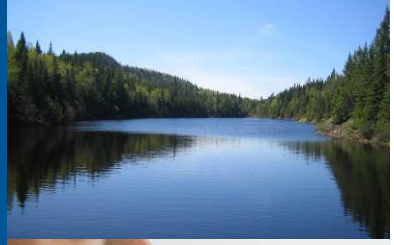
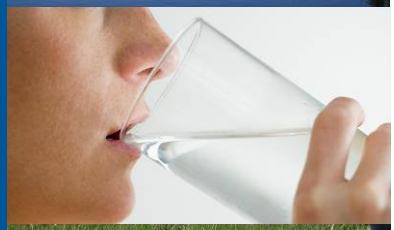






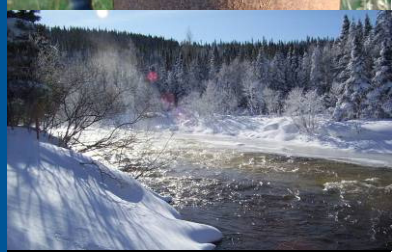

Real Time Water Quality Report
Main River at Paradise Pool

Deployment Period 2010-08-24 to 2010-11-03

2011-01-05

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division

General

- This station is operated cooperatively with Environment Canada.
- This station is operated seasonally from early spring as soon as the site is free of ice and up until the late fall before ice forms along the river.
- Staff of the Water Resources Management Division (WRMD) monitors the real-time web page on a daily basis. Any unusual observations are investigated.
- This is a remote site accessible by helicopter only and site visits for QA/QC purposes and the installation of freshly calibrated instruments are conducted by staff of the WRMD approximately five or six times per field season.

Maintenance and Calibration of Instrumentation

- On August 24, 2010 the Main River at Paradise Pool **DataSonde®** was removed and replaced with one that was freshly calibrated. This instrument remained deployed continuously until November 03, 2010 when it was removed at the end of the field season.

Quality Assurance / Quality Control (QA/QC) Measures

- As part of the QA/QC protocol, an assessment of the reliability of data recorded by an instrument is made at the beginning and end of the deployment period. The procedure is based on the approach used by the United States Geological Survey. See **Table 1**.

	Rank				
Parameter	**Excellent**	**Good**	**Fair**	**Marginal**	**Poor**
Temperature (oC)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	<+/-1
pH (unit)	<=+/-0.2	>+/-0.2 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Sp. Conductance (µS/cm)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Sp. Conductance > 35 µS/cm (%)	<=+/-3	>+/-3 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20
Dissolved Oxygen (mg/L) (% Sat)	<=+/-0.3	>+/-0.3 to 0.5	>+/-0.5 to 0.8	>+/-0.8 to 1	>+/-1
Turbidity <40 NTU (NTU)	<=+/-2	>+/-2 to 5	>+/-5 to 8	>+/-8 to 10	>+/-10
Turbidity > 40 NTU (%)	<=+/-5	>+/-5 to 10	>+/-10 to 15	>+/-15 to 20	>+/-20

Table 1

- Upon deployment, a QA/QC **DataSonde®** is temporarily deployed along side the Field **DataSonde®**. Values for temperature and dissolved oxygen are compared between the two instruments. A grab sample is taken to compare with the Field **DataSonde®** for specific conductivity, pH and turbidity parameters. Based on the difference between parameters recorded by the Field **DataSonde®** and QAQC **DataSonde®** a qualitative statement is made on the data quality upon deployment.

- At the end of a deployment period, readings are taken in the water body from the Field **DataSonde®** before and after a thorough cleaning in order to assess the degree of biofouling. During calibration in the laboratory, an assessment of calibration drift is made and the two error values are combined to give Total Error (T_e). If T_e exceeds a predetermined data correction criterion, a correction based on T_e is applied to the dataset using linear interpolation. Based on the value for T_e, a qualitative statement is also made on the data quality upon removal.

- The ranking at the beginning and end of the deployment period are shown in **Table 2**.
- With the exception of water quantity data (Stage), all data used in the preparation of the graphs and subsequent discussion below adhere to this stringent Quality Assurance and Quality Control (QA/QC) protocol. Water Survey of Canada is responsible for QA/QC of water quantity data. Corrected data can be obtained upon request.

Main River at Paradise Pool (NF02YG0009)		
Date (yyyy-mm-dd)	**Parameter**	**Ranking**
2010-08-24 Deployment	Temp (^{o}C)	Excellent
	pH (units)	Fair
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (mg/L)	Excellent
	Turbidity (NTU)	Excellent
2010-11-03 Removal	Temp (^{o}C)	Excellent
	pH (units)	Fair
	Sp. Conductivity (uS/cm)	Excellent
	Dissolved Oxygen (%)	Fair
	Turbidity (NTU)	Poor*

Table 2

* At the time of removal, the turbidity probe was impacted by significant bio-fouling causing it to give false high turbidity readings which meant it compared poorly with the QA/QC data.

Data Interpretation

- The water temperature (**Figure 1**) ranged from a minimum of 2.7 ˚C to a maximum of 19.8 ˚C, with a general cooling trend throughout the deployment period.

- It would appear that while there is a general cooling trend over the fall there is considerable variability in temperature from day to day which is related to both the air temperature and significant changes in stream flow.

- Temperature shows a diurnal trend with warming during the day and cooling at night.

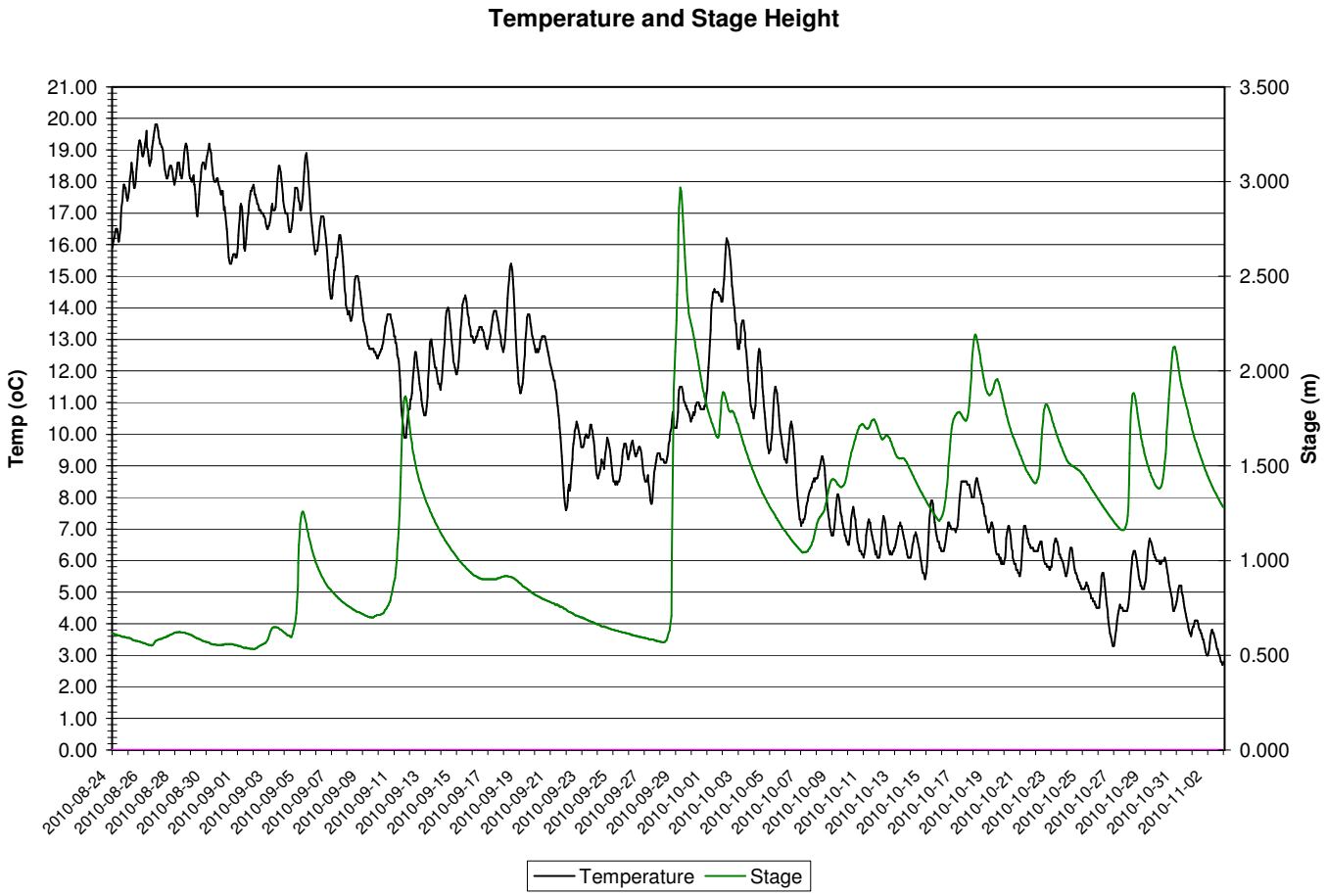

Figure 1

- The corrected pH ranged from a low of 4.58 to a high of 6.52 and remained relatively stable throughout the deployment period. (**Figure 2**).

- There are numerous instances throughout the deployment period where the pH values decrease in relation to an increase in stage height and flow. The two most noticeable decreases are represented on the graph in the red ovals (September 13th and 29th).

- Most of the pH readings were below the range of 6.5 to 9.0 recommended by CCME for the protection of aquatic life. It should be noted that these pH readings are normal for Main River and that its aquatic ecosystems are healthy with abundant aquatic life. The CCME guidelines are developed for the country as a whole and cannot accommodate the site specific conditions of all aquatic ecosystems such as Main River's.

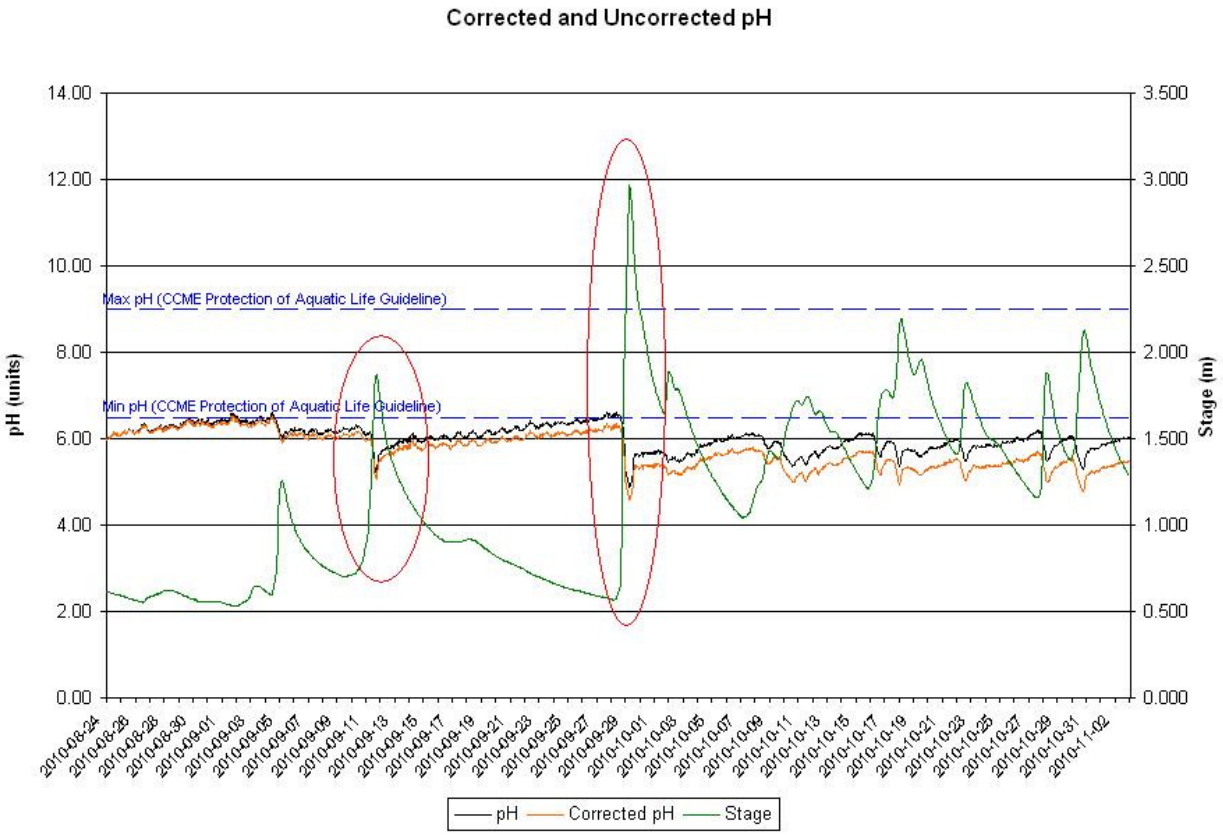

Figure 2

- The specific conductivity **(Figure 3)** ranged from a minimum of 16.8µS/cm to a maximum of 25.1 µS/cm and was relatively stable over the deployment period.

- It appears that day to day variability in specific conductivity is at least partially related to stream flow and a rapid increase in stage height around September 29th corresponds with a distinct spike in specific conductivity (see inside red oval).

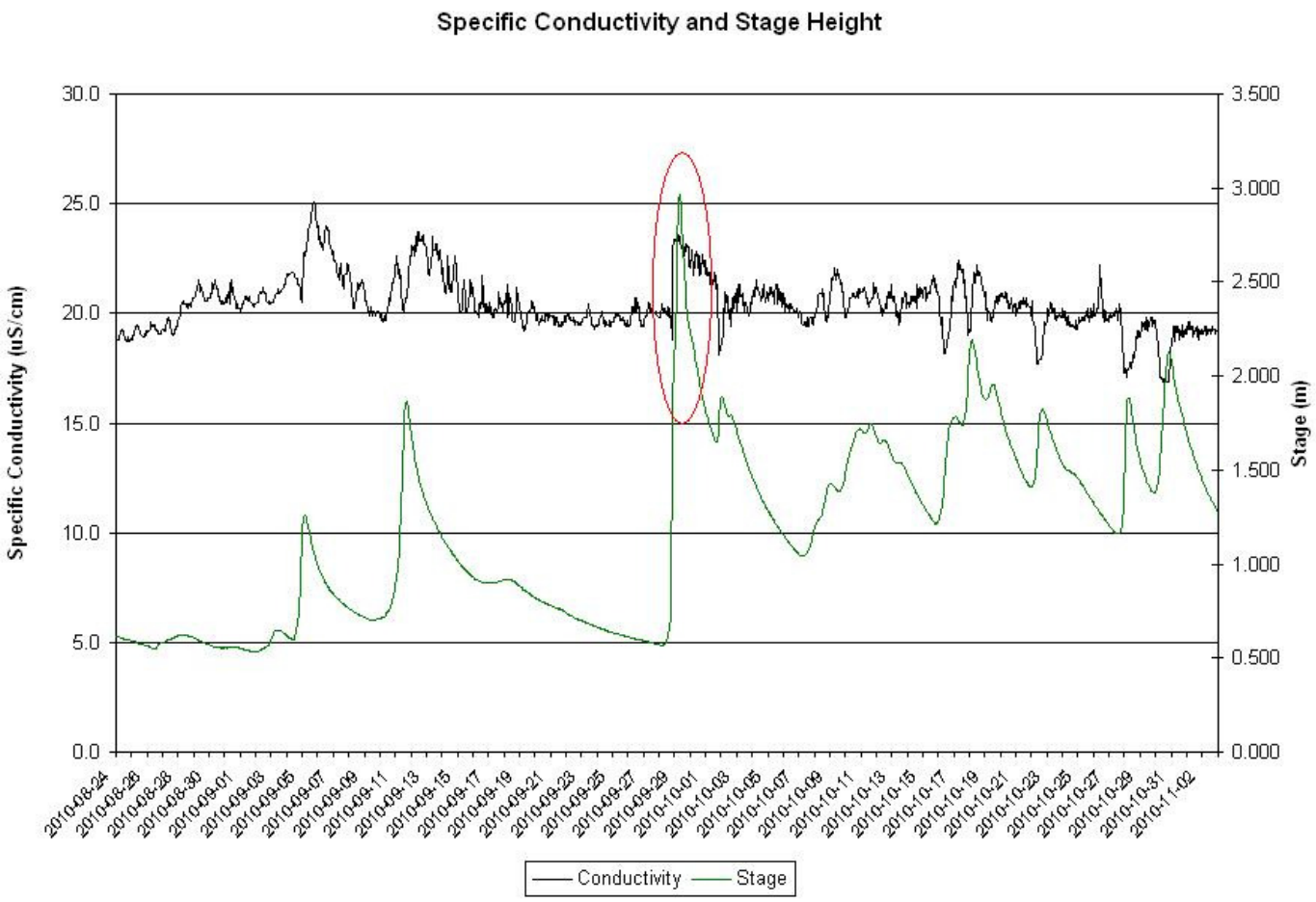

Figure 3

- The dissolved oxygen (**Figure 4**) values ranged from a minimum of 7.67 mg/L to a maximum of 11.83 mg/L over the deployment period with the corresponding corrected percent saturation ranging between 78.5% and 95.6%.

- There is a general rising trend in DO(mg/L) over the deployment period which is related to the cooling trend over the same period.

- Throughout the first half of the deployment period most of the dissolved oxygen values fell below the limits recommended by CCME *Canadian Water Quality Guidelines for the Protection of Aquatic Life* for the Protection of Cold Water Early Life Stages (9.5 mg/l) and above the Guideline for the Protection of Cold Water Other Life Stages (6.5 mg/l).

- There is a clear diurnal trend for dissolved oxygen which is related to the diurnal temperature trend.

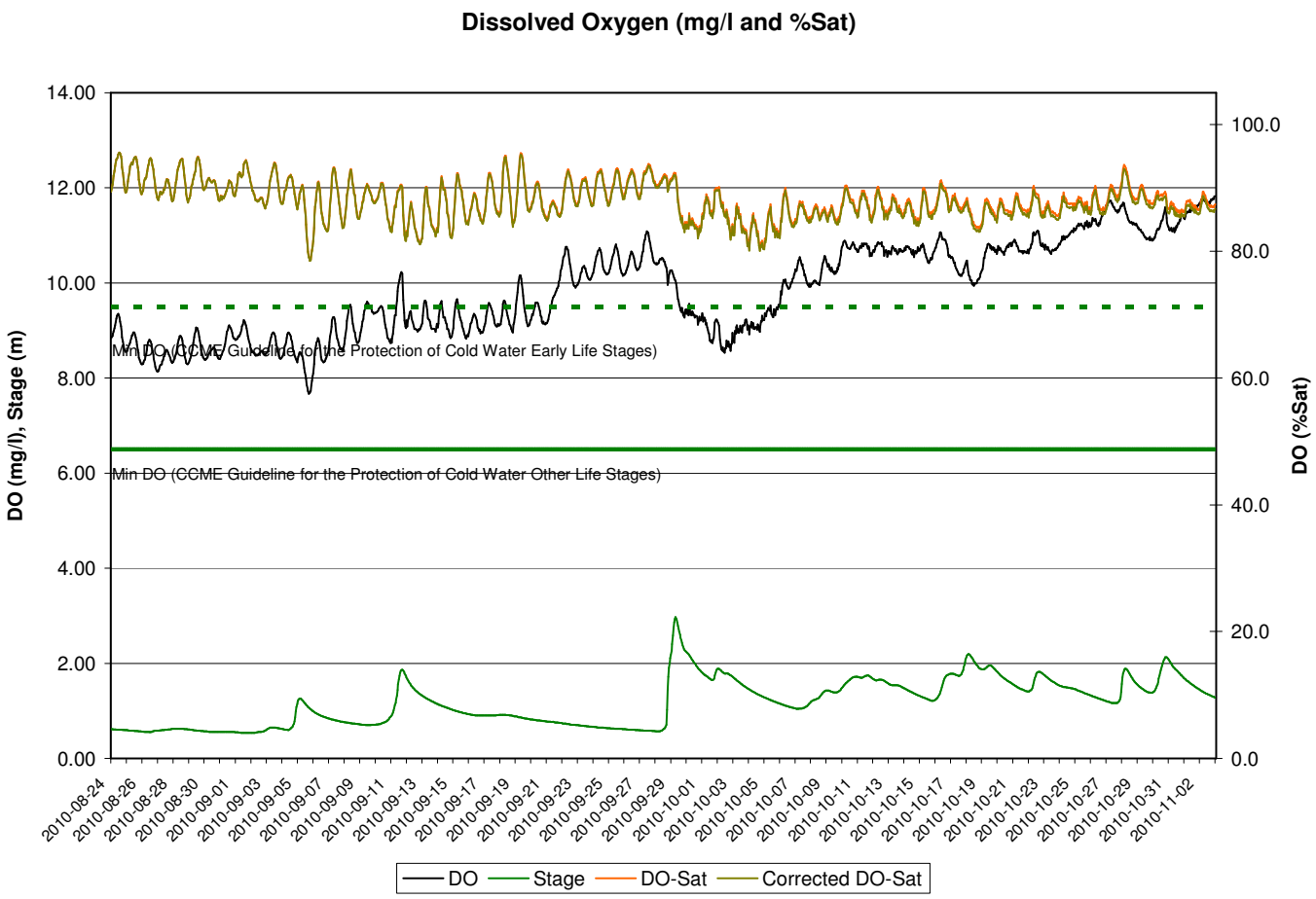

Figure 4

- The turbidity values (**Figure 5**) ranged from a minimum of 0.0 NTU to a maximum of 386.9 NTU.

- While the higher turbidity values in the first half of the deployment period are most likely related to the rapid rise in stage height and flow(see inside red ovals), the higher turbidity values during the latter half of the deployment period are related to bio-fouling of the probe and do not reflect actual turbidity levels in the river.

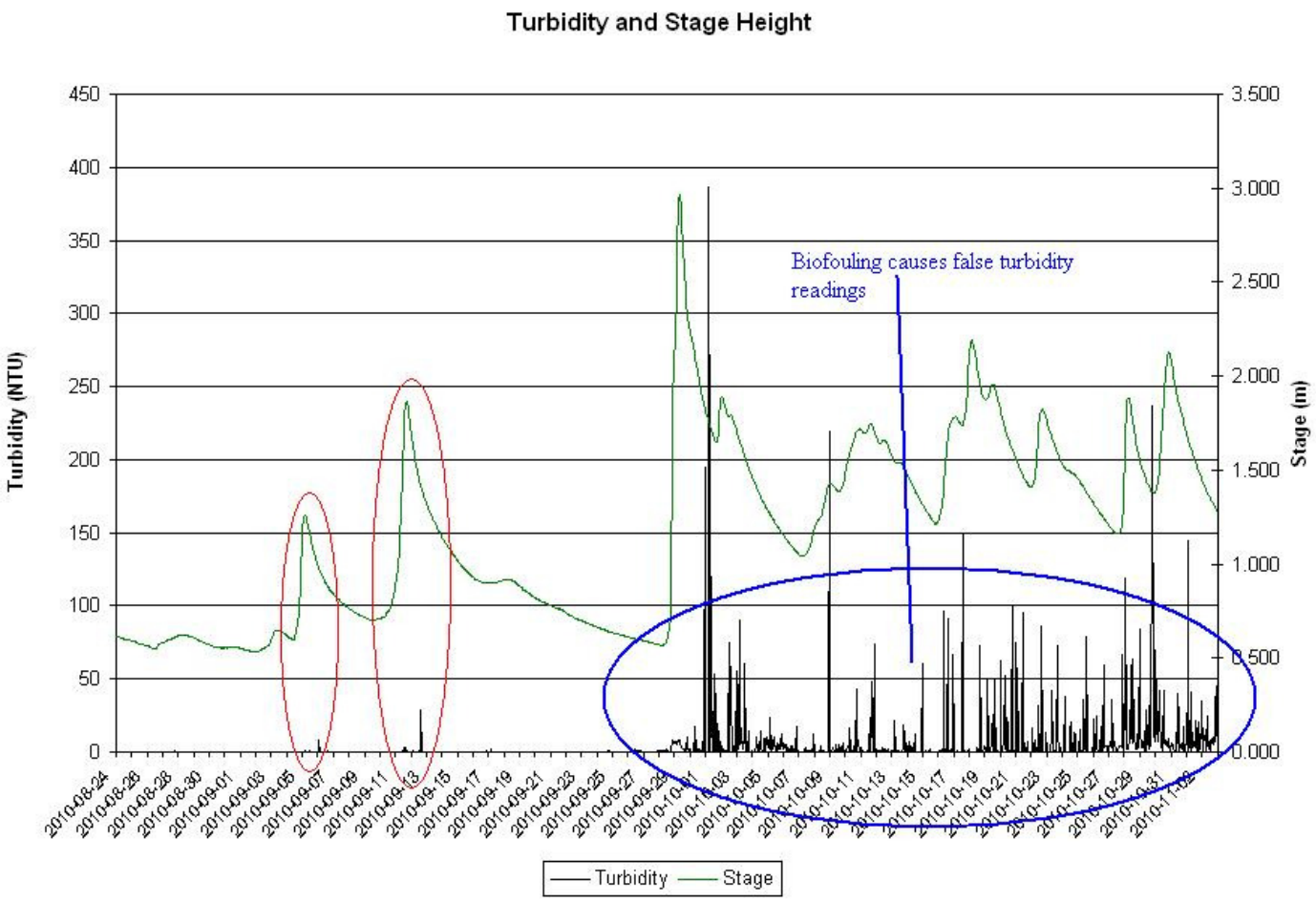

Figure 5

- The stage height (**Figure 6**) or water level ranged from a minimum of 0.532 m to a maximum of 2.969 m which corresponds to a range of flow values from 3.8 m^3/s to 232 m^3/s with the highest peaks resulting from significant precipitation events. The precipitation data in Appendix A is from the Rocky Harbour weather station and gives an indication of conditions in the watershed for Main River.

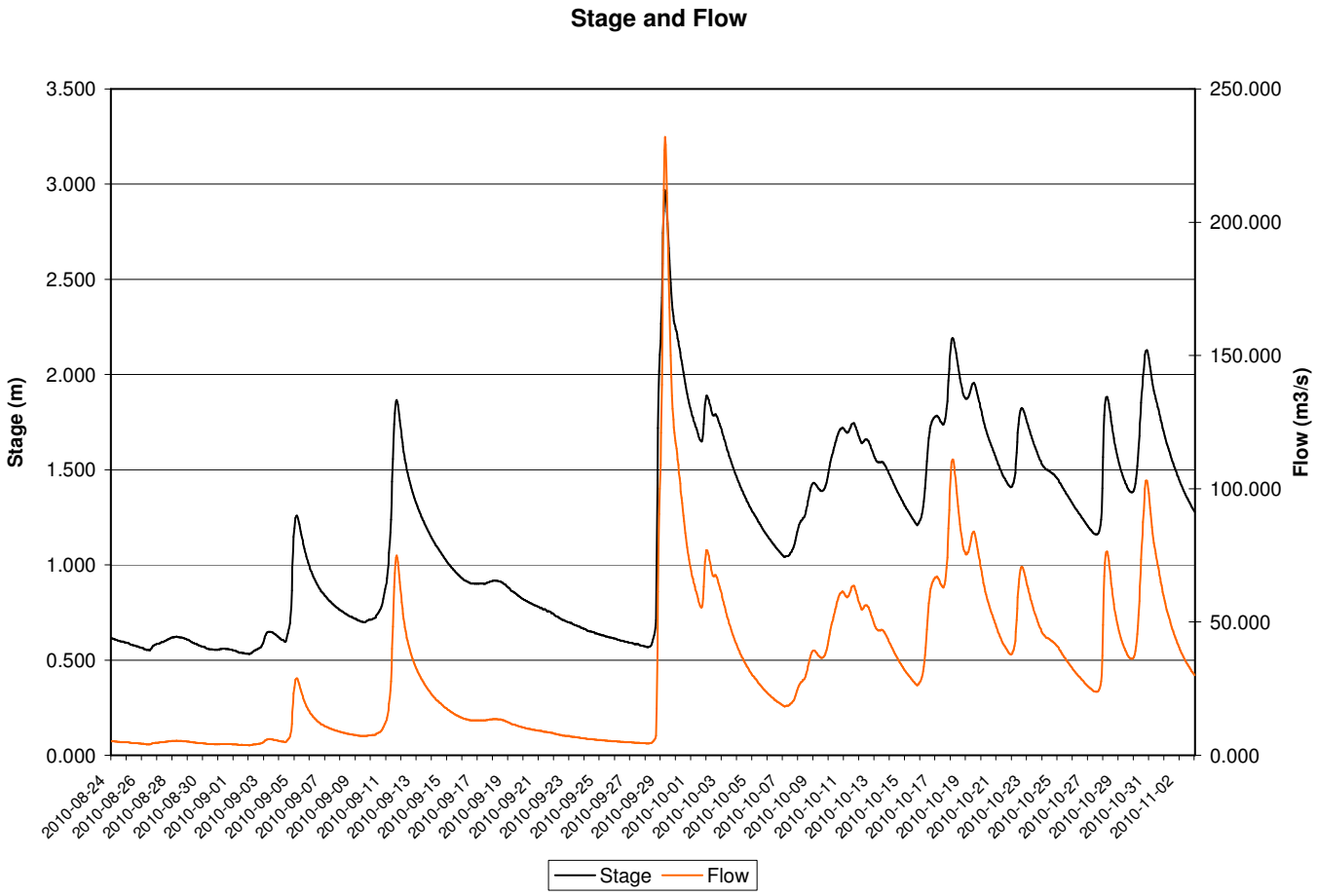

Figure 6

Climate Data

- Climate data for the full deployment period from the nearest station (Rocky Harbour) is included in Appendix A.

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Appendix A

August Climate Data

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
24†	21.6	8.7	15.2	2.8	0.0	M	M	0.0			<31
25†	22.5	10.9	16.7	1.3	0.0	M	M	0.0			<31
26†	26.0	10.4	18.2	0.0	0.2	M	M	10.9		16E	32E
27†	23.1	15.2	19.2	0.0	1.2	M	M	9.3		24E	33E
28†	21.2	9.7	15.5	2.5	0.0	M	M	0.0			<31
29†	23.6	10.9	17.3	0.7	0.0	M	M	0.0			<31
30†	21.0	9.9	15.5	2.5	0.0	M	M	0.3			<31
31†	20.1	9.3	14.7	3.3	0.0	M	M	0.7		25E	43E
Sum				**46.7**	**9.5**	**M**	**M**	**76.3**			
Avg	**22.5**	**11.1**	**16.78**								
Xtrm	**26.0**	**7.1**								**24E**	**44E**

September Climate Data

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	23.3	8.7	16.0	2.0	0.0	M	M	1.0			<31
02†	20.5	15.3	17.9	0.1	0.0	M	M	7.0			<31
03†	20.3	13.5	16.9	1.1	0.0	M	M	0.3			<31
04†	26.4	15.0	20.7	0.0	2.7	M	M	13.1		9E	67E
05†	22.5	15.7	19.1	0.0	1.1	M	M	0.0		23E	54E
06†	16.3	13.2	14.8	3.2	0.0	M	M	0.0		25E	50E
07†	19.2	10.3	14.8	3.2	0.0	M	M	0.0		24E	44E
08†	16.8	9.7	13.3	4.7	0.0	M	M	0.0			<31
09†	14.2	10.1	12.2	5.8	0.0	M	M	2.3		10E	43E
10†	22.0	13.0	17.5	0.5	0.0	M	M	6.3		10E	33E
11†	14.7	7.3	11.0	7.0	0.0	M	M	22.5		8E	33E
12†	15.4	1.0	8.2	9.8	0.0	M	M	0.0			<31
13†	16.8	1.1	9.0	9.0	0.0	M	M	0.0			<31
14†	16.0	5.7	10.9	7.1	0.0	M	M	0.3		16E	32E
15†	21.3	8.9	15.1	2.9	0.0	M	M	0.0			<31
16†	15.6	11.2	13.4	4.6	0.0	M	M	0.0		25E	32E
17†	15.3	10.3	12.8	5.2	0.0	M	M	2.8		25E	35E
18†	17.3	5.3	11.3	6.7	0.0	M	M	1.4			<31
19†	20.0	4.1	12.1	5.9	0.0	M	M	0.0			<31
20†	17.3	11.2	14.3	3.7	0.0	M	M	0.0			<31
21†	11.5	8.3	9.9	8.1	0.0	M	M	0.0		33E	54E
22†	14.6	8.2	11.4	6.6	0.0	M	M	0.0		24E	46E
23†	12.9	8.5	10.7	7.3	0.0	M	M	0.0		25E	50E
24†	12.5	4.7	8.6	9.4	0.0	M	M	0.0		26E	37E
25†	13.0	4.5	8.8	9.2	0.0	M	M	0.0			<31
26†	11.7	-1.2	5.3	12.7	0.0	M	M	0.0			<31
27†	13.5	-0.3	6.6	11.4	0.0	M	M	0.0		23E	35E

28†	17.5	11.6	14.6	3.4	0.0	M	M	75.4	23E	48E
29†	18.8	12.3	15.6	2.4	0.0	M	M	16.4	23E	69E
30†	14.8	9.8	12.3	5.7	0.0	M	M	0.0	15E	32E
Sum				**158.7**	**3.8**	**M**	**M**	**148.8**		
Avg	**17.1**	**8.6**	**12.82**							
Xtrm	**26.4**	**-1.2**							**23E**	**69E**

October Climate Data

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	26.0	14.8	20.4	0.0	2.4	M	M	0.0		22E	72E
02†	25.7	8.7	17.2	0.8	0.0	M	M	0.0		22E	41E
03†	11.1	5.0	8.1	9.9	0.0	M	M	0.0			<31
04†	13.8	1.7	7.8	10.2	0.0	M	M	0.0			<31
05†	13.9	6.9	10.4	7.6	0.0	M	M	0.0		25E	43E
06†	9.3	-1.8	3.8	14.2	0.0	M	M	0.0			<31
07†	12.4	1.5	7.0	11.0	0.0	M	M	0.0		14E	52E
08†	11.6	4.4	8.0	10.0	0.0	M	M	0.0		24E	54E
09†	8.0	4.5	6.3	11.7	0.0	M	M	0.0		26E	37E
10†	7.4	3.4	5.4	12.6	0.0	M	M	0.0		26E	41E
11†	7.3	3.4	5.4	12.6	0.0	M	M	0.0			<31
12†	9.8	4.7	7.3	10.7	0.0	M	M	0.0		25E	44E
13†	8.1	3.7	5.9	12.1	0.0	M	M	0.0			<31
14†	7.5	-0.7	3.4	14.6	0.0	M	M	0.0			<31
15†	14.3	-1.1	6.6	11.4	0.0	M	M	0.0		12E	43E
16†	13.0	6.7	9.9	8.1	0.0	M	M	0.0		12E	52E
17†	18.6	10.4	14.5	3.5	0.0	M	M	0.0			<31
18†	10.4	4.2	7.3	10.7	0.0	M	M	0.0		25E	44E
19†	5.9	3.5	4.7	13.3	0.0	M	M	0.0		25E	61E
20†	11.6	3.9	7.8	10.2	0.0	M	M	0.0		25E	32E
21†	13.4	4.3	8.9	9.1	0.0	M	M	0.0		11E	44E
22†	8.5	5.1	6.8	11.2	0.0	M	M	0.0		9E	52E
23†	8.4	4.2	6.3	11.7	0.0	M	M	0.0			<31
24†	6.7	4.1	5.4	12.6	0.0	M	M	0.0			<31
25†	7.7	2.9	5.3	12.7	0.0	M	M	0.0		26E	33E
26†	9.5	-1.0	4.3	13.7	0.0	M	M	0.0			<31
27†	8.0	-1.3	3.4	14.6	0.0	M	M	0.0		15E	46E
28†	12.5	4.6	8.6	9.4	0.0	M	M	0.0		24E	44E
29†	11.5	6.3	8.9	9.1	0.0	M	M	0.0		22E	32E
30†	7.3	3.0	5.2	12.8	0.0	M	M	0.0		26E	44E
31†	6.2	-2.6	1.8	16.2	0.0	M	M	0.0			<31
Sum				**328.3**	**2.4**	**M**	**M**	**0.0**			
Avg	**11.1**	**3.8**	**7.46**								
Xtrm	**26.0**	**-2.6**								**22E**	**72E**

November Climate Data

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	4.3	-2.2	1.1	16.9	0.0	M	M	0.0			<31
02†	5.1	-1.6	1.8	16.2	0.0	M	M	0.0			<31
03†	2.7	-0.3	1.2	16.8	0.0	M	M	0.0			<31