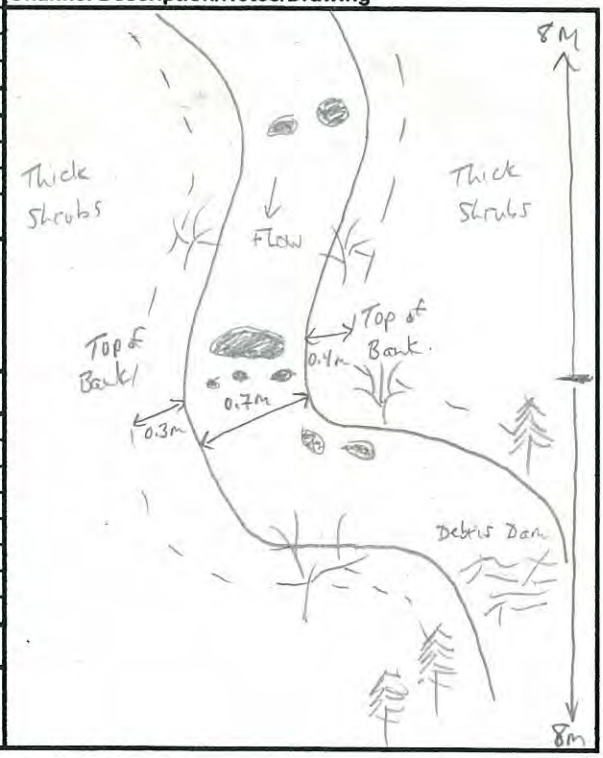
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	1 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	20 %
Filamentous	0 %
Aquatic Moss	80 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	2 %	Overhead Litter >150 mm (%)	3 %
Overhead Undercut Banks	2 %	Overhanging Trees	~~25~~ 5 %
Overhanging Grasses	5 %	Overhanging Shrubs	25 %

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	5 °C	
Cloud Cover (5%)	100 %	
Wind Direction + speed (km/h)	calm	

In situ Water Parameters

Sample Depth (m)	0.05			
Dissolved Oxygen (%)	—			
Dissolved Oxygen (mg/L)	11.8			
Secchi Depth (m)	—			
Temperature (°C)	5.7			
pH	7.9			
Turbidity (TCU)	—			
Conductivity (uS/cm)	462			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Stream Habitat Information

Data Collectors CJ, DH	**Date** 26-Sep-14	**Time (24 H)** 12:10
Site Grainger Trib.	**Station** KP ~~1311~~ 131.3	**Project** CEN 6788
UTM NAD	**Upstream Northing** 6794966	**Upstream Easting** 481988
Access Heli	**Downstream Northing**	**Downstream Easting**

Morphology

Stream Morphology Types (%)			Length (m)				Velocity (60% depth or surface)		
Run	Riffle 100	Pool	Depth Transect (m)	@ 25% width	50%	75%	25%	50%	75%
Fall	Other:		1						
Depth/Pool (m)			2						
Channel Slope (°)			3						
Wetted Width	/ / / 0.85 m		Channel Width (m)	/ . / 2.7m			Unstable Banks (5%)		
Meander Frequency	/ / / / m		Regular / Irregular meanders				Bank slope (5°)	L	R

Instream Cover

Instream Cover (Detritus)	2 %	Instream Cover (Twigs/Sticks, etc)	2 %	Substrate (as cover)	10 %
Instream Cover (logs, etc)	0 %	Instream vegetation	5 %	Undercut Bank	2 %
Woody Debris Description (log jams, fallen trees, beaver activity, etc)					

Substrate Composition (Sum 100%)

		Embed. (%)
% Organics	0	-
% Clay	0	-
% Silt	0	-
% Sand	20	-
% Gravel	20	10
% Cobble	30	10
% Boulder	30	50
% Bedrock	10	-

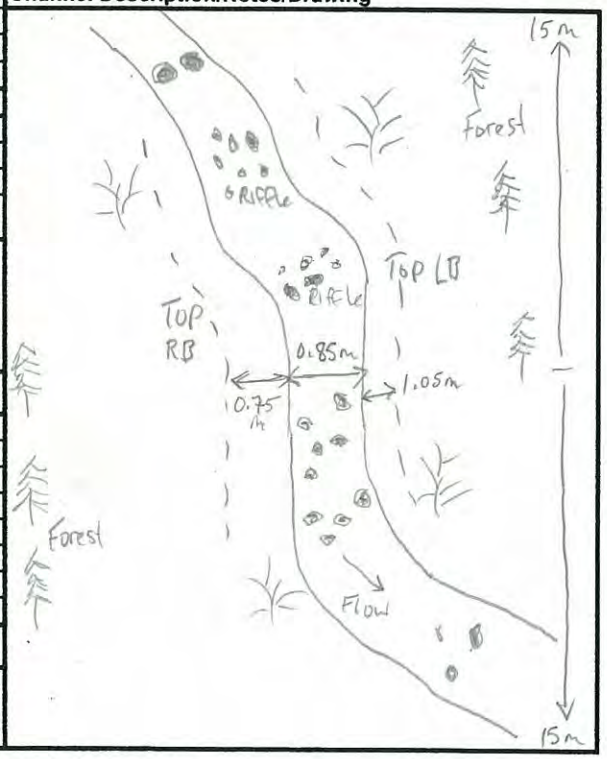
Instream Vegetaion (Sum 100%)

Rooted Emergent	0 %
Rooted Submergent	0 %
Rooted Floating	0 %
Free-floating	0 %
Floating Algae	0 %
Attached Algae	0 %
Periphyton	100 %
Filamentous	0 %
Aquatic Moss	0 %
Flooded Terrestrial Plants	0 %

Riprian Zone (25 m Buffer) circle

Mixed Forest	Coniferous Forest
Grasses	Deciduous Forest
Re-growth forest	Shrubs
Flooded	Sedges
Roads	Cutlines

Channel Description/Notes/Drawing



Overhead Cover

Overhead Litter <150 mm	%	Overhead Litter >150 mm (%)	%
Overhead Undercut Banks	%	Overhanging Trees	%
Overhanging Grasses	%	Overhanging Shrubs	%

Miscellaneous

High water mark	m	**Weather** previous 24 H
Flood Evidence (Debris on plants, etc)	m	
Air Temperature	5 °C	
Cloud Cover (5%)	100 %	
Wind Direction + speed (km/h)	3 kph E	

In situ Water Parameters

Sample Depth (m)				
Dissolved Oxygen (%)				
Dissolved Oxygen (mg/L)				
Secchi Depth (m)				
Temperature (°C)	5.2			
pH	7.8			
Turbidity (TCU)				
Conductivity (uS/cm)	457			

Landscape (Beyond 25 m Buffer) circle

Mixed Forest	Coniferous Forest	Roads
Grasses	Deciduous Forest	Cutlines
Re-growth forest	Shrubs	Hills

Visible Disturbance circle

Surface Debris	Culvert
Beaver Dam	Weir
Collapsed Bank	

Photos

Channel Features

	#	Dimensions
Islands		
Bars		

Notes

Attachment C

Hydrology Field Datasheets

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 50.2
Reach:	-
UTM:	

	Initials	Date
Field Personnel:	CJ, BH	21-Sep-14
Data Entry:	CJ	21-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
RB HW	0.5	0.959				
1	1.00			0.969		
2	1.2			1.229		
Top of RB	2.4			1.322		
RB	3.1			1.648	WL = 0.187 cut	
in channel	3.3			2.194	= 0.280 cut	
in channel	3.5			2.288	= 0.206 cut	
in channel	3.9			2.217		
Top LB	4.1			1.614		
	4.6			1.351		
	5.7			1.243		
	6.4			1.400		
	6.9			1.485		
LB HW	7.2			1.343		
DS 1	6 DS			2.737		
DS 2	10 DS			3.050		
US 1	5 US			1.949		
US 2	10 US			1.604		

Notes:

HW = high water mark

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	0,35	0	
LB	0,74	0.02	
1	0,37	0,22	0.113
2	0,43	0.27	0.120
3	0,52	0,30	0.012
4	0,64	0.25	0.001
5	0,71	0.18	0.0

Flow Measurement Details:	
Start Time:	10:20
End Time:	10:30
Method:	Wading
Equipment:	ADV
River Condition:	Low flow
Weather:	Cloudy, calm, 10

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 47.0
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	21-SEP-14
Data Entry:	CJ	21-SEP-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
LB HWL	11.2	1.176				
1	8.8			1.238		
2	7.6			1.357		
3	7.2			1.315		
4	7.0			1.140		
5	6.3			1.122		
Top of LB	5.5			1.244		
Mid LB	5.0			1.645	cut 1.135	
In channel	4.9			1.954	0.210	
"	4.75			2.033	0.120	
"	4.5			1.977		
RB Mid	4.4			1.644		
Top RB	3.8			1.317		
	3.1			1.126		
	2.2			1.140		
	1.7			0.905		
	1.3			0.858		
DS 1	DS 5m			2.180		
DS 2	12m			2.470		
DS 3	20			2.843		
US 1	7			1.829		
US 2	14			1.517		
US 3	22			1.198		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	4.4		
LB	4.95		
1	4.5	0.15	0.098
2	4.6	0.14	0.283
3	4.7	0.16	0.300
4	4.8	0.17	0.232
5	4.9	0.16	0.164

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 54.3
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	21-Sep-M
Data Entry:		
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
LB HW	7.3	2.275				
Bottom HW	6.8	~~2.602~~		2.602		
	6.2			2.464		
LB	5.9			2.533		
LB WL	5.6			3.149	cut = 0.110	
WL middle	5.1			3.209	= 0.195	
RB WL	4.4			3.207	cut = 0.195	
RB	4.0			2.470		
RB HW	~~4.8~~ 2.4			2.061		
DS 1	~~8~~ 10			3.546		
DS 2	22			3.781		
US 1	10			3.207		
	17			3.142		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	4.33		
LB	5.55		
1	4.4	0.11	0.036
2	4.6	0.13	0.042
3	4.8	0.16	0.038
4	5.0	0.16	0.046
5	5.2	0.17	0.035
6	5.4	0.16	0.003

Flow Measurement Details:	
Start Time:	~ 16:00
End Time:	16:10
Method:	Wading
Equipment:	ADV
River Condition:	Low flow
Weather:	Overcast, calm, 15

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	6788
Site Name:	KP 39.8 SUNDOG
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CT, DH	24-SEP-14
Data Entry:		
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
RB HW	2.00	1.351				
	3.4			1.646		
	4.6			2.057		
	6.2			2.285		
	8.7			2.448		
	11.9			2.468		
	15.0			2.300		
	17.9			2.214		
	19.2			2.229		
	21.2			2.378		
	24.4			2.012		
	26.8			1.911		
	28.5			1.889		
	28.7			1.945		
	31.3			1.528		
LB HW	32.3			0.979		
US 1	36			2.202		
	20			2.351		
CENTRE	0			2.363		
DS 1	27			2.791		
DS 2	55			3.763		

Notes:

No water in channel.

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	
Site Name:	ICP 27.5
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	22-Sep-14
Data Entry:	CJ	22-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
RB HW	-2.2	1.429				
Bottom HW ~~bank~~ bottom	0.4			1.998		
	1.1			2.388		
	1.8			2.556		
RB edge	2.7			2.745		
channel ~~middle~~	3.8			2.889	cut = 0.15	
channel ~~mid~~	4.3			3.031	= 0.30	
channel ~~LB~~	5.3			3.023	= 0.32	
	6.3			2.817	= 0.08	
LB edge	8.4			2.670		
	11.3			2.453		
	14.3			2.324		
bottom	18.8			2.063		
LB HW ~~bank~~	22.2			1.930		
LB HW	22.7			1.678		
← DS 1 (top of fall)	13			3.584		
~~DS 2~~	~~37~~					
~~DS of pool~~				€		
us 1	14			2.543		
us 2	23			2.079		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	2.9		
LB	7.9		
1	3.7	0.14	0.604
2	4.2	0.26	0.135
3	4.7	0.26	0.325
4	5.2	0.21	0.790
5	6.1	0.15	0.120

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

RB to 1st measurement, no flow - boulders.

5th measurement to LB, no flow.

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	
Site Name:	Kp 154.4
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	23-Sep-14
Data Entry:	CJ	23-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
RB Hist HW	0.0	1.565				
	0.6			1.878		
RB HW	0.8			2.134		
WL RB	0.9			2.315	cut = 0.04	
WL	1.3			2.335	cut = 0.06	
WL	1.55			2.356	cut = 0.08 =0.05	
WL LB	1.85			2.326		
LB HW	1.9			2.142		
CJ ~~LB Hist HW~~	2.6			1.650		
LB Hist. HW	3.0			1.547		
DS 1	5.0			2.549		
DS2	9.0			2.817		
				~~2.148~~		
US1	7.0			2.148		
US 2	12.0			1.879		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	1.1		
LB	1.9		
1			
2			
3			

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 122.8
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	23-Sept-14
Data Entry:	CJ	23-Sept-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
Top of LB	0.5	0.812				
	1.0			1.091		
LB HW	1.25			1.381	~~0~~	
LB edge	1.2			1.545	cut = 0.~~07~~0	
in channel	1.8			1.764	= 0.295	
"	1.6			1.522	= 0.05	
"	2.1			1.591	= 0.11	
	2.4			1.690	= 0.215	
~~RB edge~~	2.5			1.609	= 0.14	
	2.6			1.688	= 0.21	
RB edge	2.7			1.699	= 0.22	
RB HW	2.7			1.310		
	2.9			0.971		
Top of RB	3.4			0.849		
US 1	15			1.590		
US 2	19			1.479		
DS 1	6			1.963		
DS 2	-3			2.089		
DS 3	-14			2.060		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	2.8		
LB	1.1		
1	1.3	0.15	0.003
2	1.5	0.21	0.132
3	1.7	0.13	0.123
4	1.9	0.12	0.082
5	2.1	0.13	0.019
6	2.3	0.24	0.029
7	2.5	0.18	0.0

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	123.7
Reach:	
UTM:	

	Initials	Date
Field Personnel:	DH, CJ	23-Sep-14
Data Entry:	CJ	23-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
Upper Floodplain LB ~~HW~~	0.0	1.527				
LB HW	0.7			1.572		
HW bottom	0.9			1.911		
	1.8			2.292		
LB edge	2.6			2.449		
in channel	3.3			2.605	cut = 0.139	
"	3.8			2.654	= 0.20	
"	4.4			2.601	= 0.14	
"	5.1			2.707	= 0.21	
"	5.7			2.552	= 0.06	
"	6.0			2.703	= 0.190	
"	6.7			2.758	= 0.27	
"	7.1			2.681	= 0.19	
"	8.0			2.589	= 0.09	
RB edge	8.7			2.510		
Bar	10.0			2.348		
"	11.0			2.187		
"	12.5			2.306		
Bar Side Channel	13.4			2.716		
"	14.2			2.816		
"	15.2			2.768		
"	15.8			2.611		
~~Bank~~ RB HW	16.0			2.487		
	16.5			2.087		
Upper Floodplain	17.0			1.944		
US 1	16.0			2.522		
US 2	34.0			2.500		
DS 1	19.0			3.052		
DS 2	40.0			3.755		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
LB	3.0		
RB	8.85		
1	3.6	0.10	0.366
2	4.2	0.10	0.954
3	4.8	0.15	0.189
4	5.9	0.16	0.142
5	6.3	0.21	0.436
6	6.7	0.23	0.468
7	7.4	0.15	0.034
8	8.0	0.09	0.362

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CEN 6788
Site Name:	KP 125.1 (Groundage)
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, JA	23-Sept-14
Data Entry:		
Data Check:		

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
upper Floodplain	0.0	1.144				
"	0.65			1.088		
LB HW	1.6			1.724		
~~LB edge~~	2.4			2.685		
LB edge	5.1			2.467		
in channel	6.0			2.600	cut = 0.12	
"	8.6			2.763	= 0.29	
"	7.2			2.786	= 0.20	
"	7.9			2.758	= 0.28	
"	8.6			2.608	= 0.11	
~~RB edge~~	10.0			2.508	= 0.02	
RB edge ~~RB edge~~	~~tork~~ 11.2			2.461	= ~~0.80~~	
	12.5			2.437		
RB HW	13.7			2.086		
BEDROCK FACE ~~RB HW~~	14.5			1.520		
US 1	24			2.508		
US 2	33			2.545		
DS 1	18			2.722		
DS 2	33			3.068		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
LB	5,2		
RB	10,0		
1	6,3	0,16	0,112
2	6,5	0,20	0,025
3	6,7	0,25	0,163
4	6,9	0,27	0,370
5	7,1	0,25	0,426
6	7,3	0,28	0,485
7	7,5	0,24	0,540
8	7,7	0,25	0,530
9	7,9	0,19	0,462
10	8,1	0,18	0,320
11	8,45	0,06	0,191

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 133.7
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	24-Sep-14
Data Entry:	CJ	24-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
Top RB	0.90	1.224				
RB HW	1.4			1.673		
RB edge	1.45			1.858		
in channel	1.6			1.964	cut = 0.14	
"	1.7			1.871	= 0.04	
"	1.9			1.936	= 0.095	
"	2.0			2.014	= 0.18	
"	2.3			1.968	= 0.14	
"	2.6			1.983	= 0.16	
LB edge	3.0			1.889	= 0.05	
LB HW	3.05			1.651		
CB Top Bank	3.5			1.308		
				~~1.993~~ 1.993		
US 1	6.0			1.951		
US 2	11.0			~~2.412~~		
				~~2.947~~ 2.412		
DS 1	5.0			2.947		
DS 2	8.0					

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
LB	3.05		
RB	1.4		
1	2.1	0.06	0.093
2	2.35	0.13	0.253
3	2.6	0.11	0.063
4			

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 87.7
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	24-Sep-14
Data Entry:	CJ	24-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
RB Top	2.7	0.536				
RB HW	3.6			0.982		
RB edge	4.5			1.478		
RB WL edge	10.3			1.501		
In channel	14.9			1.567	cut = 0.03	
"	17.0			1.671	= 0.01	
"	19.8			1.774	= 0.18	
"	22.5			1.817	= 0.02	
"	23.2			1.840	= 0.23	
"	24.5			1.748	= 0.16	
"	25.8			1.779	= 0.20	
	26.3			1.841	= 0.26	
LB WL edge	26.6			1.825	= 0.24	
LB HW	26.6			1.166		
~~LB Top~~	27.6			0.065		
Top ~~Channel~~ LB	28.0			0.048		
US1	23			1.550		
US2	39			1.529		
DS1	18			2.061		
DS2	43			2.407		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	9.9		
LB	26.6		
1	16.3	0.05	0.753
2	17.3	0.12	0.678
3	18.3	0.13	0.788
4	19.3	0.12	0.952
5	20.3	0.16	0.688
6	21.3	0.16	0.747
7	22.3	0.16	0.934
8	23.3	0.19	0.424
9	24.3	0.15	0.445
10	25.3	0.14	0.255

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	Old Road at Tsitsela Trib.
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	24-Sep-14
Data Entry:	CJ	24-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
LB Top Bank	0.0	1.178				
	0.3			1.425		
LB HW	0.5			1.879		
LB WL edge	1.1			2.249		
in channel	2.5			2.525	cut = 0.27	
"	3.6			2.615	= 0.36	
"	4.3			2.653	= 0.41	
RB WL edge	6.0			2.249		
Gravel bar	7.4			2.010		
"	10.4			1.877		
"	11.6			1.525		
"	13.0			1.499		
LB HW	13.6			1.838		
WL edge	14.3			1.952		
in side channel	15.3			2.046	= 0.09	
"	15.9			2.133	= 0.17	
RB WL edge	16.6			2.028		
RB HW	16.75			1.585		
	16.85			1.395		
RB Top Bank	17.2			1.295		
US 1	17			2.227		
US 2	25			1.665		
DS 1	14			2.471		
DS 2	32			2.690		

Bar { LB

side channel {

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	6.0		
LB	1.05		
1	1.7	0.09	0.033
2	2.1	0.08	0.023
3	2.6	0.28	0.039
4	2.95	0.22	0.042
5	3.5	0.32	0.074
6	3.8	0.39	0.103
7	4.3	0.39	0.082
8	4.85	0.24	0.101
9	5.4	0.16	0.111
~~LB~~	~~14.3~~ BAR		
10	15.1	0.05	0.010
RB	16.3		
LB	14.3		

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	Old Road at Tetcela mainstem
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	24-Sep-14
Data Entry:	CJ	24-Sep-14
Data Check:		

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
RB Top Bank	0.6	0.806				
	2.2			1.183		
RB HW	2.9			1.515		
RB WL edge	7.8			2.140		
in channel	11.7			2.248	cut = 0.100	
"	13.6			2.292	= 0.15	
"	17.4			2.339	= 0.20	
"	20.2			2.401	= 0.28	
"	21.9			2.374	= 0.26	
LB WL edge	23.1			2.127		
LB HW	24.3			1.789		
	25.4			1.342		
LB Top Bank	26.0			1.259		
DS 1	16			2.339		
DS 2	31			2.555		
US 1	19			2.432		
US 2	31			2.424		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	7.9		
LB	22.9		
1	9.2	0.05	0.173
2	10.7	0.06	0.362
3	11.9	0.14	0.315
4	13.2	0.13	0.534
5	14.6	0.12	0.513
6	15.9	0.14	0.519
7	16.9	0.16	0.525
8	17.9	0.17	0.578
9	18.9	0.20	0.636
10	19.9	0.22	0.680
11	20.9	0.21	0.576
12	21.9	0.20	0.451

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 135.6 (GRAINGER TRIB)
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	25-Sep-14
Data Entry:	CJ	25-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
Top LB	0.6	1.819				
LB HW	1.25			2.395		
WL edge	1.3			2.[illegible]	cut = 0.095	
In channel	1.5			2.592	= 0.055	
RB edge	1.8			2.565	= 0.025	
HW	1.8			2.338		
	2.3			1.800		
RB Top	2.8			1.563		
DS1	6.0			2.885		
DS2	11.0			3.176		
US1	5.0			2.154		
US2	10.0			1.995		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
RB	1.9		
LB	1.0		
1	1.6	0.10	0.104
2	1.8	0.086	0.229
3	1.3	0.103	0.212

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 136.7
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	26-Sep-14
Data Entry:	CJ	26-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
Top LB	0.7	1.340				
HW	1.05			1.708		
WL edge	1.1			1.828	cut = 0.05	
in channel	1.35			1.891	= 0.015	
"	1.6			1.878	= ~~0.065~~ CJ 0.1	
WL edge	1.8			1.830	= 0.05	
HW	1.9			1.691		
Top RB	2.1			1.550		
US 1	4.0			1.675		
US 2	8.0			1.118		
DS 1	5.0			2.146		
DS 2	8.0			2.610		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
LB	0.95		
RB	1.75		
1	1.2	0.08	0.238
2	1.1	0.08	0.036

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Hatfield Consultants Hydrometric Visit Fieldsheet

Project:	CZN 6788
Site Name:	KP 131.3
Reach:	
UTM:	

	Initials	Date
Field Personnel:	CJ, DH	26-Sep-14
Data Entry:	CJ	26-Sep-14
Data Check:		

Hatfield CONSULTANTS

Cross-Section/Longitudinal Reach Survey:

Mmt:	Offset	BS (m):	HI (m):	FS (m):	Elevation (m):	Photo?
LB Top	~~0.15~~ 0.5	1.518				
	~~3.65~~ 1.1			1.702		
HW	1.5			2.099		
WL edge	1.55			2.357	cut = 0.05	
in channel	1.9			2.439	= 0.12	
"	2.0			2.433	= 0.13	
WL edge	2.45			2.308	= 0.02	
HW	2.85			2.127		
RB Top	3.2			1.831		
DS 1	8.0			2.699		
DS 2	15.0			2.943		
US 1	5.0			1.955		
US 2	11.0			1.395		

Notes:

Flow Measurement:			
Mmt:	Offset	Depth (m):	Velocity (m/s):
LB	1.55		
RB	2.1		
1	1.7	0.09	0.091
2	1.85	0.10	0.007
3	2.0	0.10	0.188
4	2.2	0.04	0.377

Flow Measurement Details:	
Start Time:	
End Time:	
Method:	
Equipment:	
River Condition:	
Weather:	

Flow Measurement Notes:

Attachment D

Scanned Field Note Book

CONTENTS

PAGE	REFERENCE	DATE

CZN 6788 25 July '14 ①

Purpose: Trip up to mine.
Left Vancouver @ 9:15 on central mountain air. Transfered to Villers early afternoon. Arrived @ mine before dinner. Dave + I on CMA, Earnie + Brian (road engineering technicians) joined us @ Ft Nelson. Garry Scrimgeour arrived at dinner. General safety orientation and ATV orientation Talked w/ Garry after dinner Eat about plan tomorrow.

Calibration of 02-2907AK

pre		post	23.1
7.01	6.63	7.11	
4.01	3.88	3.96	
1413	1245	1415	

02-4776AJ

pre		post	23.4
7.01	6.87	6.7.01	
4.01	4.09	3.97	
1413	1170	1415	

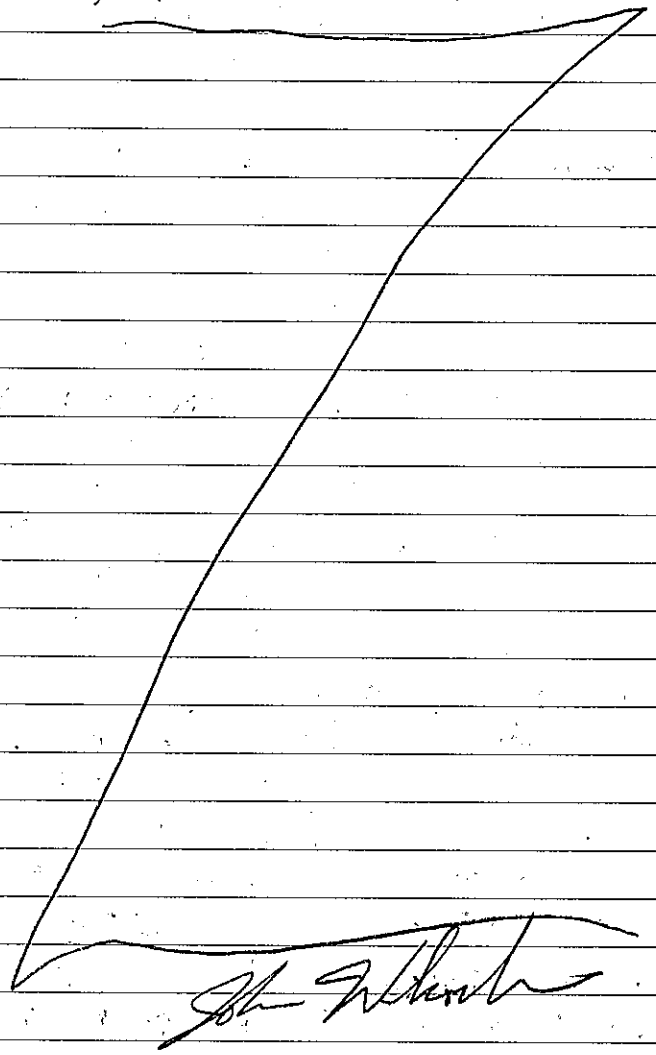
calibration solution info →

Rite in the Rain

(2) CZN6788 25 July '14

Hanna Calibration sachets

pH 4.01 Lot 6406 Exp 07 18
7.01 4628 Exp 06 17
1413 µS/cm 6111 Exp 05 18



(3) CZN6788 26 July '14

Purpose: Cabin sampling on Prairie

Crew: John W + Garry S.

Weather: Clear, cool in morning

leaving warehouse @ 8AM

Started d/s of mine closest to Harrison, so we were close to mine in case we forgot anything

~~Site~~ Parks Site 43 ≃ 3.1 km d/s and then proceeding to site 46 and site 44, which is just upstream of the confluence with Galeena Ck (which is also on the opposite side of Prairie). All sites had very low periphyton densities. Finished about 2pm. For the benthos used the bucket rince approach, discarding the heavy sand/gravel substrate. Next sampled 47, which is located at the southern

JW

most corner of the water storage pond. Then 73, which was just d/s of the AEMP reference location while at the site, walked upstream to last years' sampling location and noted a ~~strong~~ substantial increase in periphyton density on rocks. 13PC-Ref is just upstream of a confluence of a small stream. Water appears to be entering Prairie Creek through coarse material u/s of the confluence. Garry noted damp soil + water between rocks on left bank of Prairie, apparently from the trib. Garry suggested assessing nutrients from the trib and Prairie in a couple locations in an attempt to characterize natural variability of nutrients in Prairie Ck. Next Stn 72 ~1 km S of Casket Ck.

GW

Periphyton was still very low, but slightly higher than most d/s locations. This site may also received some influence from a trib. Noted "dr Seuess" flowers in bloom in flood plain. Never seen these before, suggesting that warm dry summer thus far, may be advancing growth/maturity of local natural systems. Took a photo.

CZN6788 27 July'14

Purpose: First day of Road assessment - Sundog to Cat camp + Polge (Bubbling Springs) Ck. Electrofishing Sundog + net/trap mosquito

Crew: John, Dave, Garry + Jon

Electrofishing settings ~~used in past~~ last year 425v ± 25v 30HZ
~~Duty cycle~~ 12% (Neal)
US: sculpin - 400v 50HZ 20DC
Trout - 40 HZ

Km 44 look at potential migration barrier prefer culvert over bridge.
Km 35-38 - possible re-alignment, shocking here.
Trib to Polge (bubbling springs)

Km 24 - falls
wp 10 drop of electrofishing gear. ~Km 36

Tetsela
44 fish migration barrier 47-49 alignment

GW

CZN6788 27 July'14 (7)

WP 11 Catcamp
431569
6829953
Km 43 Crossing WP 012

WP 13 Trib to Sundog long Chute ~75m S
Photo + Photo north ~150 m long against black colored cliff 10° slope ~12° further upstream in chute

0831295
6830730
WP 14 Downstream pool, ~~Dave~~ saw fish ~10cm upstream of pool ~10° Furthest D/S point

WP 15 S N, WP ~~17~~ 16 S N W pool
WP 17 S N WP 18 S N (not recorded)

1215 @ Sundog Ck realignment location #1
pH ~~9.5~~ 7.6°C 221 µS (AJ)
GW pH 8.60 8.68°C 260 µS (AK)

upstream riffle flows / depths

		depth	flow
Top	25	22cm	.29
~~Mid~~	50	40cm	.75
~~bottom~~	~~75~~	26 cm	.61
Mid	25	32cm	.59
	50	46cm	.97
	75	22	.27
Bottom	25	28	.92
	50	32	1.20
	75	42cm	1.06

DO on meter 11.20 mg/L
94.8%

DO titration 10.8 mg/L

WP22 Sundog goes to ground.

Second sundog realignment site (Location ~~#2A~~ ~~Site A~~)

Top wpt 023 426356
6829278

Bottom WP 024 426418
6829265

Cond 268 µS / 9.1°C / 7.40 (AK)

DO meter 99.4% 11.83 mg/L
pH 8.63 7.4°C 233 µS (AJ)
DO titration 10.2 mg/L

second sundog realign site
Location B

Top wpt 025 426255
6829318

Bottom wpt 026 426323
6829305

End ~ 1635.

Pilot late picking us up - decided to send just Garry + Dave to sundog trib to electrofish 1730 - 1815
back @ camp about 1835

For the sundog allignment locations, Jon and I did habitat sheets, while Garry + Dave electrofished

A sundog 1, ~~site A~~ 1348sec
ARGR FL (mm): 190, 183, 181, 192
SLSC FL (mm): 81, 92, 93, ?

Rite in the Rain

Settings for sites ~~A + B~~ 1 + 2
500v, freq: 50

For the Sundog Alligment, site 2
d/s location ("A") - no fish 327 sec
u/s " ("B") - no fish 188 sec

For trib to Sundog (visited earlier in day)
724 sec
wp 27 (431594 / 6829949)
to wp 28 (431514 / 6829743)
assume Sinuosity of 2.0
assume wetted width 2.5m

CZN 6788 28 July '14

Purpose:- habitat ass @ Polje Creek crossings + assess trib. Trapping near outlet of Mosquito. + Flying much of road alligment where ~~cros~~ there are crossings.

Crew:- Dave H, Gary S, Jonathan T, John W.

Broken high overcast took off @ 742.

Road allignment from air photos

~~WP 28~~

Picked up gear (nets + traps) + dropped at "dry" lake near polgi ck - then dropped ~~two~~ people in at a time to Polgi Ck. ~ km 53
WP 28 is landing spot created log landing pad.
Walked to two small trib to west - second trib

not flowing + no defined channel ~~grass~~ moss, ~~sed~~ shrubs + holes w/ logs. walked further 100 m to confirm that second channel was not missed (WP29, 277 m from landing site). Area. Photo WNES Labrador tea, dwarf spruce, lichen, moss, horsetail. Larch (?)

2nd stream west WP30 photo WNES (before this photo)

Following road back looking for tribs

WP 33 small defined channel < 1m wide

WP 34/35 larger trib gushe encised dead + falling trees in channel

WP 36 small defined channel < 1m wide

WP 37 another small channel < 1m wide (photo just before

last 3 photos WP39

JW

WP 34/35 likely green dot on map km 46.5

last 4 photos WP40

Polgyes

Tetsela - last photo first crossing

Next photos second crossing WP 41

Fish trap - last few + next few WP 42

Flow ~0.02 m/s (garry's estimate

Pen: 20.3°C 589 µS pH 8.08

YSI (DO calibrated) 19.7°C 11.3 mg/L 124% O_2 Sat pH 8.54 476 µS

Water striders noted on surface Gary said that they are a good indicator for fish absence, since they get hammered by fish. Gary also believes that DO of Fish Trap would be much lower at night when aquatic plants start using O_2.

JW

CZN6788 28 July 14

Sampling site WP 043
Bank height ~ 1m
DO titration 9.8 mg/L
1345 finish
- collected nets + minnow traps + fish cat on way back.
- Took multiple photos of ~~wall~~ Sundog Creek realignment
- Back @ camp ate lunch + downloaded photos.
- went out w/ Dave to look @ Casket Ck comp habitat opened up some channels, saw a young grizzly.
Then to water storage pond. took 4 cores for geoteck purposes.

CZN6788 29 July 14

Purpose: Flying road east of park to characterize # crossings

Crew: John W., Dave, H + Brian + Eamie from AllNorth

Broken cloud ~ 80%
Departing 8 AM.
using blue camera w/ gps
Road engineers looking at Tetsela + Fish trap
Exploring new route east of silent hills, higher elevation :: less/ smaller stream crossings (photo before) + after - draws, but brush too dense to see water.
→ Grange gap + back
two large moose, then
stream ~ 3-4m wide,
new route is close to 104 + km10 but further west - prefer top of ridge to hill side - East slopes typically more unstable

Rite in the Rain

Checking out airstrip
WP 051
wetland lots of beaver dams, instream veg. flow not some loss of connectivity, Iron sheen observed in some locations - crossing to south -
Granger gap dropped off + walking west to culvert crossing of wet land WP 52/53 as close as we can get to channel south of Granger Lake, wet dont have waders on.
0948, May take road south to avoid channel from Granger Lake channel + bottom of fan.
- Signs of beaver activity (trails) + moose foot prints
54 - Fan - mostly dry except near Granger some surface flow Flow of Granger appears to double as it passes fan = lots of sub surface flow.
On south side flow coming out from draw next to cliff WP 055

JW

From refuling will take a look at 2 wetland crossings
Inlet to Granger Lake comes from beaver impounded lake some riffle + some swampy low flow (in middle).
Downstream Granger gap river crossing.
WP 56
KM 137
138
WP 57 defined channel <1m
58 " " <1m
59 dry stream
60 small stream
61 outwash from slope

Refuling again at 1227
1249 take off
start 138km
141 1/2 km (took photo of)
WP 062 bridge.
Last photo KM 151 - mostly dry fan - some standing water amongst tall trees.
(WP 63)

JW

(18) CZN6788 29 July '14

Battery just about dead on blue camera

144 km

wp 65 <154km

wp 68 crossing [illegible] just downstream in rock crossing

wp 69 crossing of Liard

Km 163 Km 165.5

Km 164 Km 168.4

Km 172.2

1430 - finish w/ helicopter wait till 1680 for Islander out of Nahanni Butte.

1700 take off arrive 1830 mountain time

Overnight in Fort Nelson

~~1515 Pacific~~ f

1315 pacific flight (central mountain air) home next day

Rite in the Rain

(20) CZN 6788 21-SEP-14

CHRIS JAEGGLE

DAVID HARPLEY

- DEPARTED MINE AT 8:30.
- ARRIVED AT KP 50.2 (TRIBUTARY TO POLJE)
  - FLOW MMT, CROSS SECTION AND REACH SURVEY.
  - HABITAT ASSESSMENT.

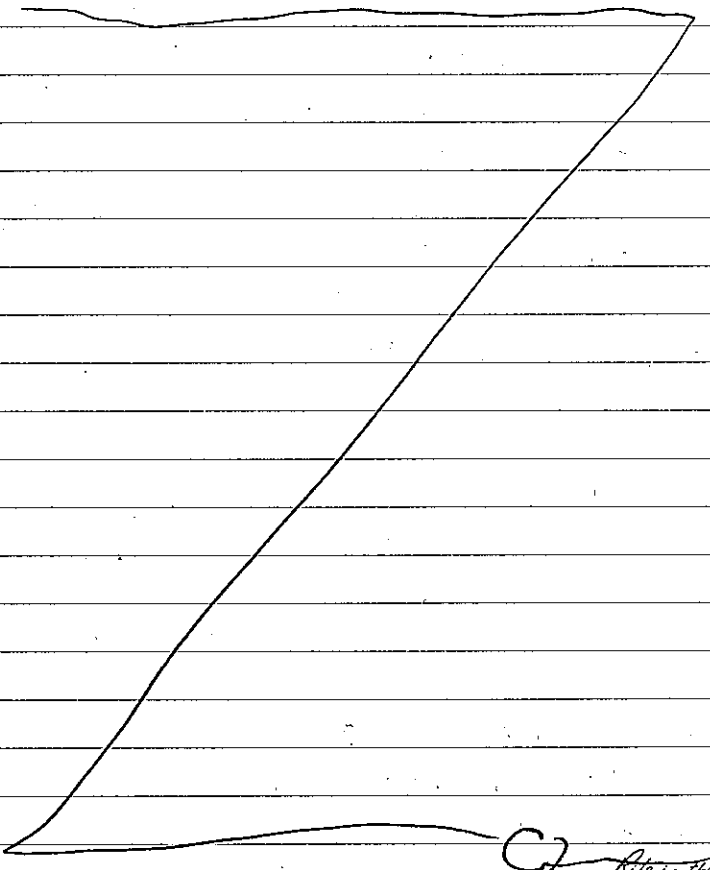
- ARRIVED AT KP 49.1 CROSSING (POLJE TRIB.)
  - NO ASSESSMENT NEEDED - ALL FLOW GOES INTO GROUND (UNDER SLOUGHED BANKS) - NOT FISH BEARING CREEK!

- ARRIVED AT KP 49.4.
  - NO VISIBLE WATER FLOWING INTO MAIN POLJE CHANNEL - NO ASSESSMENT.
- PICKED UP BY HELICOPTER.

- ARRIVED AT KP 46
  - NO WATER - NO ASSESSMENT.
- ARRIVED AT KP 47.
  - FLOW MMT, CROSS-SECTION AND REACH SURVEY.
  - HABITAT ASSESSMENT
- ARRIVED AT ~~KP 54.3~~ KP 54.3 (POLJE MAIN CHANNEL).
  - FLOW MMT, CROSS SECTION AND CHANNEL SURVEYS.
- ARRIVED AT 54.4.
  - SEDIMENT SAMPLING.

(21)

- PICKED UP BY HELI.
- ARRIVED AT KP 39.8 (SUNDOG).
  - COMPLETELY DRY, INCLUDING SUNDOG MAIN CHANNEL.
  - CROSS SECTION AND REACH SURVEYS.
  - PARTIAL HABITAT ASSESSMENT (SEE FIELD SHEET).
  - COLLECTED SEDIMENT SAMPLES.
- RETURNED TO MINE AT 19:00.



(22) CZN 6788 22-Sep-14

CHRIS JAEGGLE

DAVID HARPLEY

- HAD TO WAIT FOR REPLACEMENT HELICOPTER FIRST THING IN THE MORNING (BROKEN FUEL PUMP ON 407 SO AN ASTAR BEING SENT).
- FIRST CREW DEPARTED IN ASTAR AROUND 10^{30}.
- WHILE WAITING, RECEIVED CALL SAYING THAT DUE TO HIGH WINDS THE HELI. WAS GROUNDED.
- AROUND 2^{30} (14^{30}) DAVID AND I DECIDED TO GO TO SUNDOG CREEK VIA ATV.
- ARRIVED AT KP 27.1 AFTER HIKING FROM ATVs (PARKED AT 26 KM DUE TO LANDSLIDE ACROSS ROAD).
- ~~HT~~ - HABITAT ASSESSMENT.
- HIKED TO KP 27.5.
  - HABITAT ASSESSMENT.
- HIKED TO KP 28.4,
  - FLOW MMT, CROSS SECTION AND REACH SURVEY, HABITAT ASSESSMENT.
- HIKED BACK TO ATVS AND THEN DROVE BACK TO MINE.
- ARRIVED BACK MINE AT 21^{20}.

NOTE! Diss. O_2 not measured as one reagent spilled while on ATV - COULD NOT DO TITRATION.

(23) CZN 6788 23-SEP-14

CHRIS JAEGGLE, DAVID HARPLEY.

- LEFT MINE IN HELI AT ~ 8^{45}.
- STOPPED AT KP 27.5 (SITE FROM YESTERDAY)
  - COLLECTED D.O. SAMPLE → 10.8 mg/L.
- ARRIVED AT KP 29.2 (SUNDOG CREEK).
  - HABITAT ASSESSMENT AT CROSSING.
  - SEDIMENT SAMPLED.
  - PICKED UP BY HELI.
- ARRIVED AT KP 154.4 (LIARD TRIB.)
  - HABITAT ASSESSMENT, CROSS SECTION AND REACH SURVEYS. ONLY ONE VELOCITY MMT DONE DUE TO LARGE BOULDERS THROUGHOUT CREEK.
- PICKED UP BY HELI AND DROPPED AT KP 122.8 (GRAINGER TRIB.)
  - HABITAT ASSESSMENT, CROSS SECTION AND REACH SURVEY, FLOW MMT.
- PICKED UP BY HELI. AND DROPPED AT KP 123.7 (GRAINGER MAINSTEM).
  - HABITAT ASSESSMENT, CROSS-SECTION AND REACH SURVEY, FLOW MMT.
- HIKED TO KP 125.1 (GRAINGER MAINSTEM).
  - HABITAT ASSESSMENT, CROSS-SECTION AND REACH SURVEYS, FLOW MMT, SEDIMENT SAMPLING.
- RELOCATED TO NAHANNI BUTTE VIA HELI.

(24) CZN 6788 · 24-SEP-14

CHRIS JAEGGLE

DAVID HARPLEY

- LEFT NAHANNI BUTTE IN HELI.
- 8^{50} ARRIVED AT KP 133.7 (GRAINGER TRIB.)
  - HABITAT ASSESSMENT, FLOW MMT, CROSS SECTION AND REACH SURVEY.
- 14^{00} ARRIVED AT KP 87.7 (TETCELA MAINSTEM).
  - HABITAT ASSESSMENT, CROSS SECTION AND REACH SURVEY, FLOW MMT.
- 16^{30} ARRIVED AT ~~KP~~ "OLD ROAD AT TETCELA TRIBUTARY".
  - HABITAT ASSESSMENT, FLOW MMT, CROSS SECTION AND REACH SURVEYS, SEDIMENT SAMPLING.
- 17^{15} ARRIVED AT "OLD ROAD AT TETCELA MAINSTEM".
  - HABITAT ASSESSMENT, FLOW MMT, CROSS SECTION AND REACH SURVEYS, SEDIMENT SAMPLING.
- ON FLIGHT BACK TO NAHANNI BUTTE, STOPPED AT "FISHTRAP" AND "UNNAMED CREEK" TO COLLECT WATER QUALITY SAMPLES AND PERFORM IN-SITU MMTS.
- ARRIVED BACK IN NAHANNI BUTTE AT 19:30.

CJ

(25) CZN 6788 24-SEP-14

CHRIS JAEGGLE

DAVID HARPLEY

~~H~~ IN-SITU WATER QUALITY MEASUREMENTS NOT ON FIELDSHEETS:

- FROM FISHTRAP SITE:
  - pH: 7.87
  - Temp: 11.4 °C
  - Conductivity: 810 µS
  - Diss. O_2: 12.0 mg/L
- From Unnamed Creek:
  - Diss. O_2: 9.8 mg/L

CJ

Rite in the Rain

(26) CZN 6788 25-Sep-14

CHRIS JAEGGLE

DAVID HARBLEY.

LIARD RIVER US RB SURVEY.

MMT	OFFSET ~~REF~~	READING	NOTE
TOP RB	~~-3.5~~	0.081	
	-1.9	0.474	
HW	-1.3	0.989	
	3.8	2.009	
	13	3.199	
	24	4.725	
WL	38	6.071	
	LB SURVEY		
~~TOP~~ HW	-1.0	0.161	
	0.2	1.613	
	2.0	2.233	
	7.0	3.610	
	17	4.971	CJ
WL	35	5.674	

CJ

(27) CZN 6788 25-Sep-14

CHRIS JAEGGLE

DAVID HARBLEY.

- 8[10] DEPARTED NAHANNI BUTTE VIA HELI.
- WEATHER DICTATED THAT WE RETURN, DUE TO LOW CEILING AND LOW TEMP (FREEZING RAIN POSSIBLE).

- DECIDED TO PERFORM LIARD BATHYMETRY SURVEY INSTEAD OF HELI SITES. DEPARTED VIA BOAT AROUND 10[30].
- PERFORMED BATHYMETRY OF CROSSING (AND OPTIONAL) AREAS WITH DEPTH SOUNDER.
  - DEPTH SOUNDER OFFSET = 0.148 m
- PERFORMED BANK SURVEYS ON LB AND RB OF MAIN PROPOSED CROSSING AREA (SEE DATA ON PG 25).
- DURING BATHYMETRY SURVEY, ALSO RECORDED SIMULTANEOUS PHOTOS AND GPS WAYPOINTS (LABELLED "1B to 19B").
- RETURNED TO NAHANNI BUTTE AROUND 14[30] TO WAIT OUT WEATHER.
- WEATHER LIFTED ENOUGH AND DEPARTED IN HELI AT 16[30].
- ARRIVED AT KP 144.7 (TRIANGLE LAKE OUTLET).
  - FROM OUTLET PAST CROSSING IS HIGHLY BEAVER IMPOUNDED AND IMPASSABLE FOR FISH - SEE PHOTOS.
  - NO ASSESSMENT FOR HABITAT, FLOW, ETC.

Rain

(28) - CONTINUED FROM PG 27:

- ARRIVED AT KP 135.6 (GRAINGER TRIB.)
  - HABITAT ASSESSMENT, FLOW MMT, CROSS SECTION AND REACH SURVEYS.
- ARRIVED BACK IN NAHANNI BUTTE AT 9[30].

(29) CZN C788 26-SEP-14

CHRIS JAEGGLE

DAVID HARPLEY

10[35] - DEPARTED NAHANNI BUTTE VIA HELI, AFTER WEATHER DELAYS.

11[00] - ARRIVED AT KP 136.7 (GRAINGER TRIB.)
- HABITAT ASSESSMENT, FLOW MMT, CROSS SECTION AND REACH SURVEYS.

12[10] - ARRIVED AT KP 131.3 (GRAINGER TRIB.).
- HABITAT ASSESSMENT, FLOW MMT, CROSS SECTION AND REACH SURVEYS.

13[15] - ARRIVED AT BLUEFISH CREEK
- WATER QUALITY SAMPLING AND IN-SITU MMTS, SEDIMENT SAMPLING.
- IN-SITU WQ:

pH: 7.93
Temp: 5.90 °C
Cond: 495 µS
D.O. 12.6 mg/L

- FLEW AROUND DOING AERIAL RECONNAISSANCE AND MOVING OTHER CREWS AROUND.
- RETURNED TO NAHANNI BUTTE AT. 16[00].
- FLEW TO FT. SIMPSON AT 18[00].

Attachment E

Hydrometric Station Cross–Section/Reach Survey Field Record

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 28.4 (Sundog Creek)

UTM Location: -

Visit Date: September 22, 2014

Visit Time: 16:30

Cross-Section/Bank Survey Data

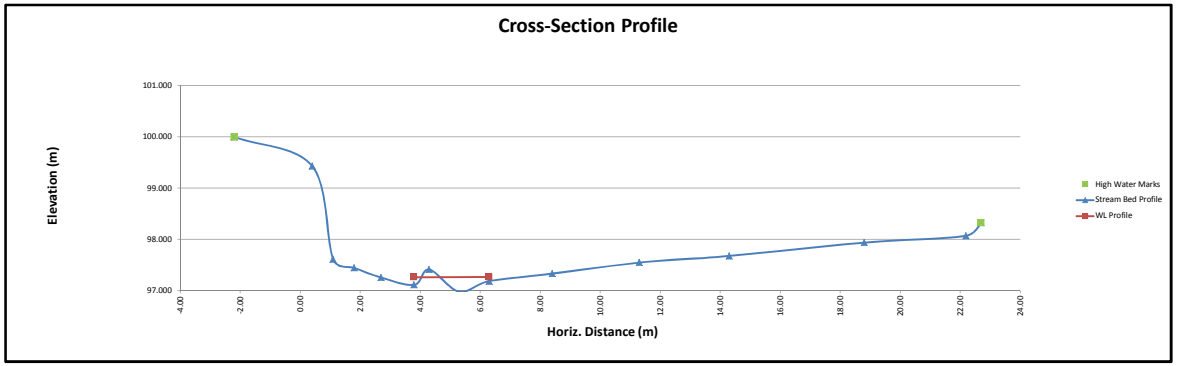
Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
RB High Water Mark	-2.20	1.429			100.000
RB High Water Mark Step Bottom	0.40		1.998		99.431
1	1.10		2.388		97.612
2	1.80		2.556		97.444
RB WL edge	2.70		2.745		97.255
Channel Bed #1	3.80		2.889		97.111
WL #1	3.80			0.150	97.261
Channel Bed #2	4.30		3.031		97.411
WL #2	4.30			0.300	97.711
Channel bed #3	5.30		3.023		96.977
WL #3	5.30			0.320	97.297
Channel bed #4	6.30		2.817		97.183
WL #4	6.30			0.080	97.263
LB WL edge	8.40		2.670		97.330
3	11.30		2.453		97.547
4	14.30		2.324		97.676
5	18.80		2.063		97.937
LB High Water Mark Step Bottom	22.20		1.930		98.070
LB High Water Mark	22.70		1.678		98.322

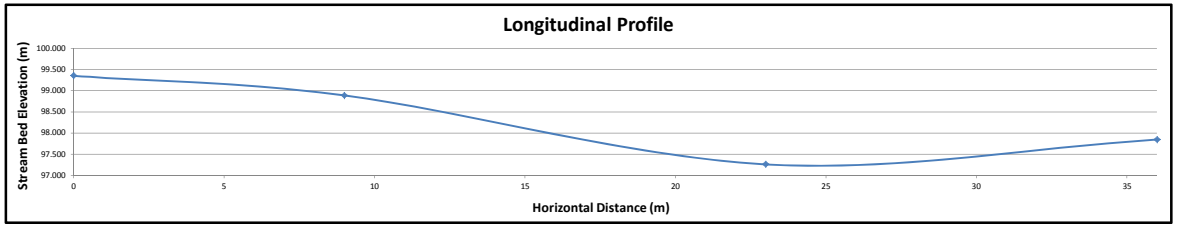
Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	14.0	2.543	98.886	Riffle	
	23.0	2.079	99.350	Riffle	
At Cross-section	0.0		97.261	Riffle	
Downstream	13.0	3.584	97.845	Riffle	

Slope Data:	
Horizontal Distance Surveyed:	36.0
Change in Channel Elevation:	1.505
Average Channel Slope (%):	4.181

Survey Information:	
Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.429
Datum elevation (m):	100.000





General Notes:

Field Personnel:	CJ, DH	Trip Date:	22-Sep-14
Data Entry Personnel:	CJ	Date:	6-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 39.8 (Sundog Creek Tributary)

UTM Location: 428369 E, 6830273 N

Visit Date: September 21, 2014

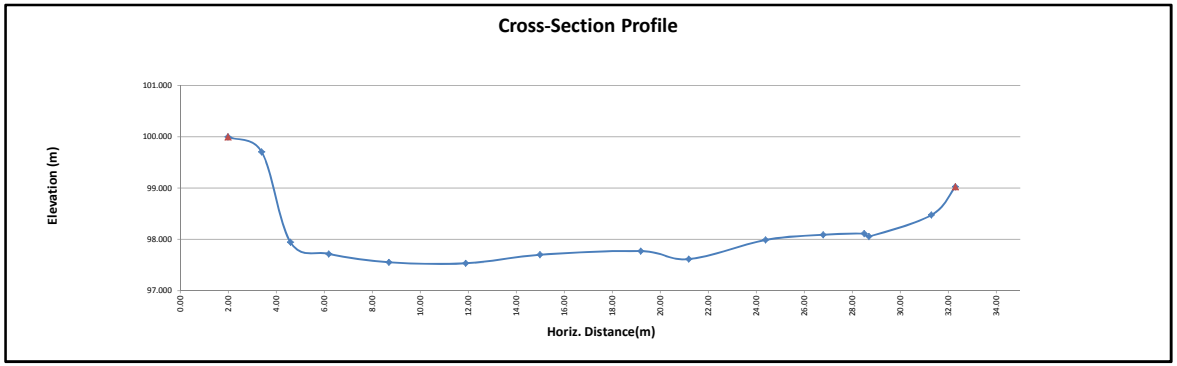
Visit Time: 17:00

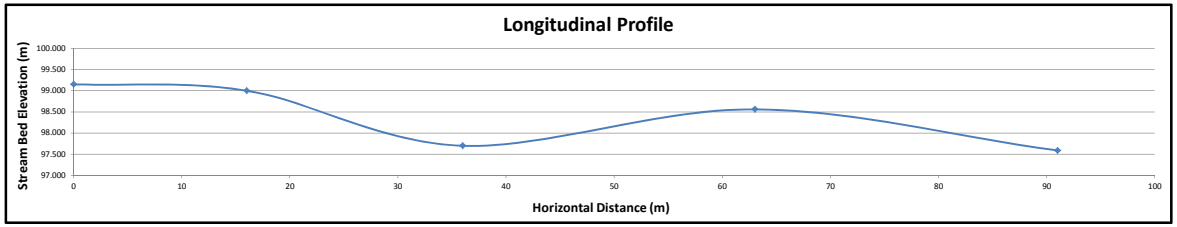
Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
RB High Water Mark	2.00	1.351			100.000
1	3.40		1.646		99.705
2	4.60		2.057		97.943
3	6.20		2.285		97.715
4	8.70		2.448		97.552
5	11.90		2.468		97.532
6	15.00		2.300		97.700
7	17.90		2.214		97.700
8	19.20		2.229		97.771
9	21.20		2.387		97.613
10	24.40		2.012		97.988
11	26.80		1.911		98.089
12	28.50		1.889		98.111
13	28.70		1.945		98.055
14	31.30		1.528		98.472
LB High Water Mark	32.30		0.979		99.021

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.351
Datum elevation (m):	100.000





Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	20.0	2.351	99.000		
	36.0	2.202	99.149		
At Cross-section	0.0	2.363	97.700		
Downstream	27.0	2.791	98.560		
	55.0	3.763	97.588		

Slope Data:

Horizontal Distance Surveyed:	91.0
Change in Channel Elevation:	1.561
Average Channel Slope (%):	1.715

General Notes:

-River channel was completely dry

Field Personnel:	CJ, DH	Trip Date:	21-Sep-14
Data Entry Personnel:	CJ	Date:	6-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 47.0 (Polje Creek Tributary)

UTM Location: 434240 E, 6829338 N

Visit Date: September 21, 2014

Visit Time: 14:15

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of RB	1.30	0.858			100.000
1	1.70		0.905		99.953
2	2.20		1.140		98.860
3	3.10		1.126		98.874
RB High Water Mark	3.80		1.317		98.683
RB WL edge	4.40		1.644		98.356
Channel bed #1	4.50		1.977	0.120	98.023
WL #1	4.50				98.143
Channel bed #2	4.75		2.033	0.210	98.143
WL #2	4.75				98.353
Channel bed #3	4.90		1.954	0.135	98.046
WL #3	4.90				98.181
LB WL edge	5.00		1.645		98.355
LB High Water Mark	5.50		1.244		98.756
4	6.30		1.122		98.878
5	7.00		1.140		98.860
6	7.20		1.315		98.685
7	7.60		1.357		98.643
8	8.80		1.238		98.762
Top of LB	11.20		1.176		98.824

Channel Slope Survey Data

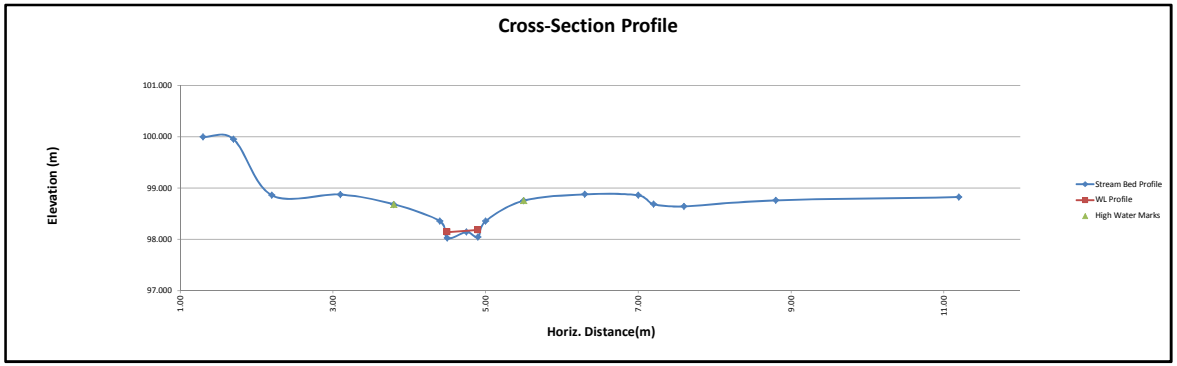
Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	7.0	1.829	99.029	Run	
	14.0	1.517	99.341	Run	
	22.0	1.198	99.660	Run	
At Cross-section	0.0		98.143	Run	
Downstream	5.0	2.180	98.678	Run	
	12.0	2.470	98.388	Run	
	20.0	2.843	98.015	Run	

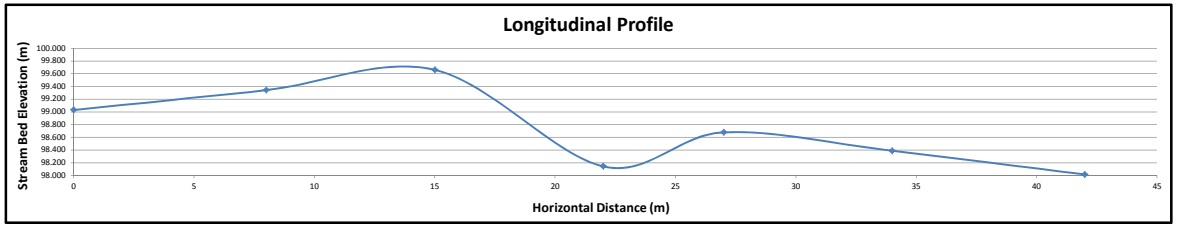
Slope Data:

Horizontal Distance Surveyed:	42.0
Change in Channel Elevation:	1.645
Average Channel Slope (%):	3.917

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	100.858
Datum elevation (m):	100.000





General Notes:

Field Personnel:	CJ, DH	Trip Date:	21-Sep-14
Data Entry Personnel:	CJ	Date:	30-Sep-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 50.2 (Polje Tributary)

UTM Location: 436944 E, 6829737 N

Visit Date: September 21, 2014

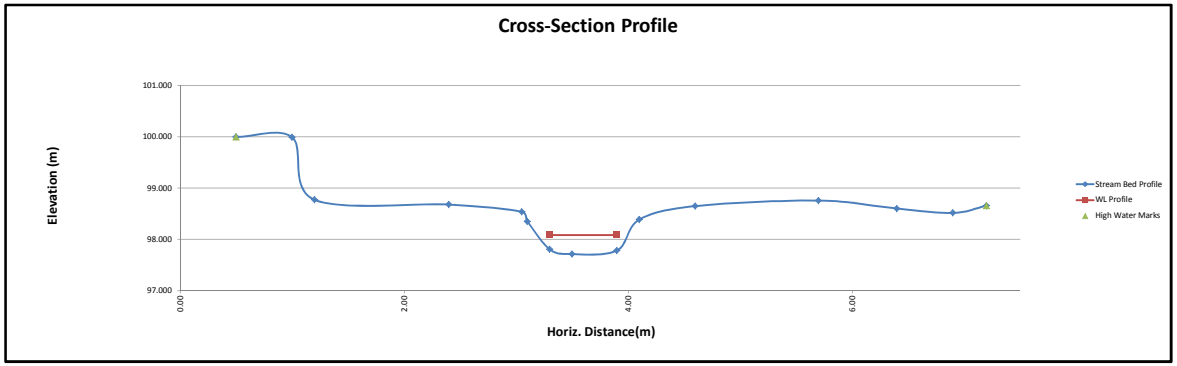
Visit Time: 9:50

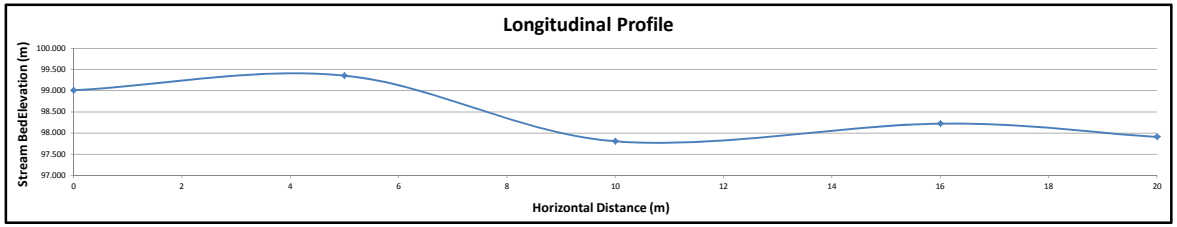
Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
RB High Water Mark	0.50	0.959			100.000
1	1.00		0.969		99.990
2	1.20		1.229		98.771
Top of RB	2.40		1.322		98.678
RB WL edge	3.05		1.461		98.539
channel bed #1	3.10		1.648		98.352
channel bed #2	3.30		2.194	0.280	97.806
WL elevation	3.30				98.086
channel bed #3	3.50		2.288		97.712
LB WL edge	3.90		2.217		97.783
Top of LB	4.10		1.614		98.386
3	4.60		1.351		98.649
4	5.70		1.243		98.757
5	6.40		1.400		98.600
6	6.90		1.485		98.515
LB High Water Mark	7.20		1.343		98.657

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	100.959
Datum elevation (m):	100.000





Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	5.0	1.949	99.010	Run	
	10.0	1.604	99.355	Run	
At Cross-section	0.0		97.806	Run	
Downstream	6.0	2.737	98.222	Run	
	10.0	3.050	97.909	Run	

Slope Data:

Horizontal Distance Surveyed:	20.0
Change in Channel Elevation:	1.446
Average Channel Slope (%):	7.230

General Notes:

Field Personnel:	CJ, DH	Trip Date:	21-Sep-14
Data Entry Personnel:	CJ	Date:	30-Sep-14
Data Check Personnel:	TL	Date:	28-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 54.3 (Polje Creek Tributary)

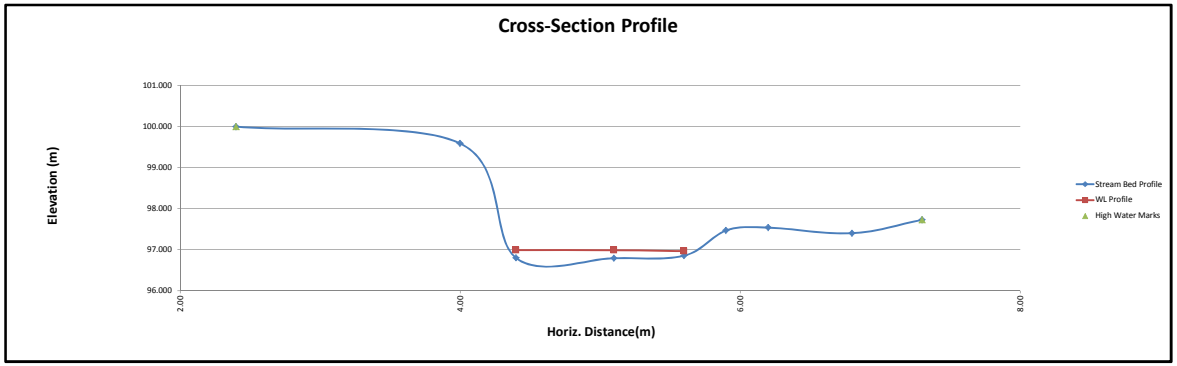
UTM Location: 440622 E, 6830769 N

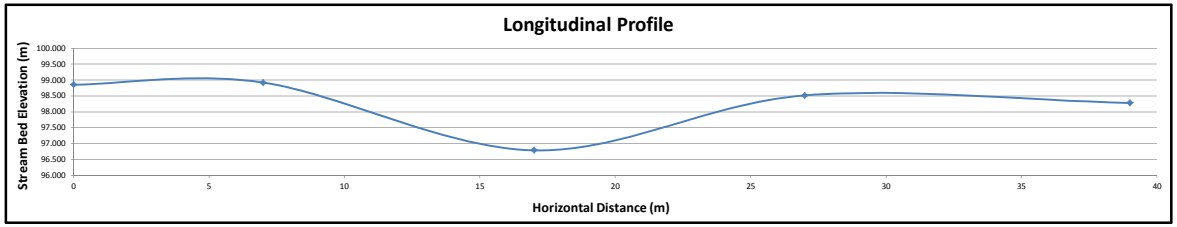
Visit Date: September 21, 2014

Visit Time: 15:45

Cross-Section/Bank Survey Data					
Mmt #:	**Offset**	**BS (m):**	**FS (m):**	**Cut (m):**	**Elevation (m):**
RB High Water Mark	2.40	2.061		-	**100.000**
RB WL edge	4.00		2.470	-	99.591
channel bed	4.40		3.207	0.195	96.793
WL	4.40				96.988
channel bed	5.10		3.209	0.195	96.791
WL	5.10				96.986
channel bed	5.60		3.149	0.110	96.851
WL	5.60				96.961
LB WL edge	5.90		2.533	-	97.467
1	6.20		2.464	-	97.536
Bottom of HW Step	6.80		2.602	-	97.398
LB High Water Mark (Step)	7.30		2.275	-	97.725

Survey Information:	
Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	102.061
Datum elevation (m):	100.000





Channel Slope Survey Data					
Measured Data			**Calculated Data**	**Channel Reach Notes**	
Direction from Cross-section	**Distance from Cross-section**	**Survey Reading**	**Elevation (m)**	**Morphology**	**Substrate**
Upstream	10.0	3.207	98.854	Run	
	17.0	3.142	98.919	Run	
At Cross-section	0.0		96.791	Run	
Downstream	10.0	3.546	98.515	Run	
	22.0	3.781	98.280	Run	

Slope Data:	
Horizontal Distance Surveyed:	39.0
Change in Channel Elevation:	0.639
Average Channel Slope (%):	1.638

General Notes:

Field Personnel:	**CJ, DH**	**Trip Date:**	**21-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**30-Sep-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 87.7 (Tetcela River)

UTM Location: 460241 E, 6812386 N

Visit Date: September 24, 2014

Visit Time: 14:00

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of RB	2.70	0.536			100.000
RB High Water Mark	3.60		0.982		99.554
1	4.50		1.478		99.058
RB WL edge	10.30		1.501		99.035
Channel bed #1	14.90		1.567		98.969
WL #1	14.90			0.030	98.999
Channel bed #2	16.30		1.567		98.949
WL #2	16.30			0.050	98.999
Channel bed #3	17.30		1.567		98.949
WL #3	17.30			0.120	98.999
Channel bed #4	18.30		1.567		98.879
WL #4	18.30			0.130	98.999
Channel bed #5	19.30		1.567		98.869
WL #5	19.30			0.120	98.999
Channel bed #6	19.80		1.774		98.762
WL #6	19.80			0.180	98.942
Channel bed #7	20.30		1.774		98.782
WL #7	20.30			0.160	98.942
Channel bed #8	21.30		1.774		98.782
WL #8	21.30			0.160	98.942
Channel bed #9	22.30		1.774		98.782
WL #9	22.30			0.160	98.942
Channel bed #10	23.30		1.774		98.752
WL #10	23.30			0.190	98.942
Channel bed #11	24.30		1.774		98.792
WL #11	24.30			0.150	98.942
Channel bed #12	25.30		1.774		98.802
WL #12	25.30			0.140	98.942
Channel bed #13	25.80		1.779		98.757
WL #13	25.80			0.200	98.957
Channel bed #14	26.30		1.841		98.695
WL #14	26.30			0.260	98.955
LB WL edge	26.60		1.825		98.711
LB High Water Mark	26.60		1.166		99.370
2	27.60		0.065		100.471
Top of LB	28.00		0.048		100.488

Channel Slope Survey Data

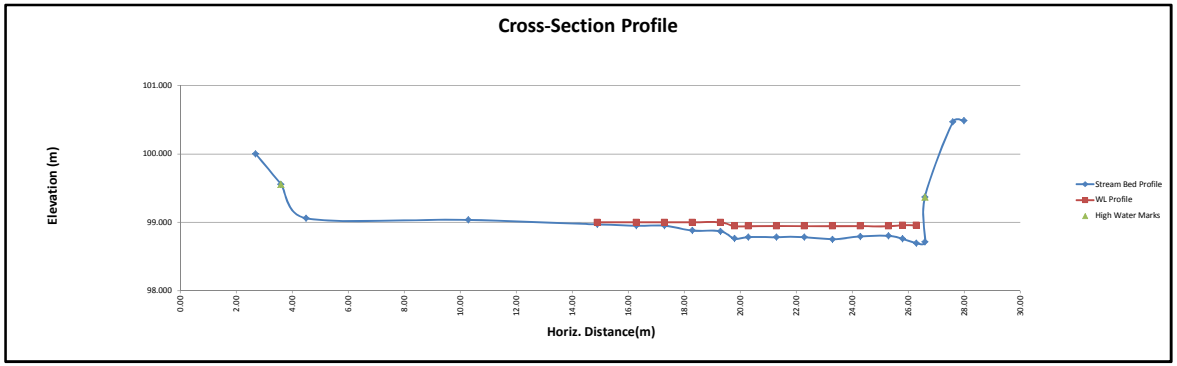
Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	23.0	1.550	98.986	Run	
	39.0	1.529	99.007	Riffle	
At Cross-section	0.0		98.949	Run	
Downstream	18.0	2.061	98.475	Run	
	43.0	2.407	98.129	Run	

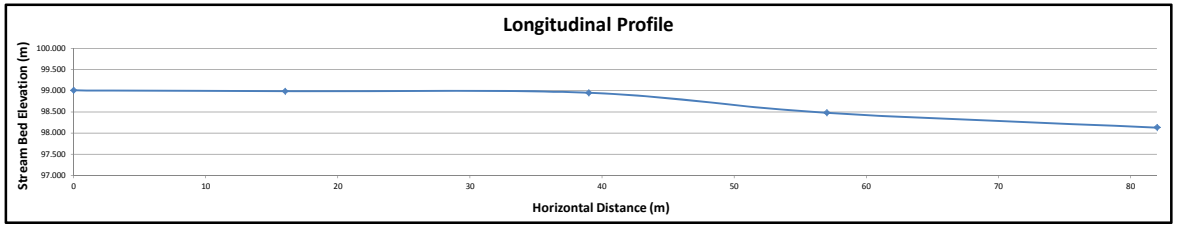
Slope Data:

Horizontal Distance Surveyed:	82.0
Change in Channel Elevation:	0.878
Average Channel Slope (%):	1.071

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	100.536
Datum elevation (m):	100.000





General Notes:

Field Personnel:	CJ, DH	Trip Date:	24-Sep-14
Data Entry Personnel:	CJ	Date:	8-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 122.8 (Grainger Tributary)

UTM Location: 477151 E, 6798715 N

Visit Date: September 23, 2014

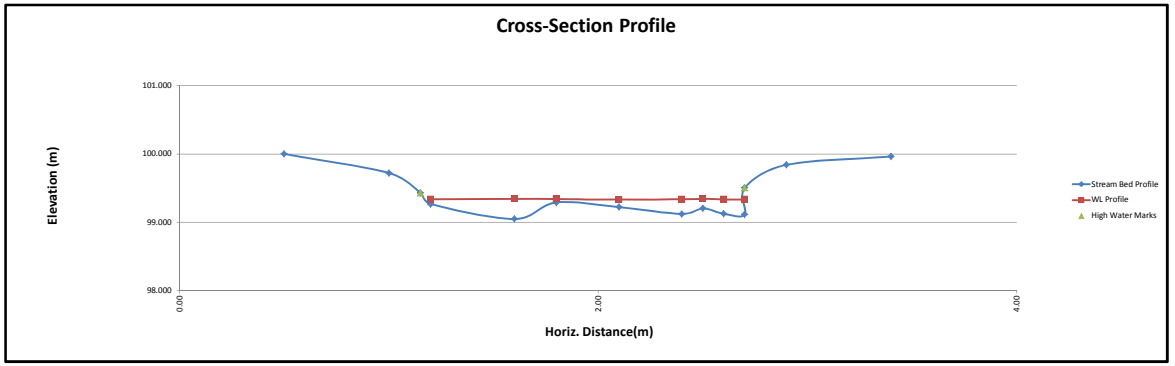
Visit Time: 15:20

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of LB	0.50	0.812			100.000
1	1.00		1.091		99.721
LB High Water Mark	1.15		1.381		99.431
LB edge	1.20		1.545		99.267
LB edge WL	1.20			0.070	99.337
Channel bed #1	1.60		1.764		99.048
WL #1	1.60			0.295	99.343
Channel bed #2	1.80		1.522		99.290
WL #2	1.80			0.050	99.340
Channel bed #3	2.10		1.591		99.221
WL #3	2.10			0.110	99.331
Channel bed #4	2.40		1.690		99.122
WL #4	2.40			0.215	99.337
Channel bed #5	2.50		1.609		99.203
WL #5	2.50			0.140	99.343
Channel bed #6	2.60		1.688		99.124
WL #6	2.60			0.210	99.334
RB edge	2.70		1.699		99.113
RB edge WL	2.70			0.220	99.333
RB High Water Mark	2.70		1.310		99.502
2	2.90		0.971		99.841
Top of RB	3.40		0.849		99.963

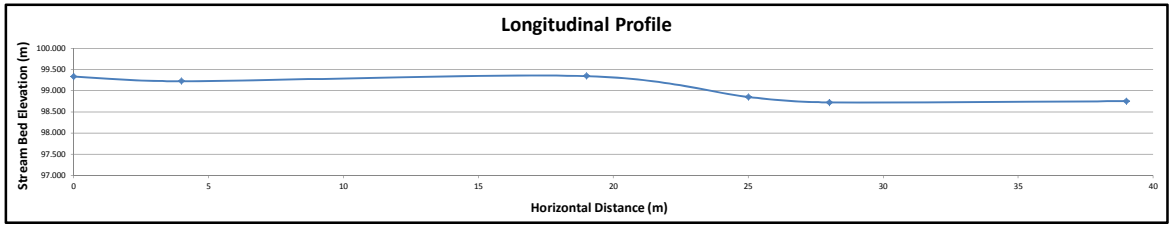
Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	100.812
Datum elevation (m):	100.000



Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	15.0	1.590	99.222	Riffle	
	19.0	1.479	99.333	Riffle	
At Cross-section	0.0		99.343	Riffle	
Downstream	6.0	1.963	98.849	Run	
	9.0	2.089	98.723	Run	
	20.0	2.060	98.752	Run	



General Notes:

-Large boulders throughout channel

Slope Data:	
Horizontal Distance Surveyed:	39.0
Change in Channel Elevation:	0.610
Average Channel Slope (%):	1.564

Field Personnel:	CJ, DH	Trip Date:	23-Sep-14
Data Entry Personnel:	CJ	Date:	7-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 123.7 (Grainger River)

UTM Location: 478319 E, 6799043 N

Visit Date: September 23, 2014

Visit Time: 17:10

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
LB Upper Floodplain	0.00	1.527			100.000
LB High Water Mark (On Step)	0.70		1.572		99.955
LB Step Bottom	0.90		1.911		99.616
1	1.80		2.292		99.235
LB WL edge	2.60		2.449		99.078
Channel bed #1	3.30		2.605		98.922
WL #1	3.30			0.139	99.061
Channel bed #2	3.80		2.654		98.873
WL #2	3.80			0.200	99.073
Channel bed #3	4.40		2.601		98.926
WL #3	4.40			0.140	99.066
Channel bed #4	5.10		2.707		98.820
WL #4	5.10			0.210	99.030
Channel bed #5	5.70		2.552		98.975
WL #5	5.70			0.060	99.035
Channel bed #6	6.00		2.703		98.824
WL #6	6.00			0.190	99.014
Channel bed #7	6.70		2.758		98.769
WL #7	6.70			0.270	99.039
Channel bed #8	7.10		2.681		98.846
WL #8	7.10			0.190	99.036
Channel bed #9	8.00		2.589		98.938
WL #9	8.00			0.090	99.028
RB WL edge (Gravel bar edge)	8.70		2.510		99.017
Gravel bar	10.00		2.348		99.179
Gravel bar	11.00		2.187		99.340
Gravel bar	12.50		2.306		99.221
Dry Side Channel	13.40		2.716		98.811
Dry Side Channel	14.20		2.816		98.711
Dry Side Channel	15.20		2.768		98.759
Dry Side Channel	15.80		2.611		98.916
RB High Water Mark	16.00		2.437		99.090
2	16.50		2.087		99.440
RB Upper Floodplain	17.00		1.944		99.583

Channel Slope Survey Data

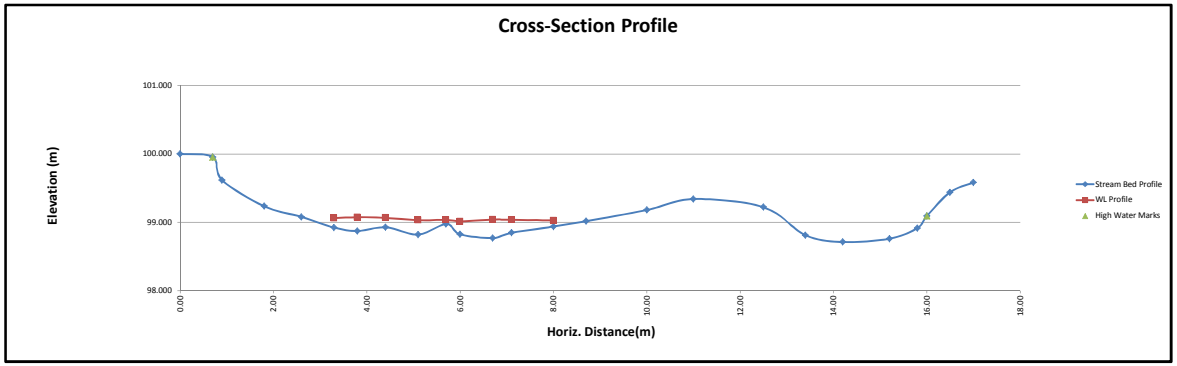
Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	16.0	2.522	99.005	Run	
	34.0	2.500	99.027	Run	
At Cross-section	0.0		99.014	Riffle	
Downstream	19.0	3.052	98.475	Riffle	
	40.0	3.755	97.772	Run	

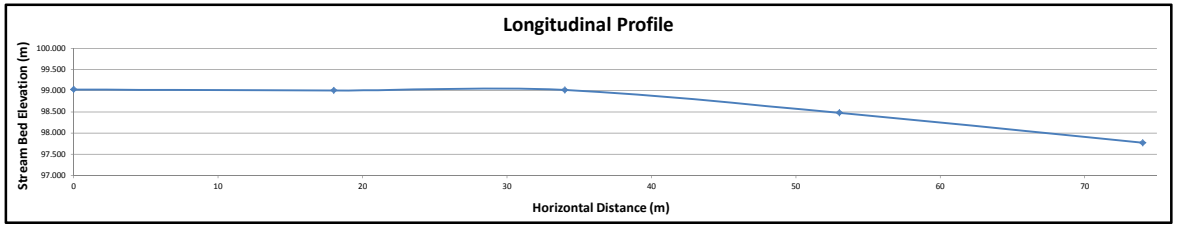
Slope Data:

Horizontal Distance Surveyed:	74.0
Change in Channel Elevation:	1.255
Average Channel Slope (%):	1.696

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.527
Datum elevation (m):	100.000





General Notes:

-A gravel bar followed by a dry side channel are present on the right side of the active channel.

Field Personnel:	CJ, DH	Trip Date:	23-Sep-14
Data Entry Personnel:	CJ	Date:	7-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 125.1 (Grainger River)

UTM Location: 479156 E, 6799517 N

Visit Date: September 23, 2014

Visit Time: 18:30

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
LB Upper Floodplain	0.00	1.144			**100.000**
1	0.65		1.088		100.056
LB High Water Mark	1.60		1.724		99.420
2	2.40		2.085		99.059
LB WL edge	5.10		2.467		98.677
Channel bed #1	6.30		2.600		98.544
WL#1	6.30			0.120	98.664
Channel bed #2	6.50		2.608		98.336
WL#2	6.50			0.200	98.536
Channel bed #3	6.70		2.608		98.286
WL#3	6.70			0.250	98.536
Channel bed #4	6.90		2.608		98.266
WL#4	6.90			0.270	98.536
Channel bed #5	7.10		2.608		98.286
WL#5	7.10			0.250	98.536
Channel bed #6	7.30		2.608		98.256
WL#6	7.30			0.280	98.536
Channel bed #7	7.50		2.608		98.296
WL#7	7.50			0.240	98.536
Channel bed #8	7.70		2.608		98.286
WL#8	7.70			0.250	98.536
Channel bed #9	7.90		2.608		98.346
WL#9	7.90			0.190	98.536
Channel bed #10	8.10		2.608		98.356
WL#10	8.10			0.180	98.536
Channel bed #11	8.45		2.608		98.476
WL#11	8.45			0.060	98.536
Channel bed #12	8.60		2.608		98.426
WL #12	8.60			0.110	98.536
Channel bed #13	10.00		2.508		98.636
WL #13	10.00			0.020	98.656
RB WL edge	11.20		2.461		98.683
3	12.50		2.437		98.707
RB High Water Mark	13.70		2.086		99.058
RB bedrock face	14.50		1.520		99.624

Channel Slope Survey Data

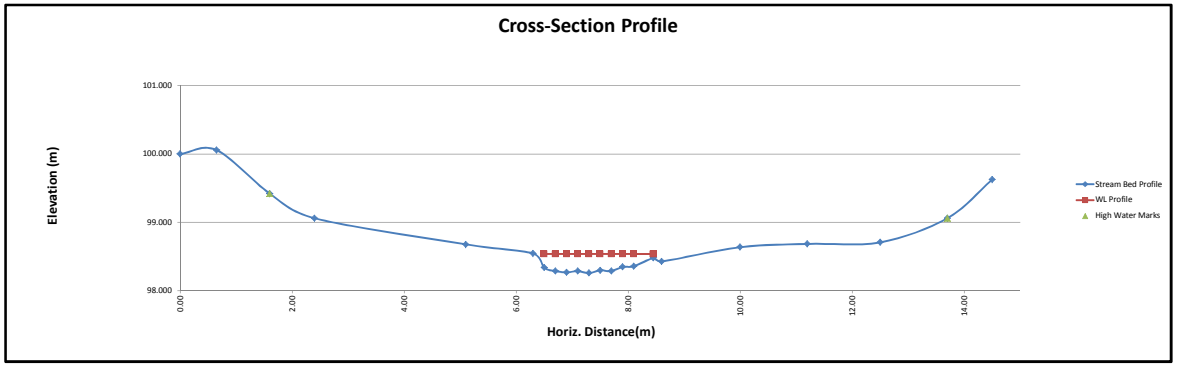
Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	24.0	2.508	98.636	Run	
	33.0	2.545	98.599	Run	
At Cross-section	0.0		98.256	Run	
Downstream	18.0	2.722	98.422	Riffle	
	33.0	3.068	98.076	Riffle	

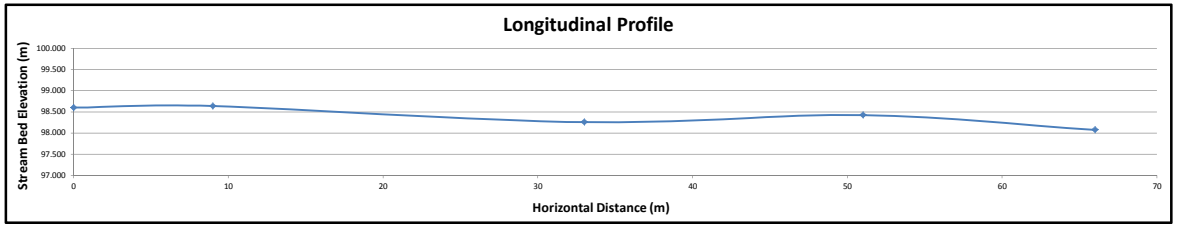
Slope Data:

Horizontal Distance Surveyed:	66.0
Change in Channel Elevation:	0.560
Average Channel Slope (%):	0.848

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.144
Datum elevation (m):	100.000





General Notes:

-Gravel bars and dry side channel (LB) are downstream of surveyed cross section

Field Personnel:	CJ, DH	Trip Date:	23-Sep-14
Data Entry Personnel:	CJ	Date:	7-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 131.3 (Grainger Tributary)

UTM Location: 481988 E, 6794966 N

Visit Date: September 26, 2014

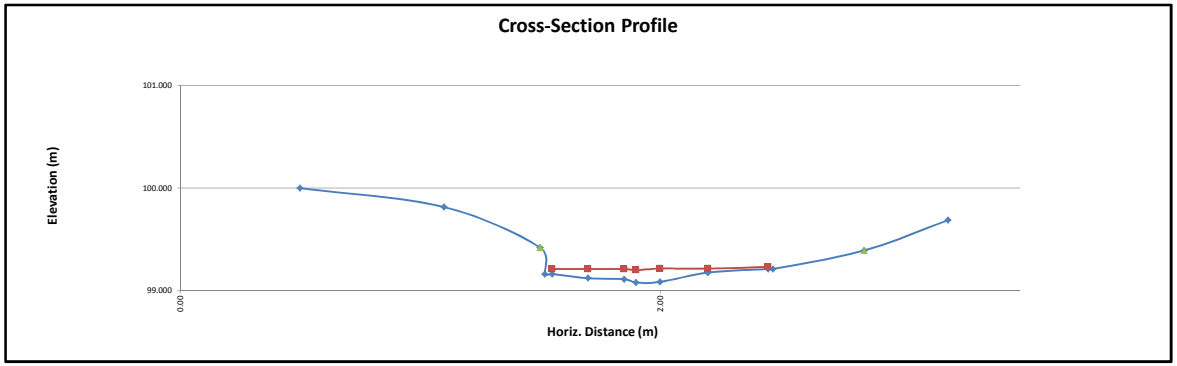
Visit Time: 12:10

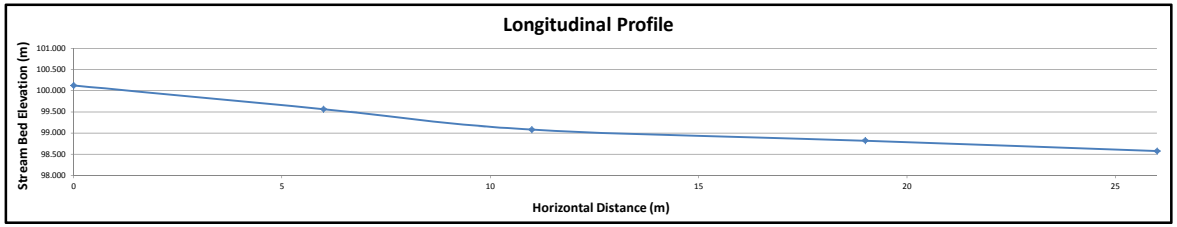
Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of LB	0.50	1.518			100.000
1	1.10		1.702		99.816
LB High Water Mark	1.50		2.099		99.419
LB WL edge	1.52		2.357		99.161
Channel bed #1	1.55		2.357		99.161
WL #1	1.55			0.050	99.211
Channel bed #2	1.70		2.357		99.121
WL #2	1.70			0.090	99.211
Channel bed #3	1.85		2.357		99.111
WL #3	1.85			0.100	99.211
Channel bed #4	1.90		2.439		99.079
WL #4	1.90			0.120	99.199
Channel bed #5	2.00		2.433		99.085
WL #5	2.00			0.130	99.215
Channel bed #6	2.20		2.433		99.175
WL #6	2.20			0.040	99.215
Channel bed #7	2.45		2.308		99.210
WL #7	2.45			0.020	99.230
RB WL edge	2.47		2.308		99.210
RB High Water Mark	2.85		2.127		99.391
Top of RB	3.20		1.831		99.687

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.518
Datum elevation (m):	100.000





Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	5.0	1.955	99.563	Riffle	
	11.0	1.395	100.123	Riffle	
At Cross-section	0.0		99.079	Riffle	
Downstream	8.0	2.699	98.819	Riffle	
	15.0	2.943	98.575	Riffle	

General Notes:

-Lots of embedded cobble and boulders throughout the channel.

Slope Data:

Horizontal Distance Surveyed:	26.0
Change in Channel Elevation:	1.548
Average Channel Slope (%):	5.954

Field Personnel:	CJ, DH	Trip Date:	26-Sep-14
Data Entry Personnel:	CJ	Date:	8-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name:	KP 133.7 (Grainger Tributary)	**Visit Date:**	September 24, 2014
UTM Location:	482671 E, 6793161 N	**Visit Time:**	9:00

Cross-Section/Bank Survey Data

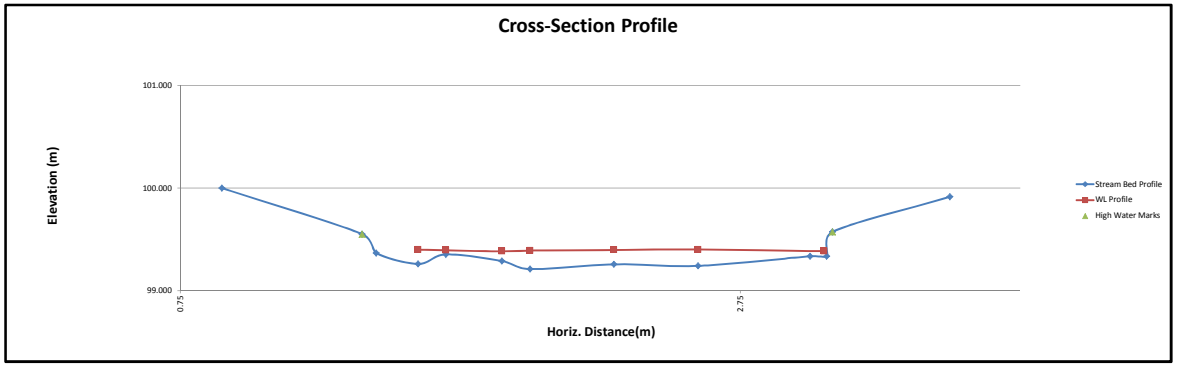
Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of RB	0.90	1.224			**100.000**
RB High Water Mark	1.40		1.673		99.551
RB WL edge	1.45		1.858		99.366
Channel bed #1	1.60		1.964		99.260
WL #1	1.60			0.140	99.400
Channel bed #2	1.70		1.871		99.353
WL #2	1.70			0.040	99.393
Channel bed #3	1.90		1.936		99.288
WL #3	1.90			0.095	99.383
Channel bed #4	2.00		2.014		99.210
WL #4	2.00			0.180	99.390
Channel bed #5	2.30		1.968		99.256
WL #5	2.30			0.140	99.396
Channel bed #6	2.60		1.983		99.241
WL #6	2.60			0.160	99.401
Channel bed #7	3.00		1.889		99.335
WL #7	3.05			0.050	99.385
LB WL edge	3.06		1.889		99.335
LB High Water Mark	3.08		1.651		99.573
Top of LB	3.50		1.308		99.916

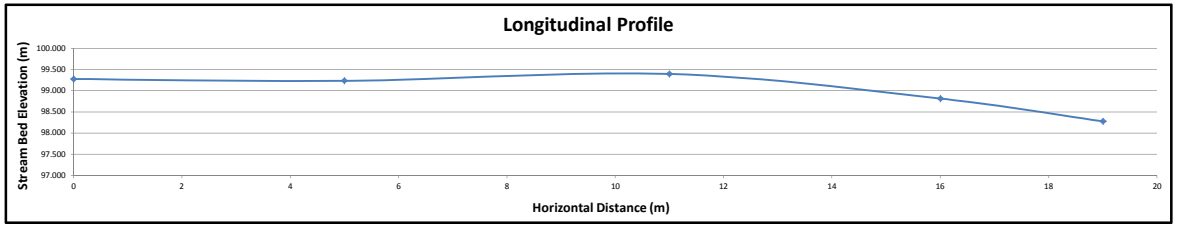
Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	6.0	1.993	99.231	Riffle	
	11.0	1.951	99.273	Riffle	
At Cross-section	0.0		99.393	Riffle	
Downstream	5.0	2.412	98.812	Riffle	
	8.0	2.947	98.277	Riffle	

Slope Data:	
Horizontal Distance Surveyed:	19.0
Change in Channel Elevation:	0.996
Average Channel Slope (%):	5.242

Survey Information:	
Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.224
Datum elevation (m):	100.000





General Notes:

Field Personnel:	CJ, DH	Trip Date:	24-Sep-14
Data Entry Personnel:	CJ	Date:	7-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 135.6 (Grainger Tributary)

UTM Location: 482380 E, 6791274 N

Visit Date: September 25, 2014

Visit Time: 18:45

Cross-Section/Bank Survey Data

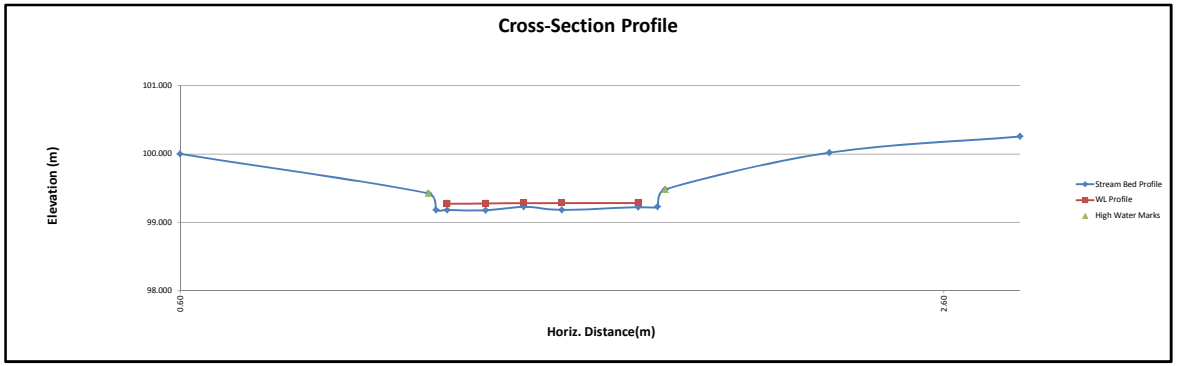
Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of LB	0.60	1.819			**100.000**
LB High Water Mark	1.25		2.395		99.424
LB WL edge	1.27		2.640		99.179
Channel bed #1	1.30		2.640		99.179
WL #1	1.30			0.095	99.274
Channel bed #2	1.40		2.640		99.174
WL #2	1.40			0.100	99.274
Channel bed #3	1.50		2.592		99.227
WL #3	1.50			0.055	99.282
Channel bed #4	1.60		2.592		99.182
WL #4	1.60			0.100	99.282
Channel bed #5	1.80		2.592		99.222
WL #5	1.80			0.060	99.282
RB WL edge	1.85		2.592		99.227
RB High Water Mark	1.87		2.338		99.481
1	2.30		1.800		100.019
Top of RB	2.80		1.563		100.256

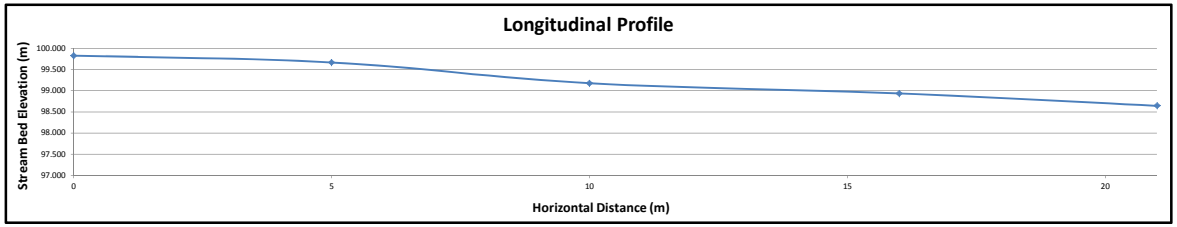
Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	5.0	2.154	99.665	Riffle	
	10.0	1.995	99.824	Riffle	
At Cross-section	0.0		99.174	Run	
Downstream	6.0	2.885	98.934	Run	
	11.0	3.176	98.643	Riffle	

Slope Data:	
Horizontal Distance Surveyed:	21.0
Change in Channel Elevation:	1.181
Average Channel Slope (%):	5.624

Survey Information:	
Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.819
Datum elevation (m):	100.000





General Notes:

-Large cobble and boulders throughout stream

Field Personnel:	CJ, DH	Trip Date:	25-Sep-14
Data Entry Personnel:	CJ	Date:	8-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 136.7 (Grainger Tributary)

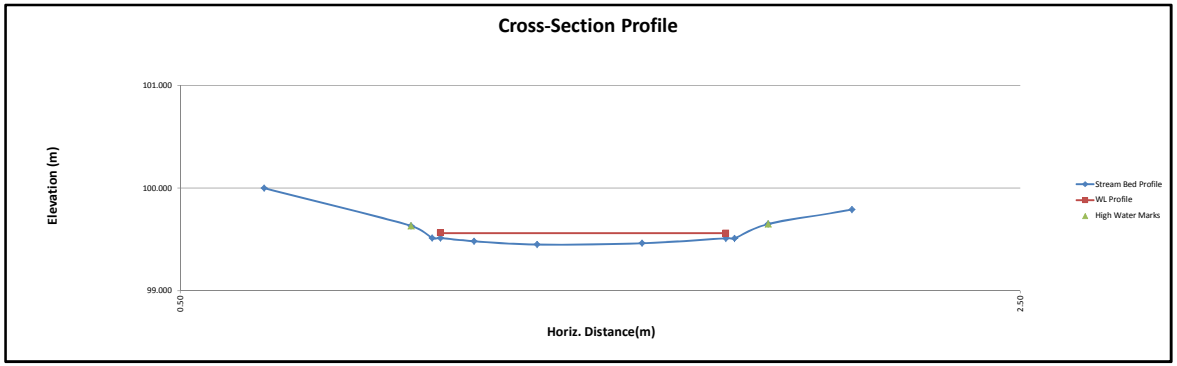
UTM Location: 483132 E, 6790094 N

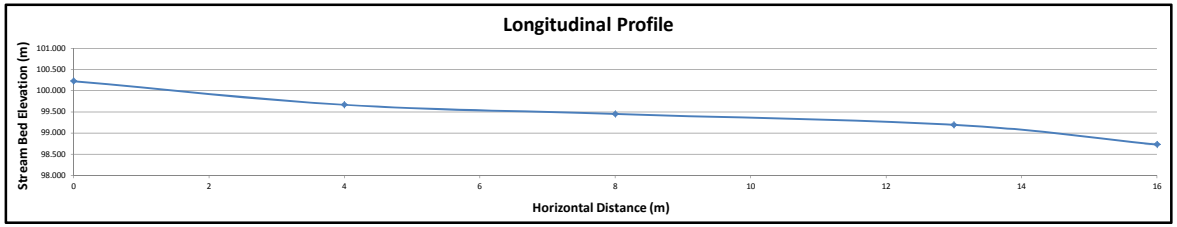
Visit Date: September 26, 2014

Visit Time: 11:00

Cross-Section/Bank Survey Data					
Mmt #:	**Offset**	**BS (m):**	**FS (m):**	**Cut (m):**	**Elevation (m):**
Top of LB	0.70	1.34			**100.000**
LB High Water Mark	1.05		1.708		99.632
LB WL edge	1.10		1.828		99.512
Channel bed #1	1.12		1.828		99.512
WL #1	1.12			0.050	99.562
Channel bed #2	1.20		1.828		99.482
WL #2	1.20			0.080	99.562
Channel bed #3	1.35		1.891		99.449
WL #3	1.35			0.015	99.464
Channel bed #4	1.60		1.878		99.462
WL #4	1.60			0.100	99.562
Channel bed #5	1.80		1.830		99.510
WL #5	1.80			0.050	99.560
RB WL edge	1.82		1.830		99.510
RB High Water Mark	1.90		1.691		99.649
Top of RB	2.10		1.550		99.790

Survey Information:	
Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.340
Datum elevation (m):	100.000





Channel Slope Survey Data					
Measured Data			**Calculated Data**	**Channel Reach Notes**	
Direction from Cross-section	**Distance from Cross-section**	**Survey Reading**	**Elevation (m)**	**Morphology**	**Substrate**
Upstream	4.0	1.675	99.665	Riffle	
	8.0	1.118	100.222	Riffle	
At Cross-section	**0.0**		99.449	Riffle	
Downstream	5.0	2.146	99.194	Riffle	
	8.0	2.610	98.730	Riffle	

Slope Data:	
Horizontal Distance Surveyed:	16.0
Change in Channel Elevation:	1.492
Average Channel Slope (%):	9.325

General Notes:

-Large boulders throughout stream.

-A debris dam was present several meters downstream of the cross section

Field Personnel:	**CJ, DH**	**Trip Date:**	**26-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**8-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: KP 154.4 (Liard Tributary)

UTM Location: 486500 E, 6774900 N

Visit Date: September 23, 2014

Visit Time: 13:40

Cross-Section/Bank Survey Data

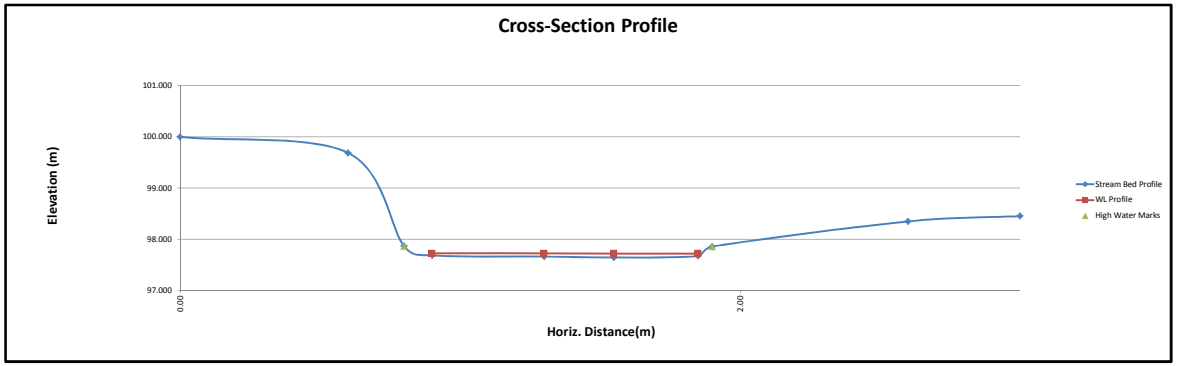
Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
RB Historical High Water Mark	0.00	1.565			100.000
1	0.60		1.878		99.687
RB High Water Mark	0.80		2.134		97.866
Channel bed #1	0.90		2.315		97.685
WL #1	0.90			0.040	97.725
Channel bed #2	1.30		2.335		97.665
WL #2	1.30			0.060	97.725
Channel bed #3	1.55		2.356		97.644
WL #3	1.55			0.080	97.724
Channel bed #4	1.85		2.326		97.674
WL #4	1.85			0.050	97.724
LB High Water Mark	1.90		2.142		97.858
2	2.60		1.650		98.350
LB Historical High Water Mark	3.00		1.547		98.453

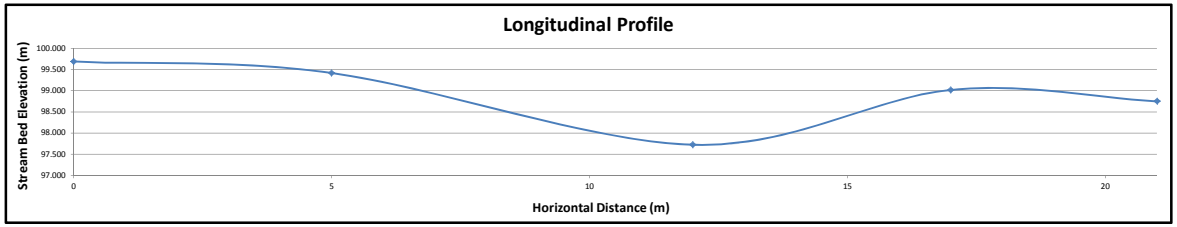
Channel Slope Survey Data

Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	7.0	2.148	99.417	Run	
	12.0	1.879	99.686	Run	
At Cross-section	0.0		97.725	Run	
Downstream	5.0	2.549	99.016	Run	
	9.0	2.817	98.748	Run	

Slope Data:	
Horizontal Distance Surveyed:	21.0
Change in Channel Elevation:	0.938
Average Channel Slope (%):	4.467

Survey Information:	
Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.565
Datum elevation (m):	100.000





General Notes:

-Discharge measurement not conducted due to extremely low water depths. One velocity measurement taken in mid-channel: 0.053 m/s.

Field Personnel:	CJ, DH	Trip Date:	23-Sep-14
Data Entry Personnel:	CJ	Date:	6-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: Old Road at Tetcela River (Mainstem)

UTM Location: 461370 E, 6815670 N

Visit Date: September 24, 2014

Visit Time: 17:15

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of RB	0.60	0.806			100.000
1	2.20		1.183		99.623
RB High Water Mark	2.90		1.515		99.291
RB WL edge	7.80		2.140		98.666
Channel bed #1	9.20		2.248		98.608
WL #1	9.20			0.050	98.658
Channel bed #2	10.70		2.248		98.598
WL #2	10.70			0.060	98.658
Channel bed #3	11.70		2.248		98.558
WL #3	11.70			0.100	98.658
Channel bed #4	13.60		2.292		98.514
WL #4	13.60			0.150	98.664
Channel bed #5	14.60		2.292		98.544
WL #5	14.60			0.120	98.664
Channel bed #6	15.90		2.292		98.524
WL #6	15.90			0.140	98.664
Channel bed #7	17.40		2.339		98.467
WL #7	17.40			0.200	98.667
Channel bed #8	17.90		2.339		98.497
WL #8	17.90			0.170	98.667
Channel bed #9	18.90		2.339		98.467
WL #9	18.90			0.200	98.667
Channel bed #10	19.90		2.339		98.447
WL #10	19.90			0.220	98.667
Channel bed #11	20.90		2.374		98.482
WL #11	20.90			0.210	98.692
Channel bed #12	21.90		2.374		98.432
WL #12	21.90			0.260	98.692
LB WL edge	23.10		2.127		98.679
LB High Water Mark	24.30		1.789		99.017
2	25.40		1.342		99.464
Top of LB	26.00		1.259		99.547

Channel Slope Survey Data

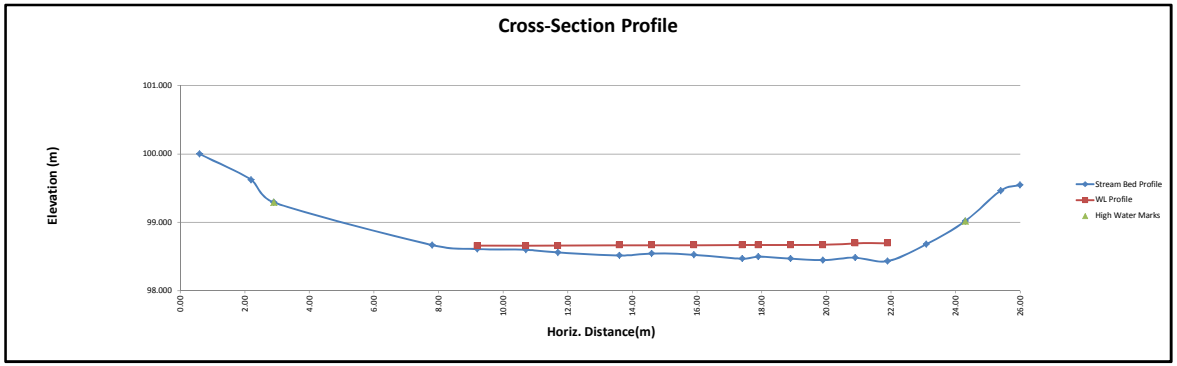
Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	19.0	2.432	98.374	Run	
	31.0	2.424	98.382	Run	
At Cross-section	0.0		98.447	Run	
Downstream	16.0	2.339	98.467	Run	
	31.0	2.555	98.251	Riffle	

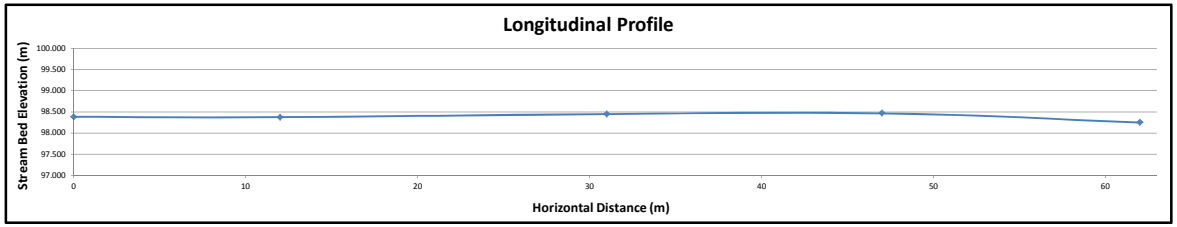
Slope Data:

Horizontal Distance Surveyed:	62.0
Change in Channel Elevation:	0.131
Average Channel Slope (%):	0.211

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	100.806
Datum elevation (m):	100.000





General Notes:

Field Personnel:	CJ, DH	**Trip Date:**	24-Sep-14
Data Entry Personnel:	CJ	**Date:**	8-Oct-14
Data Check Personnel:	TL	**Date:**	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Station Stream Cross-Section/Reach Survey Field Record

Site Name: Old Road at Tetcela Tributary

UTM Location: 460369 E, 6813941 N

Visit Date: September 24, 2014

Visit Time: 8-Oct-14

Cross-Section/Bank Survey Data

Mmt #:	Offset	BS (m):	FS (m):	Cut (m):	Elevation (m):
Top of LB	0.00	1.178			100.000
1	0.30		1.425		99.753
LB High Water Mark	0.50		1.879		99.299
LB (main channel) WL edge	1.10		2.249		98.929
Channel bed #1	1.70		2.525		98.833
WL #1	1.70			0.090	98.923
Channel bed #2	2.10		2.525		98.843
WL #2	2.10			0.080	98.923
Channel bed #3	2.50		2.525		98.653
WL #3	2.50			0.270	98.923
Channel bed #4	2.95		2.525		98.703
WL #4	2.95			0.220	98.923
Channel bed #5	3.60		2.615		98.563
WL #5	3.60			0.360	98.923
Channel bed #6	3.80		2.615		98.533
WL #6	3.80			0.390	98.923
Channel bed #7	4.30		2.615		98.533
WL #7	4.30			0.390	98.923
Channel bed #8	4.85		2.615		98.683
WL #8	4.85			0.240	98.923
Channel bed #9	5.40		2.615		98.763
WL #9	5.40			0.160	98.923
RB (main channel) WL edge	6.00		2.249		98.929
Gravel bar	7.40		2.010		99.168
Gravel bar	10.40		1.877		99.301
Gravel bar	11.60		1.525		99.653
Gravel bar	13.00		1.499		99.679
Gravel bar	13.60		1.838		99.340
LB (of bar) WL edge	14.30		1.952		99.226
Side channel bed #1	15.30		2.046		99.132
Side channel WL #1	15.30			0.090	99.222
Side channel bed #2	15.90		2.133		99.045
Side channel WL #2	15.90			0.170	99.215
RB (of bar) WL edge	16.60		2.028		99.150
RB High Water Mark	16.75		1.585		99.593
2	16.85		1.395		99.783
Top of RB	17.20		1.295		99.883

Channel Slope Survey Data

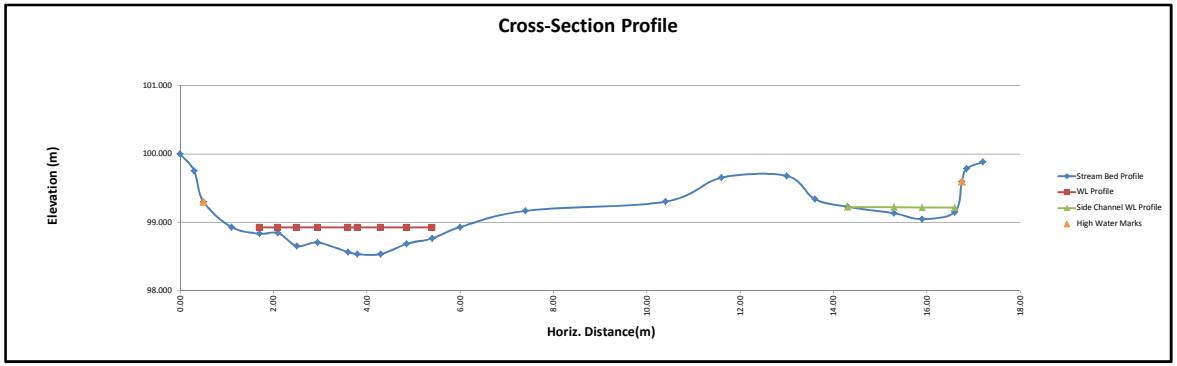
Measured Data			Calculated Data	Channel Reach Notes	
Direction from Cross-section	Distance from Cross-section	Survey Reading	Elevation (m)	Morphology	Substrate
Upstream	17.0	2.227	98.951	Riffle	
	25.0	1.665	99.513	Riffle	
At Cross-section	0.0		98.533	Riffle	
Downstream	14.0	2.471	98.707	Run	
	32.0	2.690	98.488	Run	

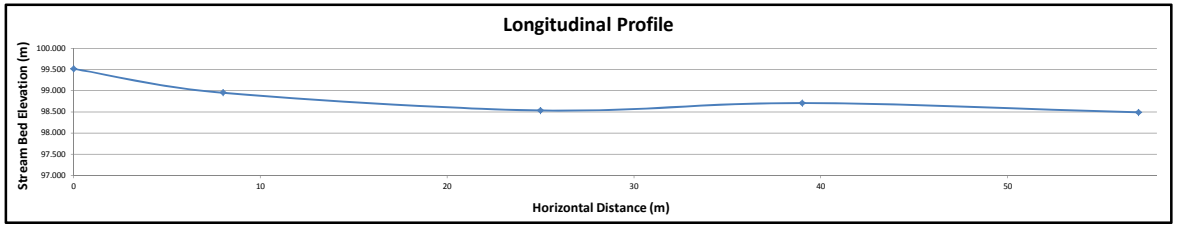
Slope Data:

Horizontal Distance Surveyed:	57.0
Change in Channel Elevation:	1.025
Average Channel Slope (%):	1.798

Survey Information:

Equipment Used:	Engineer's Level & Stadia Rod
Height of Instrument (HI) (m):	101.178
Datum elevation (m):	100.000





General Notes:

-Upstream of the crossing, two channels converge at the end of a large gravel bar, which is followed by a sizeable riffle.
-At the stream crossing, flows are slightly diverged into a main channel and small side channel by another gravel bar. There is very little flow in the side channel.

Field Personnel:	CJ, DH	Trip Date:	24-Sep-14
Data Entry Personnel:	CJ	Date:	8-Oct-14
Data Check Personnel:	TL	Date:	30-Oct-14
Entered Digitally in the Field:	No		

Attachment F

Hydrometric Measurement/Site Visit Record

Hydrometric Measurement / Site Visit Record

Site: KP 27.1 (Sundog Creek)
UTM Location: 418911 E, 6828332 N

Site Visit Date: September 22, 2014
Site Visit Time (MST): 16:30

Hatfield CONSULTANTS

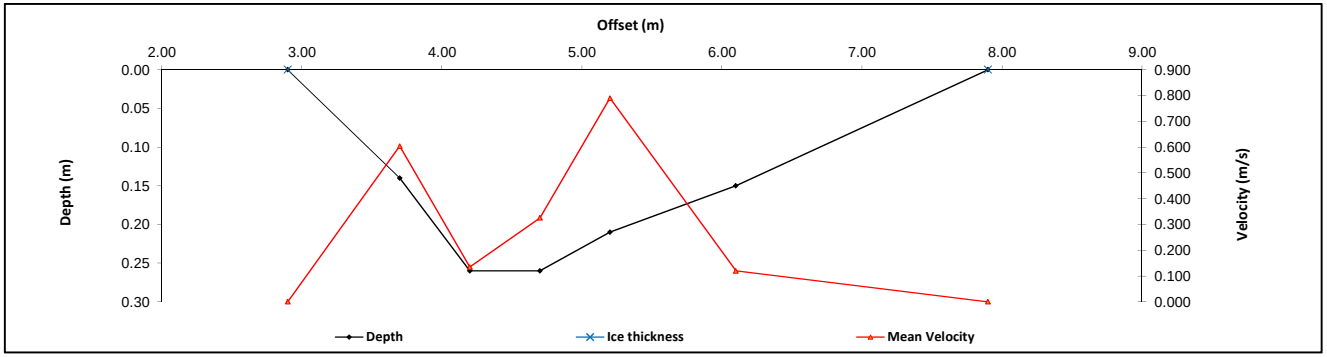
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	2.90	0.00	0.00		0.000		0.000		0.000	1.00	0.40	0.00	0.000	0.00	0.000	
1	3.70	0.14		0.08	0.604					1.00	0.65	0.14	0.604	0.09	0.055	22%
2	4.20	0.26		0.16	0.135					1.00	0.50	0.26	0.135	0.13	0.018	7%
3	4.70	0.26		0.16	0.325					1.00	0.50	0.26	0.325	0.13	0.042	17%
4	5.20	0.21		0.13	0.790					1.00	0.70	0.21	0.790	0.15	0.116	46%
5	6.10	0.15		0.09	0.120					1.00	1.35	0.15	0.120	0.20	0.024	10%
LB	7.90	0.00	0.00		0.00		0.00		0.00	1.00	0.90	0.00	0.000	0.00	0.000	
													Total Flow		**0.255**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	16:45
Meas. End Time (MST):	16:55
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Sunny, windy, 15 C



Flow characteristics:

Total Flow:	**0.255**	**(m^3/s)**
Cross Section Area:	**0.70**	**(m^2)**
Wetted Width:	**5.00**	**(m)**
Hydraulic Depth:	**0.14**	**(m)**
Mean Velocity:	**0.36**	**(m/s)**
Froude Number:	**0.31**	

General Notes:

-Lots of boulders in the channel making flow measurement difficult - lots of eddy effects.
-less than 20 measurements collected due to the rough channel morphology

Field Personnel:	CJ, DH	Trip Date:	22-Sep-14
Data Entry Personnel:	CJ	Date:	6-Oct-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Measurement / Site Visit Record

Site: KP 47.0 (Polje Creek Tributary)
UTM Location: 434240 E, 6829338 N

Site Visit Date: September 21, 2014
Site Visit Time (MST): 14:15

Hatfield CONSULTANTS

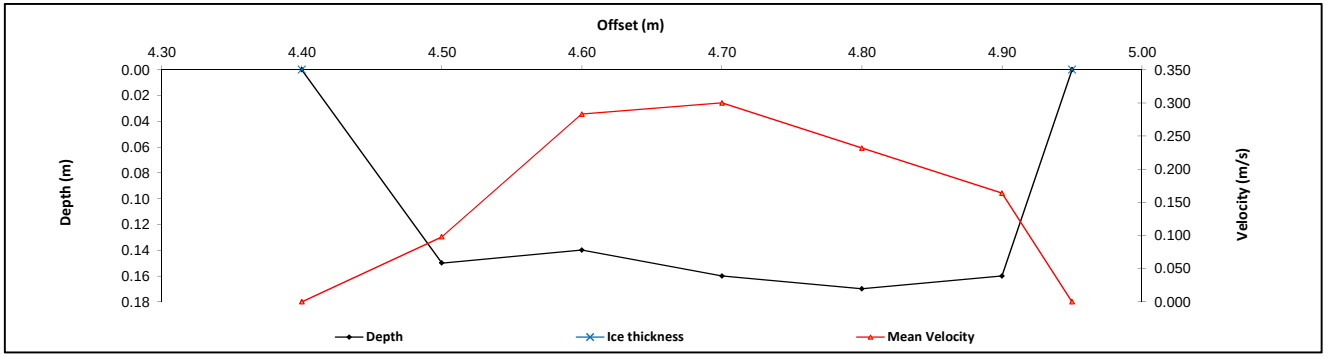
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	4.40	0.00	0.00		0.000		0.000		0.000	1.00	0.05	0.00	0.000	0.00	0.000	
1	4.50	0.15		0.09	0.098					1.00	0.10	0.15	0.098	0.01	0.001	9%
2	4.60	0.14		0.08	0.283					1.00	0.10	0.14	0.283	0.01	0.004	25%
3	4.70	0.16		0.10	0.300					1.00	0.10	0.16	0.300	0.02	0.005	30%
4	4.80	0.17		0.10	0.232					1.00	0.10	0.17	0.232	0.02	0.004	24%
5	4.90	0.16		0.10	0.164					1.00	0.08	0.16	0.164	0.01	0.002	12%
LB	4.95	0.00	0.00		0.00		0.00		0.00	1.00	0.02	0.00	0.000	0.00	0.000	
													Total Flow		**0.016**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	14:30
Meas. End Time (MST):	14:40
Equipment:	ADV
Method:	Wading
River Condition:	low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Partial cloud, calm, 15



Flow characteristics:

Total Flow:	**0.016**	**(m^3/s)**
Cross Section Area:	**0.07**	**(m^2)**
Wetted Width:	**0.55**	**(m)**
Hydraulic Depth:	**0.13**	**(m)**
Mean Velocity:	**0.22**	**(m/s)**
Froude Number:	**0.19**	

General Notes:

-Not able to collect further velocity measurements due to very low water depths and presence of large cobble and boulders obstructing flow.

Field Personnel:	**CJ, DH**	**Trip Date:**	**21-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**30-Sep-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 50.2 (Polje Tributary)
UTM Location: 436944 E, 6829737 N

Site Visit Date: September 21, 2014
Site Visit Time (MST): 09:50

Hatfield CONSULTANTS

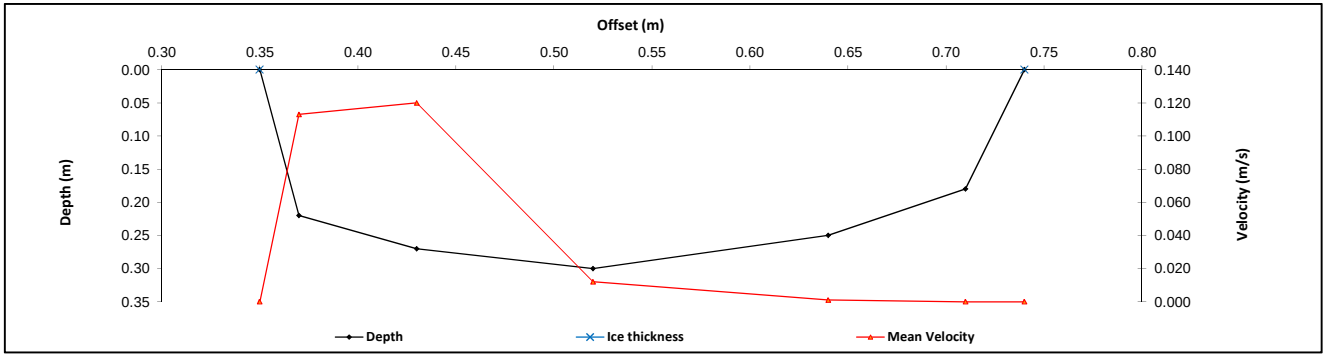
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	0.35	0.00	0.00		0.000		0.000		0.000	1.00	0.01	0.00	0.000	0.00	0.000	
1	0.37	0.22		0.13	0.113					1.00	0.04	0.22	0.113	0.01	0.001	26%
2	0.43	0.27		0.16	0.120					1.00	0.08	0.27	0.120	0.02	0.002	63%
3	0.52	0.30		0.18	0.012					1.00	0.11	0.30	0.012	0.03	0.000	10%
4	0.64	0.25		0.15	0.001					1.00	0.10	0.25	0.001	0.02	0.000	1%
5	0.71	0.18		0.11	0.000					1.00	0.05	0.18	0.000	0.01	0.000	0%
LB	0.74	0.00	0.00		0.00		0.00		0.00	1.00	0.02	0.00	0.000	0.00	0.000	
													Total Flow		**0.004**	**100%**

Flow Measurement Details:

Metering Section Location *(describe):*
At centre of road crossing

Meas. Start Time (MST):	10:20
Meas. End Time (MST):	10:30
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Overcast, calm, 10



Flow characteristics:

Total Flow:	**0.004**	**(m^3/s)**
Cross Section Area:	**0.09**	**(m^2)**
Wetted Width:	**0.39**	**(m)**
Hydraulic Depth:	**0.24**	**(m)**
Mean Velocity:	**0.04**	**(m/s)**
Froude Number:	**0.03**	

General Notes:

-Not able to collect further velocity measurements due to low water depths and presence of large cobble and boulders obstructing flow

Field Personnel:	CJ, DH	Trip Date:	21-Sep-14
Data Entry Personnel:	CJ	Date:	30-Sep-14
Data Check Personnel:	TL	Date:	29-Oct-14
Entered Digitally in the Field:	No		

Hydrometric Measurement / Site Visit Record

Site: KP 54.3 (Polje Creek Tributary)
UTM Location: 440622 E, 6830769 N

Site Visit Date: September 21, 2014
Site Visit Time (MST): 15:45

Hatfield CONSULTANTS

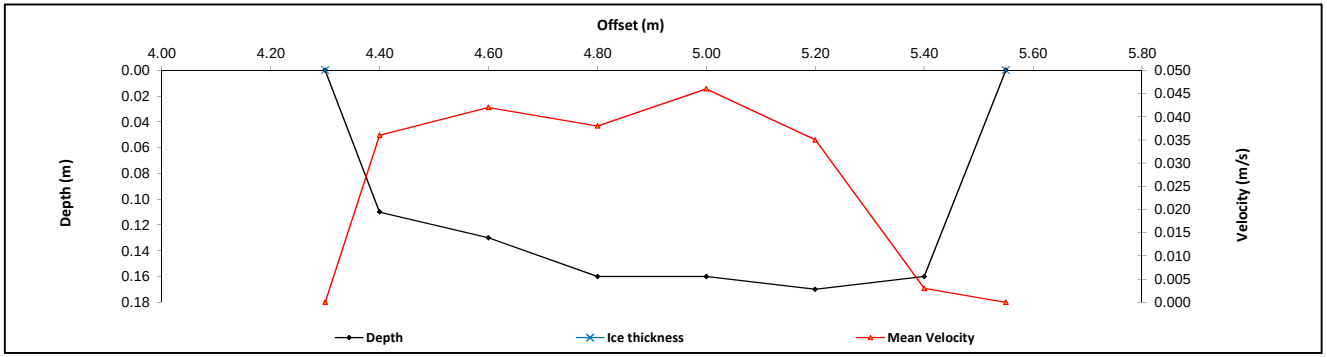
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	4.30	0.00	0.00		0.000		0.000		0.000	1.00	0.05	0.00	0.000	0.00	0.000	
1	4.40	0.11		0.07	0.036					1.00	0.15	0.11	0.036	0.02	0.001	11%
2	4.60	0.13		0.08	0.042					1.00	0.20	0.13	0.042	0.03	0.001	19%
3	4.80	0.16		0.10	0.038					1.00	0.20	0.16	0.038	0.03	0.001	22%
4	5.00	0.16		0.10	0.046					1.00	0.20	0.16	0.046	0.03	0.001	26%
5	5.20	0.17		0.10	0.035					1.00	0.20	0.17	0.035	0.03	0.001	21%
6	5.40	0.16		0.10	0.003					1.00	0.17	0.16	0.003	0.03	0.000	1%
LB	5.55	0.00	0.00		0.00		0.00		0.00	1.00	0.07	0.00	0.000	0.00	0.000	
													Total Flow		**0.006**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	16:00
Meas. End Time (MST):	16:10
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Overcast, calm, 15



Flow characteristics:

Total Flow:	**0.006**	**(m^3/s)**
Cross Section Area:	**0.17**	**(m^2)**
Wetted Width:	**1.25**	**(m)**
Hydraulic Depth:	**0.13**	**(m)**
Mean Velocity:	**0.03**	**(m/s)**
Froude Number:	**0.03**	

General Notes:

-Not able to collect further velocity measurements due to low water depths and presence of large boulders and cobble obstructing flow.

Field Personnel:	**CJ, DH**	**Trip Date:**	**21-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**30-Sep-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 87.7 (Tetcela River)
UTM Location: 460241 E, 6812386 N

Site Visit Date: September 24, 2014
Site Visit Time (MST): 14:00

Hatfield CONSULTANTS

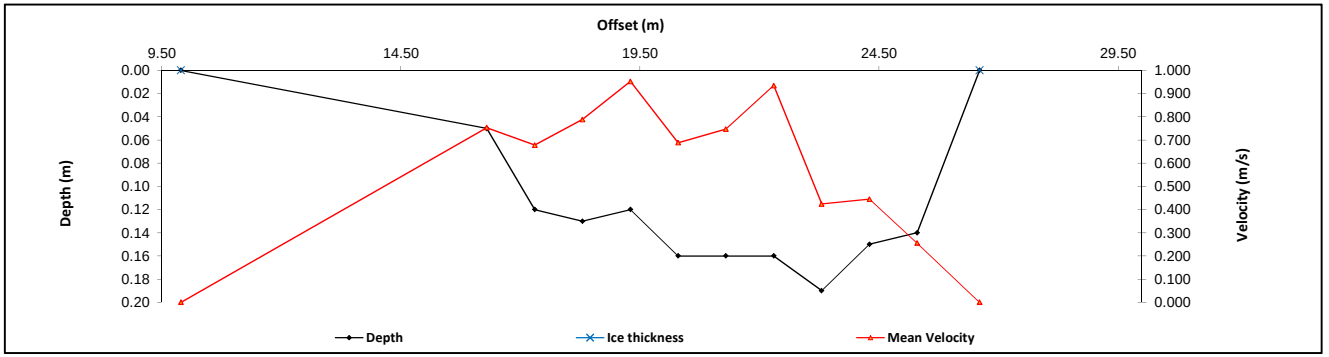
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	9.90	0.00	0.00		0.000		0.000		0.000	1.00	3.20	0.00	0.000	0.00	0.000	
1	16.30	0.05		0.03	0.753					1.00	3.70	0.05	0.753	0.19	0.139	14%
2	17.30	0.12		0.07	0.678					1.00	1.00	0.12	0.678	0.12	0.081	8%
3	18.30	0.13		0.08	0.788					1.00	1.00	0.13	0.788	0.13	0.102	10%
4	19.30	0.12		0.07	0.952					1.00	1.00	0.12	0.952	0.12	0.114	11%
5	20.30	0.16		0.10	0.688					1.00	1.00	0.16	0.688	0.16	0.110	11%
6	21.30	0.16		0.10	0.747					1.00	1.00	0.16	0.747	0.16	0.120	12%
7	22.30	0.16		0.10	0.934					1.00	1.00	0.16	0.934	0.16	0.149	15%
8	23.30	0.19		0.11	0.424					1.00	1.00	0.19	0.424	0.19	0.081	8%
9	24.30	0.15		0.09	0.445					1.00	1.00	0.15	0.445	0.15	0.067	7%
10	25.30	0.14		0.08	0.255					1.00	1.15	0.14	0.255	0.16	0.041	4%
LB	26.60	0.00	0.00		0.00		0.00		0.00	1.00	0.65	0.00	0.000	0.00	0.000	
													Total Flow		**1**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	14:15
Meas. End Time (MST):	14:25
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, calm, 8 C



Flow characteristics:

Total Flow:	**1.000**	**(m^3/s)**
Cross Section Area:	**1.54**	**(m^2)**
Wetted Width:	**16.70**	**(m)**
Hydraulic Depth:	**0.09**	**(m)**
Mean Velocity:	**0.65**	**(m/s)**
Froude Number:	**0.69**	

General Notes:

Field Personnel:	**CJ, DH**	**Trip Date:**	**24-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**7-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**30-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 122.8 (Grainger Tributary)
UTM Location: 477151 E, 6798715 N

Site Visit Date: September 23, 2014
Site Visit Time (MST): 15:20

Hatfield CONSULTANTS

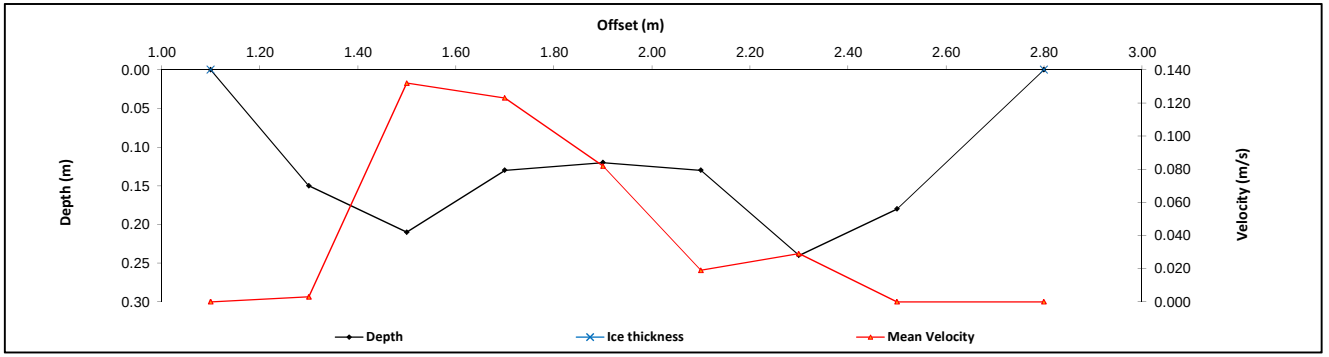
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective 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	1.00	0.10	0.00	0.000	0.00	0.000	
1	1.30	0.15		0.09	0.003					1.00	0.20	0.15	0.003	0.03	0.000	1%
2	1.50	0.21		0.13	0.132					1.00	0.20	0.21	0.132	0.04	0.006	44%
3	1.70	0.13		0.08	0.123					1.00	0.20	0.13	0.123	0.03	0.003	25%
4	1.90	0.12		0.07	0.082					1.00	0.20	0.12	0.082	0.02	0.002	15%
5	2.10	0.13		0.08	0.019					1.00	0.20	0.13	0.019	0.03	0.000	4%
6	2.30	0.24		0.14	0.029					1.00	0.20	0.24	0.029	0.05	0.001	11%
7	2.50	0.18		0.11	0.000					1.00	0.25	0.18	0.000	0.05	0.000	0%
RB	2.80	0.00	0.00		0.00		0.00		0.00	1.00	0.15	0.00	0.000	0.00	0.000	
													Total Flow		**0.0127**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	15:40
Meas. End Time (MST):	15:50
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Straight Edge (e.g. bridge/pier)
Weather:	Partial cloud, calm, 10 C



Flow characteristics:

Total Flow:	**0.013**	**(m^3/s)**
Cross Section Area:	**0.24**	**(m^2)**
Wetted Width:	**1.70**	**(m)**
Hydraulic Depth:	**0.14**	**(m)**
Mean Velocity:	**0.05**	**(m/s)**
Froude Number:	**0.04**	

General Notes:

-Large boulders throughout channel obstructing the flow, not able to collect further velocity measurements

Field Personnel:	**CJ, DH**	**Trip Date:**	**23-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**7-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 123.7 (Grainger River)
UTM Location: 478319 E, 6799043 N

Site Visit Date: September 23, 2014
Site Visit Time (MST): 17:10

Hatfield CONSULTANTS

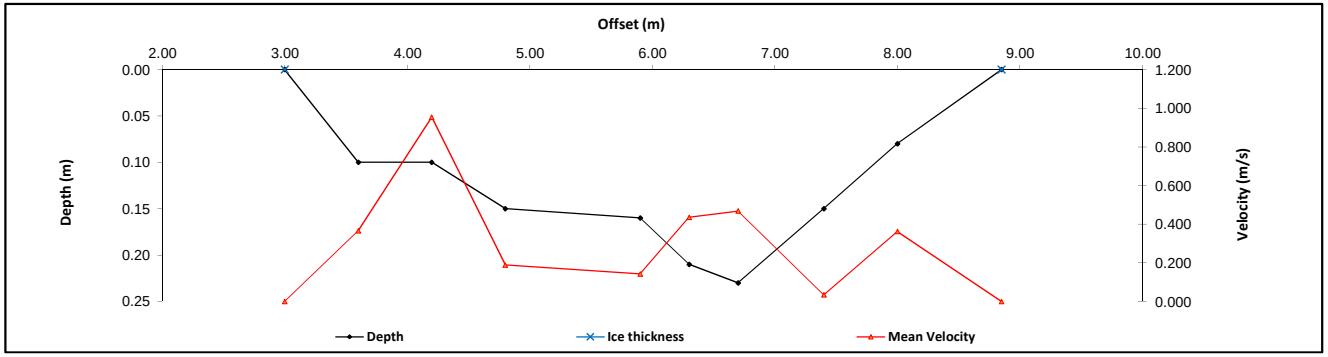
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective 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	1.00	0.30	0.00	0.000	0.00	0.000	
1	3.60	0.10		0.06	0.366					1.00	0.60	0.10	0.366	0.06	0.022	9%
2	4.20	0.10		0.06	0.954					1.00	0.60	0.10	0.954	0.06	0.057	24%
3	4.80	0.15		0.09	0.189					1.00	0.85	0.15	0.189	0.13	0.024	10%
4	5.90	0.16		0.10	0.142					1.00	0.75	0.16	0.142	0.12	0.017	7%
5	6.30	0.21		0.13	0.436					1.00	0.40	0.21	0.436	0.08	0.037	15%
6	6.70	0.23		0.14	0.468					1.00	0.55	0.23	0.468	0.13	0.059	25%
7	7.40	0.15		0.09	0.034					1.00	0.65	0.15	0.034	0.10	0.003	1%
8	8.00	0.08		0.05	0.362					1.00	0.73	0.08	0.362	0.06	0.021	9%
RB	8.85	0.00	0.00		0.00		0.00		0.00	1.00	0.43	0.00	0.000	0.00	0.000	
													Total Flow		**0.24**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	17:30
Meas. End Time (MST):	17:40
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Partial cloud, windy, 12 C



Flow characteristics:

Total Flow:	**0.240**	**(m^3/s)**
Cross Section Area:	**0.73**	**(m^2)**
Wetted Width:	**5.85**	**(m)**
Hydraulic Depth:	**0.13**	**(m)**
Mean Velocity:	**0.33**	**(m/s)**
Froude Number:	**0.30**	

General Notes:

Field Personnel:	**CJ, DH**	**Trip Date:**	**23-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**7-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 125.1 (Grainger River)
UTM Location: 479156 E, 6799517 N

Site Visit Date: September 23, 2014
Site Visit Time (MST): 18:30

Hatfield CONSULTANTS

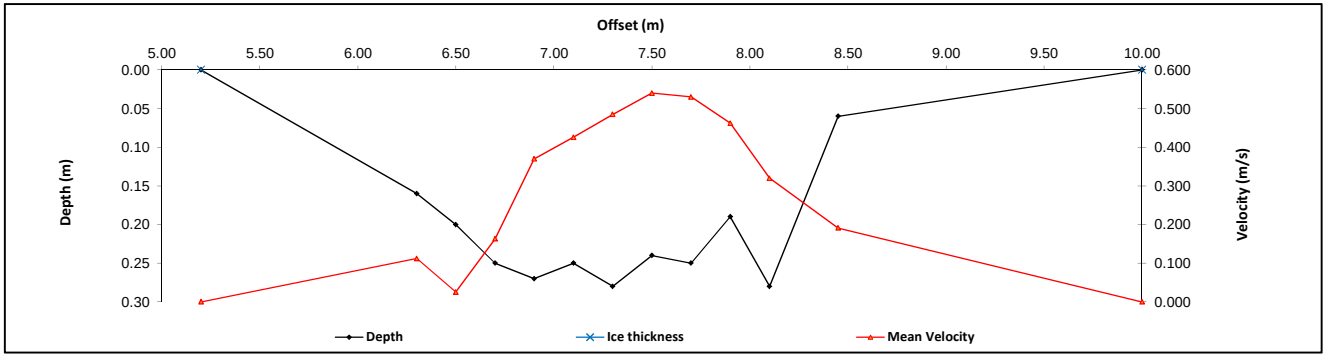
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
LB	5.20	0.00	0.00		0.000		0.000		0.000	1.00	0.55	0.00	0.000	0.00	0.000	
1	6.30	0.16		0.10	0.112					1.00	0.65	0.16	0.112	0.10	0.012	6%
2	6.50	0.20		0.12	0.025					1.00	0.20	0.20	0.025	0.04	0.001	1%
3	6.70	0.25		0.15	0.163					1.00	0.20	0.25	0.163	0.05	0.008	4%
4	6.90	0.27		0.16	0.370					1.00	0.20	0.27	0.370	0.05	0.020	10%
5	7.10	0.25		0.15	0.426					1.00	0.20	0.25	0.426	0.05	0.021	11%
6	7.30	0.28		0.17	0.485					1.00	0.20	0.28	0.485	0.06	0.027	14%
7	7.50	0.24		0.14	0.540					1.00	0.20	0.24	0.540	0.05	0.026	13%
8	7.70	0.25		0.15	0.530					1.00	0.20	0.25	0.530	0.05	0.027	14%
9	7.90	0.19		0.11	0.462					1.00	0.20	0.19	0.462	0.04	0.018	9%
10	8.10	0.28		0.17	0.320					1.00	0.27	0.28	0.320	0.08	0.025	13%
11	8.45	0.06		0.04	0.191					1.00	0.95	0.06	0.191	0.06	0.011	6%
RB	10.00	0.00	0.00		0.00		0.00		0.00	1.00	0.78	0.00	0.000	0.00	0.000	
													Total Flow		**0.195**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
-Approx. 20m upstream of crossing (above gravel bar)

Meas. Start Time (MST):	18:45
Meas. End Time (MST):	18:55
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Clear, breezy, 10 C



Flow characteristics:

Total Flow:	**0.195**	**(m^3/s)**
Cross Section Area:	**0.62**	**(m^2)**
Wetted Width:	**4.80**	**(m)**
Hydraulic Depth:	**0.13**	**(m)**
Mean Velocity:	**0.31**	**(m/s)**
Froude Number:	**0.28**	

General Notes:

- Several gravel bars and a dry side channel are located downstream of measurement cross section.

Field Personnel:	**CJ, DH**	**Trip Date:**	**23-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**7-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 131.3 (Grainger Tributary)
UTM Location: 481988 E, 6794966 N

Site Visit Date: September 26, 2014
Site Visit Time (MST): 12:10

Hatfield CONSULTANTS

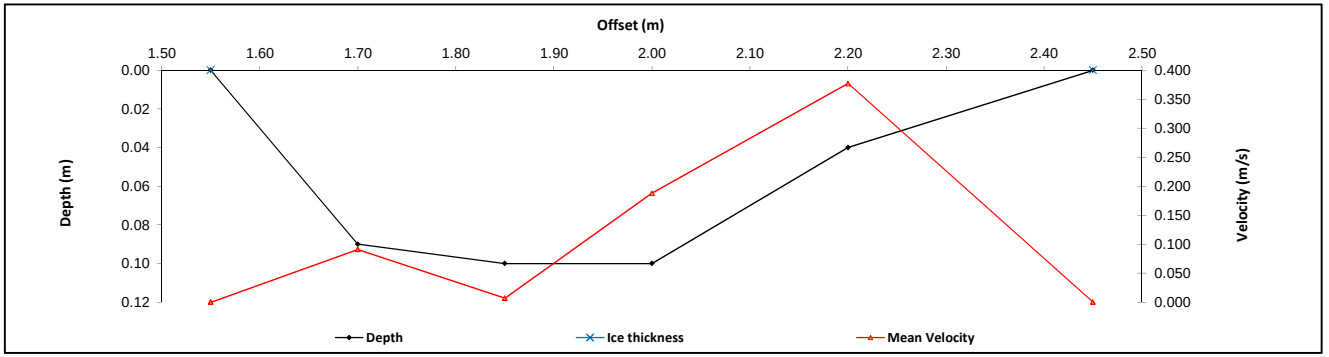
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
LB	1.55	0.00	0.00		0.000		0.000		0.000	1.00	0.08	0.00	0.000	0.00	0.000	
1	1.70	0.09		0.05	0.091					1.00	0.15	0.09	0.091	0.01	0.001	15%
2	1.85	0.10		0.06	0.007					1.00	0.15	0.10	0.007	0.02	0.000	1%
3	2.00	0.10		0.06	0.188					1.00	0.18	0.10	0.188	0.02	0.003	41%
4	2.20	0.04		0.02	0.377					1.00	0.23	0.04	0.377	0.01	0.003	42%
RB	2.45	0.00	0.00		0.00		0.00		0.00	1.00	0.13	0.00	0.000	0.00	0.000	
													Total Flow		**0.00802**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	12:20
Meas. End Time (MST):	12:30
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, light breeze, 5 C



Flow characteristics:

Total Flow:	**0.008**	**(m^3/s)**
Cross Section Area:	**0.06**	**(m^2)**
Wetted Width:	**0.90**	**(m)**
Hydraulic Depth:	**0.06**	**(m)**
Mean Velocity:	**0.15**	**(m/s)**
Froude Number:	**0.19**	

General Notes:

-Lots of embedded cobble and boulders throughout the channel.

Field Personnel:	**CJ, DH**	**Trip Date:**	**26-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**8-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**30-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 133.7 (Grainger Tributary)
UTM Location: 482671 E, 6793161 N

Site Visit Date: September 24, 2014
Site Visit Time (MST): 09:00

Hatfield CONSULTANTS

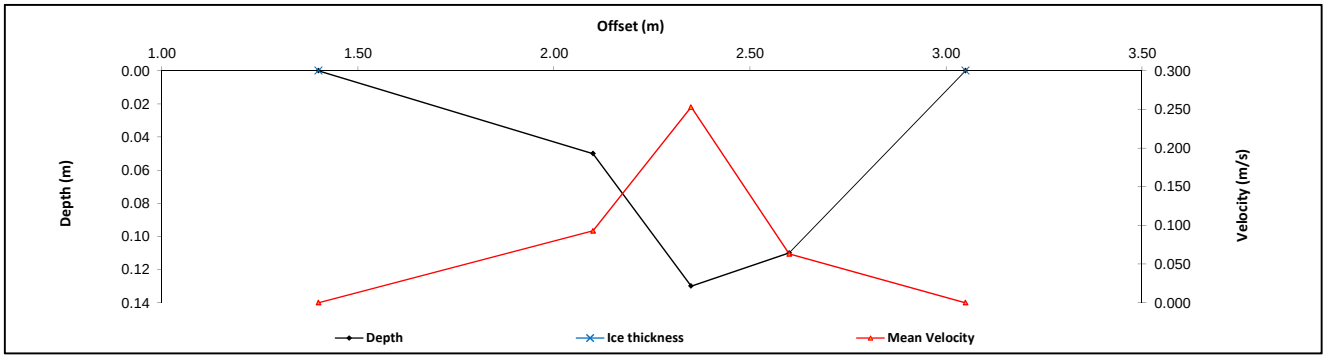
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	1.40	0.00	0.00		0.000		0.000		0.000	1.00	0.35	0.00	0.000	0.00	0.000	
1	2.10	0.05		0.03	0.093					1.00	0.48	0.05	0.093	0.02	0.002	17%
2	2.35	0.13		0.08	0.253					1.00	0.25	0.13	0.253	0.03	0.008	64%
3	2.60	0.11		0.07	0.063					1.00	0.35	0.11	0.063	0.04	0.002	19%
LB	3.05	0.00	0.00		0.00		0.00		0.00	1.00	0.23	0.00	0.000	0.00	0.000	
													Total Flow		**0.013**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	9:20
Meas. End Time (MST):	9:30
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, calm, 8 C



Flow characteristics:

Total Flow:	**0.013**	**(m^3/s)**
Cross Section Area:	**0.09**	**(m^2)**
Wetted Width:	**1.65**	**(m)**
Hydraulic Depth:	**0.06**	**(m)**
Mean Velocity:	**0.14**	**(m/s)**
Froude Number:	**0.18**	

General Notes:

-Not able to collect further velocity measurements due to very low water depths and the presence of large boulders and cobble obstructing flow.

Field Personnel:	**CJ, DH**	**Trip Date:**	**24-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**7-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 135.6 (Grainger Tributary)
UTM Location: 482380 E, 6791274 N

Site Visit Date: September 25, 2014
Site Visit Time (MST): 18:45

Hatfield CONSULTANTS

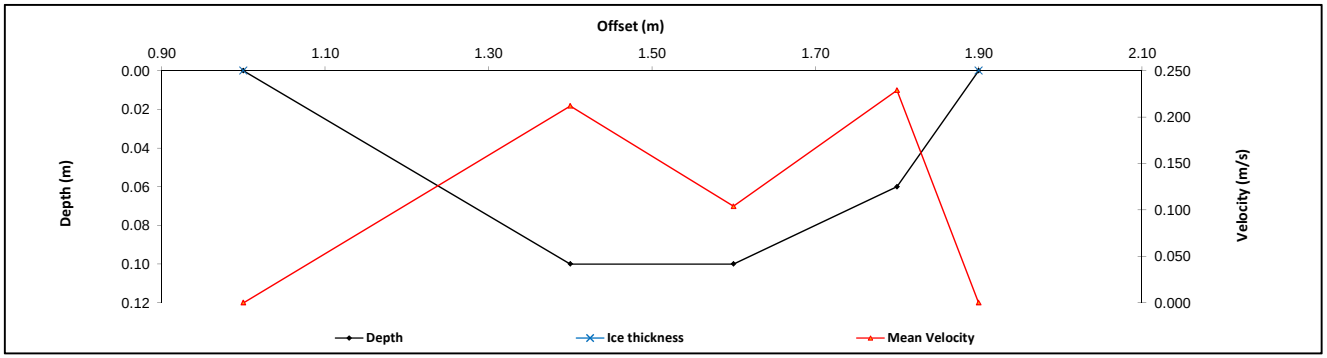
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
LB	1.00	0.00	0.00		0.000		0.000		0.000	1.00	0.20	0.00	0.000	0.00	0.000	
1	1.40	0.10		0.06	0.212					1.00	0.30	0.10	0.212	0.03	0.006	61%
2	1.60	0.10		0.06	0.104					1.00	0.20	0.10	0.104	0.02	0.002	20%
3	1.80	0.06		0.04	0.229					1.00	0.15	0.06	0.229	0.01	0.002	20%
RB	1.90	0.00	0.00		0.00		0.00		0.00	1.00	0.05	0.00	0.000	0.00	0.000	
													Total Flow		**0.0105**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	19:00
Meas. End Time (MST):	19:10
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, calm, 5 C



Flow characteristics:

Total Flow:	**0.011**	**(m^3/s)**
Cross Section Area:	**0.06**	**(m^2)**
Wetted Width:	**0.90**	**(m)**
Hydraulic Depth:	**0.07**	**(m)**
Mean Velocity:	**0.18**	**(m/s)**
Froude Number:	**0.22**	

General Notes:

-Not able to collect further velocity measurements due to very low water depths and the presence of large boulders and cobble obstructing flow.

Field Personnel:	**CJ, DH**	**Trip Date:**	**25-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**8-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: KP 136.7 (Grainger Tributary)
UTM Location: 483132 E, 6790094 N

Site Visit Date: September 26, 2014
Site Visit Time (MST): 11:00

Hatfield CONSULTANTS

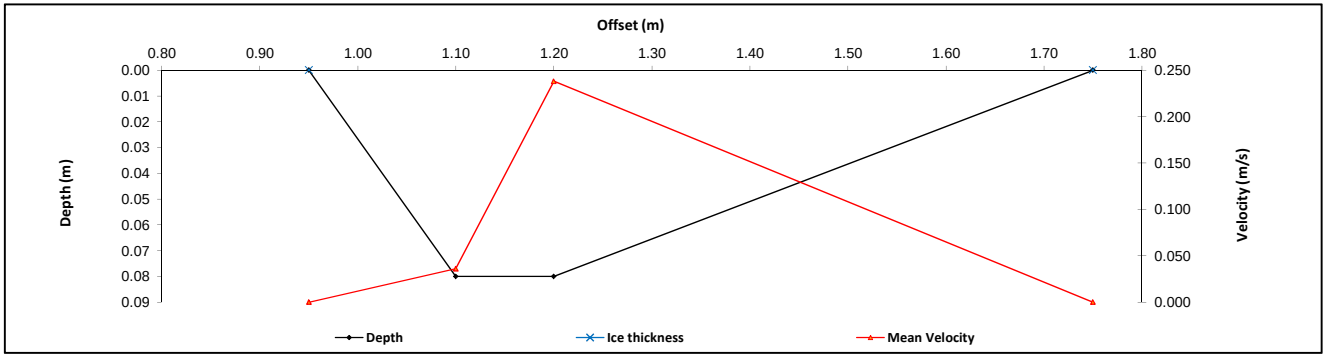
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
LB	0.95	0.00	0.00		0.000		0.000		0.000	1.00	0.08	0.00	0.000	0.00	0.000	
1	1.10	0.08		0.05	0.036					1.00	0.13	0.08	0.036	0.01	0.000	5%
2	1.20	0.08		0.05	0.238					1.00	0.33	0.08	0.238	0.03	0.006	94%
LB	1.75	0.00	0.00		0.00		0.00		0.00	1.00	0.28	0.00	0.000	0.00	0.000	
													Total Flow		**0.007**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	11:15
Meas. End Time (MST):	11:20
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, calm, 5 C



Flow characteristics:

Total Flow:	**0.007**	**(m^3/s)**
Cross Section Area:	**0.04**	**(m^2)**
Wetted Width:	**0.80**	**(m)**
Hydraulic Depth:	**0.05**	**(m)**
Mean Velocity:	**0.18**	**(m/s)**
Froude Number:	**0.27**	

General Notes:

-Not able to collect further velocity measurements due to very low water depths and presence of large cobble and boulders obstructing flow

Field Personnel:	**CJ, DH**	**Trip Date:**	**26-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**8-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: Old Road at Tetcela River (Mainstem)
UTM Location: 461370 E, 6815670 N

Site Visit Date: September 24, 2014
Site Visit Time (MST): 17:15

Hatfield CONSULTANTS

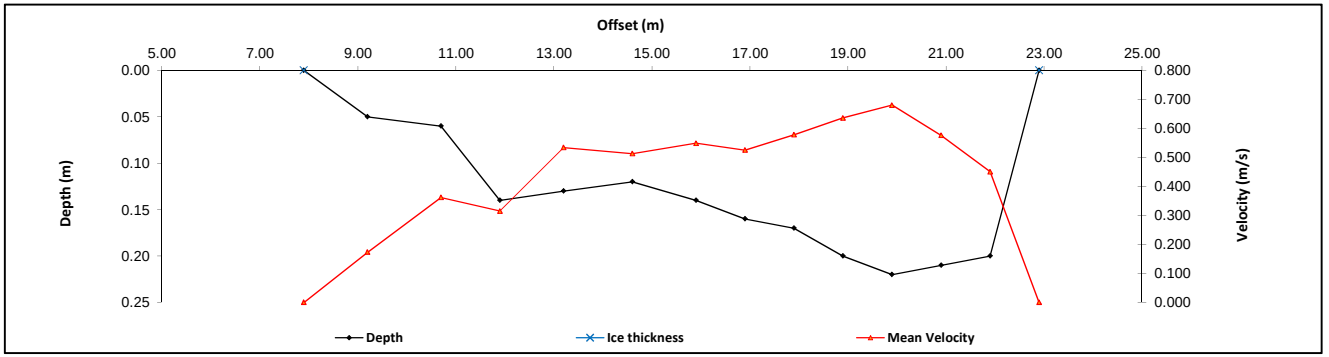
Flow Measurement:

		Measured Data								Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
RB	7.90	0.00	0.00		0.000		0.000		0.000	1.00	0.65	0.00	0.000	0.00	0.000	
1	9.20	0.05		0.03	0.173					1.00	1.40	0.05	0.173	0.07	0.012	1%
2	10.70	0.06		0.04	0.362					1.00	1.35	0.06	0.362	0.08	0.029	3%
3	11.90	0.14		0.08	0.315					1.00	1.25	0.14	0.315	0.18	0.055	5%
4	13.20	0.13		0.08	0.534					1.00	1.35	0.13	0.534	0.18	0.094	9%
5	14.60	0.12		0.07	0.513					1.00	1.35	0.12	0.513	0.16	0.083	8%
6	15.90	0.14		0.08	0.549					1.00	1.15	0.14	0.549	0.16	0.088	9%
7	16.90	0.16		0.10	0.525					1.00	1.00	0.16	0.525	0.16	0.084	8%
8	17.90	0.17		0.10	0.578					1.00	1.00	0.17	0.578	0.17	0.098	10%
9	18.90	0.20		0.12	0.636					1.00	1.00	0.20	0.636	0.20	0.127	12%
10	19.90	0.22		0.13	0.680					1.00	1.00	0.22	0.680	0.22	0.150	15%
11	20.90	0.21		0.13	0.576					1.00	1.00	0.21	0.576	0.21	0.121	12%
12	21.90	0.20		0.12	0.451					1.00	1.00	0.20	0.451	0.20	0.090	9%
LB	22.90	0.00	0.00		0.00		0.00		0.00	1.00	0.50	0.00	0.000	0.00	0.000	
													Total Flow		**1.03**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	17:25
Meas. End Time (MST):	17:35
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, calm, 8 C



Flow characteristics:

Total Flow:	**1.030**	**(m^3/s)**
Cross Section Area:	**1.98**	**(m^2)**
Wetted Width:	**15.00**	**(m)**
Hydraulic Depth:	**0.13**	**(m)**
Mean Velocity:	**0.52**	**(m/s)**
Froude Number:	**0.46**	

General Notes:

Field Personnel:	**CJ, DH**	**Trip Date:**	**24-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**8-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**29-Oct-14**
Entered Digitally in the Field:	**No**		

Hydrometric Measurement / Site Visit Record

Site: Old Road at Tetcela Tributary
UTM Location: 460369 E, 6813941 N

Site Visit Date: September 24, 2014
Site Visit Time (MST): 16:30

Hatfield CONSULTANTS

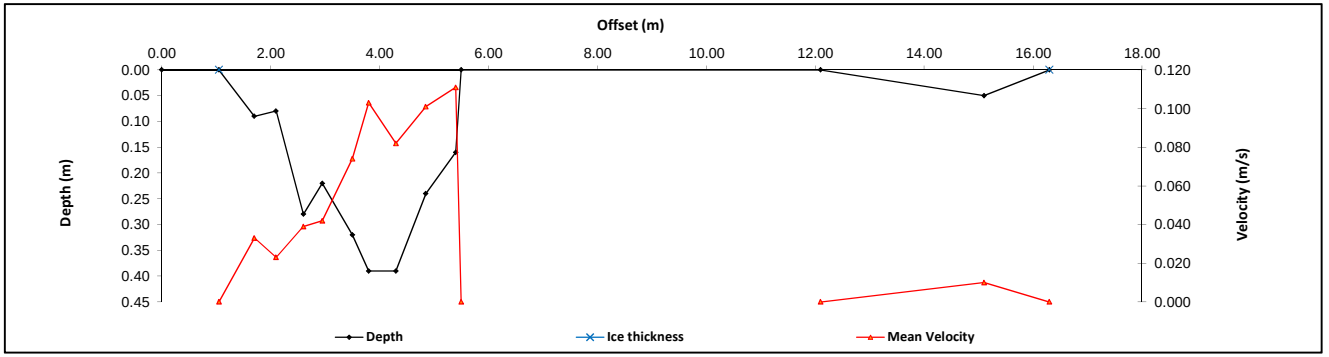
Flow Measurement:

Measured Data										Calculated Data						
Bank/ Mmt #	Offset (m)	Depth from bottom to WS (m)	WS to bottom of ice (m)	Depth of Obs. @ 0.6 Depth (m)	Velocity @ 0.6 Depth (m/s)	Depth of Obs. @ 0.8 Depth (m)	Velocity @ 0.8 Depth (m/s)	Depth of Obs. @ 0.2 Depth (m)	Velocity @ 0.2 Depth (m/s)	Velocity Correction Factor (m)	Pannel Width (m)	Effective Pannel Depth (m)	Effective Average Pannel Velocity (m/s)	Pannel Area (m^2)	Pannel Discharge (m^3/s)	Percent of total flow (%)
LB	1.05	0.00	0.00		0.000		0.000		0.000	1.00	0.33	0.00	0.000	0.00	0.000	
1	1.70	0.09		0.05	0.033					1.00	0.53	0.09	0.033	0.05	0.002	2%
2	2.10	0.08		0.05	0.023					1.00	0.45	0.08	0.023	0.04	0.001	1%
3	2.60	0.28		0.17	0.039					1.00	0.43	0.28	0.039	0.12	0.005	6%
4	2.95	0.22		0.13	0.042					1.00	0.45	0.22	0.042	0.10	0.004	6%
5	3.50	0.32		0.19	0.074					1.00	0.43	0.32	0.074	0.14	0.010	14%
6	3.80	0.39		0.23	0.103					1.00	0.40	0.39	0.103	0.16	0.016	22%
7	4.30	0.39		0.23	0.082					1.00	0.52	0.39	0.082	0.20	0.017	23%
8	4.85	0.24		0.14	0.101					1.00	0.55	0.24	0.101	0.13	0.013	18%
9	5.40	0.16		0.10	0.111					1.00	0.33	0.16	0.111	0.05	0.006	8%
10	5.50	0.00		0.00						1.00	5.45	0.00		0.00		
Bar	0.00	0.00		0.00												
11	12.10	0.00		0.00						1.00	7.55	0.00		0.00		
12	15.10	0.05		0.03	0.010					1.00	2.10	0.05	0.010	0.11	0.001	1%
LB	16.30	0.00	0.00		0.00		0.00		0.00	1.00	0.60	0.00	0.000	0.00	0.000	
													Total Flow		**0.074**	**100%**

Flow Measurement Details:

Metering Section Location *(describe)*:
At stream crossing

Meas. Start Time (MST):	16:50
Meas. End Time (MST):	17:00
Equipment:	ADV
Method:	Wading
River Condition:	Low flow
Channel Edges:	Trapezoidal Edge (e.g. stream)
Weather:	Cloudy, calm, 8 C



Flow characteristics:

Total Flow:	**0.074**	**(m^3/s)**
Cross Section Area:	**1.09**	**(m^2)**
Wetted Width:	**16.30**	**(m)**
Hydraulic Depth:	**0.07**	**(m)**
Mean Velocity:	**0.07**	**(m/s)**
Froude Number:	**0.08**	

General Notes:

-A gravel bar, with a small side channel, are present on the RB

Field Personnel:	**CJ, DH**	**Trip Date:**	**24-Sep-14**
Data Entry Personnel:	**CJ**	**Date:**	**8-Oct-14**
Data Check Personnel:	**TL**	**Date:**	**30-Oct-14**
Entered Digitally in the Field:	**No**		