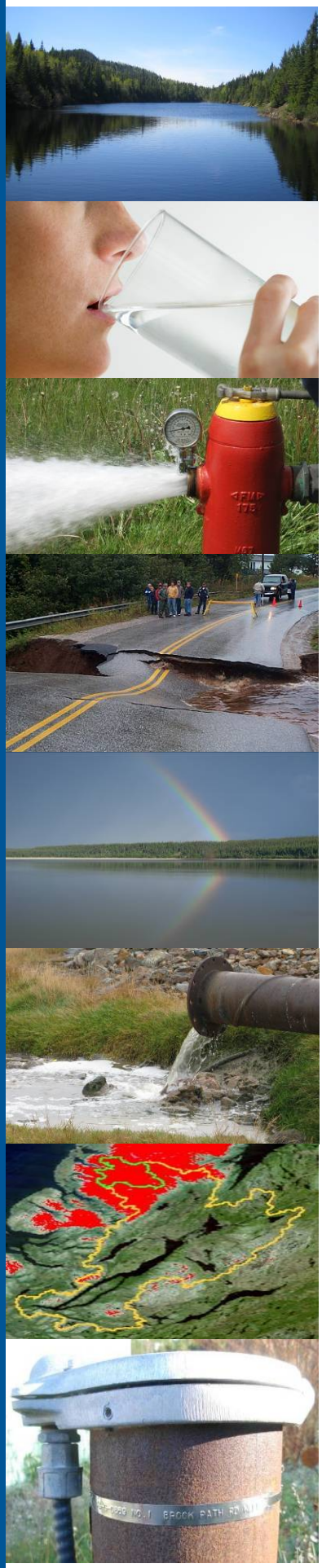


Waterford River @ Kilbride

NF02ZM0009

October 2012

Newfoundland Labrador

Government of Newfoundland & Labrador
Department of Environment and Conservation
Water Resources Management Division
St. John's, NL, A1B 4J6 Canada

Real Time Water Quality Monthly Report
Waterford River - St. John's NL
October, 2012

General

- Data from the Waterford River real-time station is regularly monitored by the Water Resources Management Division (WRMD) staff.
- The instrument used for the deployment period from July 25 to September 28 was a YSI 6600 series multi-probe, which continuously measured water temperature, dissolved oxygen, pH, specific conductivity and turbidity. The duration of the deployment was 37 days.
- A new pH sensor was installed on the sonde prior to deployment to replace the previous pH sensor, which was malfunctioning.

Maintenance and Calibration of Instrumentation

- **Table 1** displays the dates when routine cleaning, maintenance and calibration was performed on the water quality probe during this deployment.

Table 1: Table of Water Quality Probe Installation and Removal

Date Deployed	Date Removed
September 28, 2012	November 5, 2012

- Water quality readings were taken with a second freshly cleaned and calibrated water quality instrument at the time of deployment and removal in compliance with WRMD quality assurance and quality control protocol.

Quality Assurance and Quality Control (QAQC)

- Deployment comparison rankings between the field instrument and the QAQC instrument are summarized in **Table 2**.

Table 2: Comparison rankings for deployment of RTWQ instrument on September 28, 2012

Deployment

Field Sonde to QAQC Sonde Comparisons

Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	14.96	14.97	0.01	Excellent
pH	7.75	7.95	0.20	Good
Specific Conductivity (µS/cm)	536.0	541.0	0.9	Excellent
Dissolved Oxygen (mg/l)	10.40	10.81	0.41	Good
Turbidity (NTU)	2.3	0.6	1.7	Excellent

- **Deployment rankings** of "excellent" and "good" for water temperature, pH, specific conductivity, dissolved oxygen and turbidity indicate successful cleaning and calibration, which enable these sensors to produce reliable data during the deployment period.

- Removal comparison rankings between the field instrument and the QAQC instrument are summarized in **Table 3**.

Table 3: Comparison rankings for removal of RTWQ instrument on November 5, 2012

Removal

Field Sonde to QAQC Sonde Comparisons

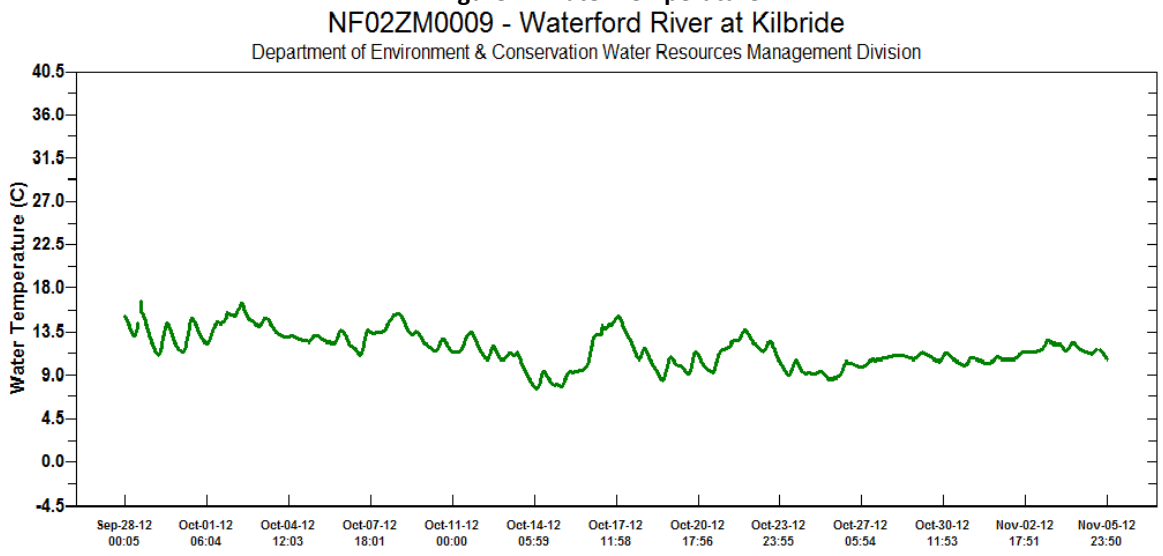
Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	11.10	11.21	0.11	Excellent
pH	7.12	7.83	0.71	Fair
Specific Conductivity (µS/cm)	345.0	346.0	0.3	Excellent
Dissolved Oxygen (mg/l)	11.10	11.24	0.14	Excellent
Turbidity (NTU)	2.3	1.8	0.5	Excellent

- **Removal rankings** of "excellent" for water temperature, specific conductivity, dissolved oxygen and turbidity increase confidence that the data collected for these parameters over the duration of this deployment are reliable. A removal ranking of "fair" for pH indicates that this sensor may have become slightly fouled, most likely towards the end of the deployment period, but the pH data are deemed reliable for the duration of the deployment.

Data Interpretation

- **Water temperatures** fluctuated between 7.10 and 15.91^{o}C during this deployment period, showing diurnal variation and a seasonal decreasing trend. Water temperature data are shown in green ink in **Figure 1**. The overall decreasing trend in water temperature corresponds to the seasonal decrease in air temperature, as shown in the Daily Climate Data for this period, in **Appendix 1** at the end of this report.

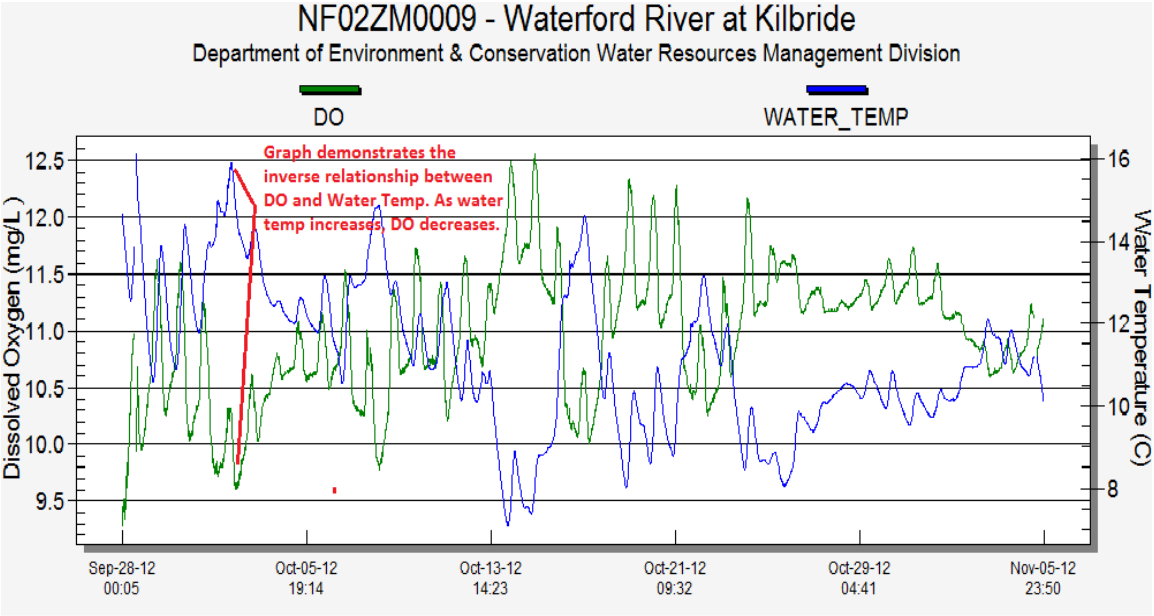
Figure 1: Water Temperature



- **Dissolved Oxygen (DO**) values were within the range of 8.61 and 12.56 mg/L during this deployment, displaying an increasing trend, in response to the decreasing water temperatures. The solubility of oxygen is greater in colder water than in warmer water, thus as water temperatures decrease DO levels increase, and visa versa. The DO and water temperature data collected during this deployment period demonstrate this inverse relationship, as shown in **Figure 2**. DO data are shown in green ink and water

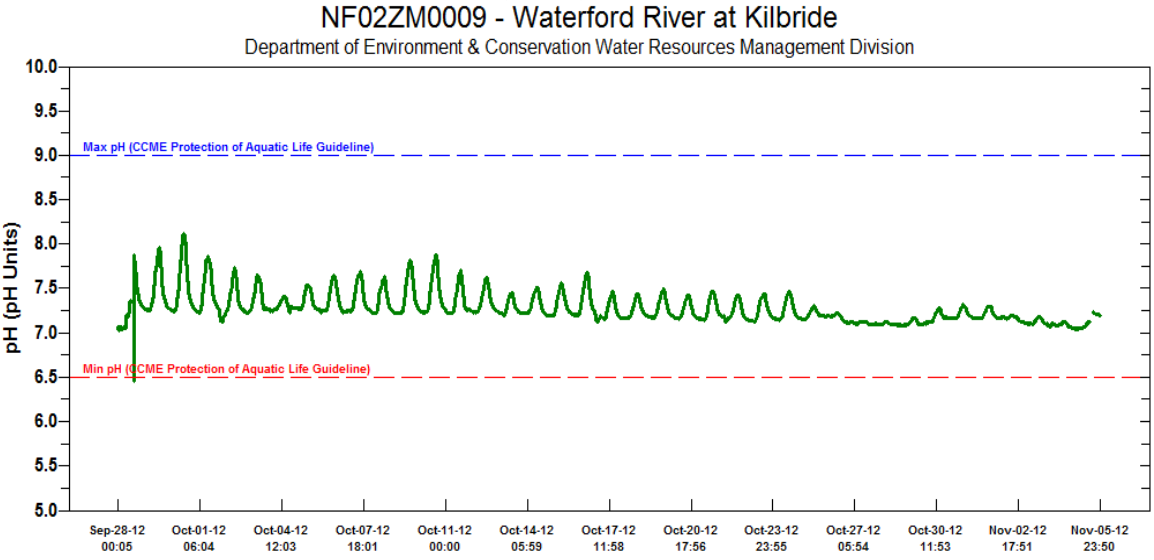
temperature in blue ink. DO levels during this period were generally above the minimum guidelines recommended by the CCME for the protection of freshwater aquatic life, of 6.5 mg/L for early life stages and 9.5 mg/L for other life stages in cold water systems.

Figure 2: Dissolved Oxygen



- **pH** values during this deployment period were fairly stable, showing mostly diurnal variation. pH values are typically lower (more acidic) at night, when photosynthesis is not occurring. During the daylight hours, the process of photosynthesis removes carbon dioxide, which readily forms carbonic acid in water, resulting in an increase in pH. pH values ranged from 7.04 to 8.12 during this deployment. Variations in diurnal peaks reflect hours of sunlight when photosynthetic activity is optimized, versus cloudy days when photosynthetic activity occurs at a slower rate. Several consecutive cloudy, rainy days occurred toward the end of this deployment, as reflected in the pH graph.

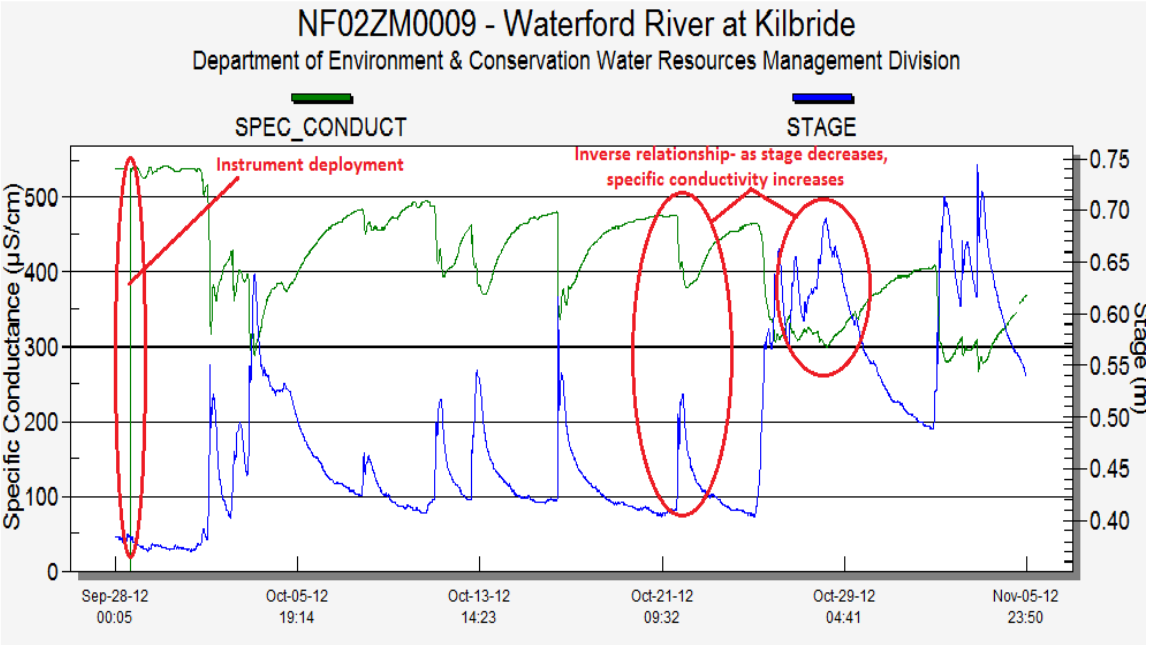
Figure3: pH



- **Specific conductivity (SpC)** values were within the expected range for an urban river throughout this deployment, ranging between 267 and 542µS/cm. Precipitation can have a dilution effect on specific conductivity during the summer and early fall, when

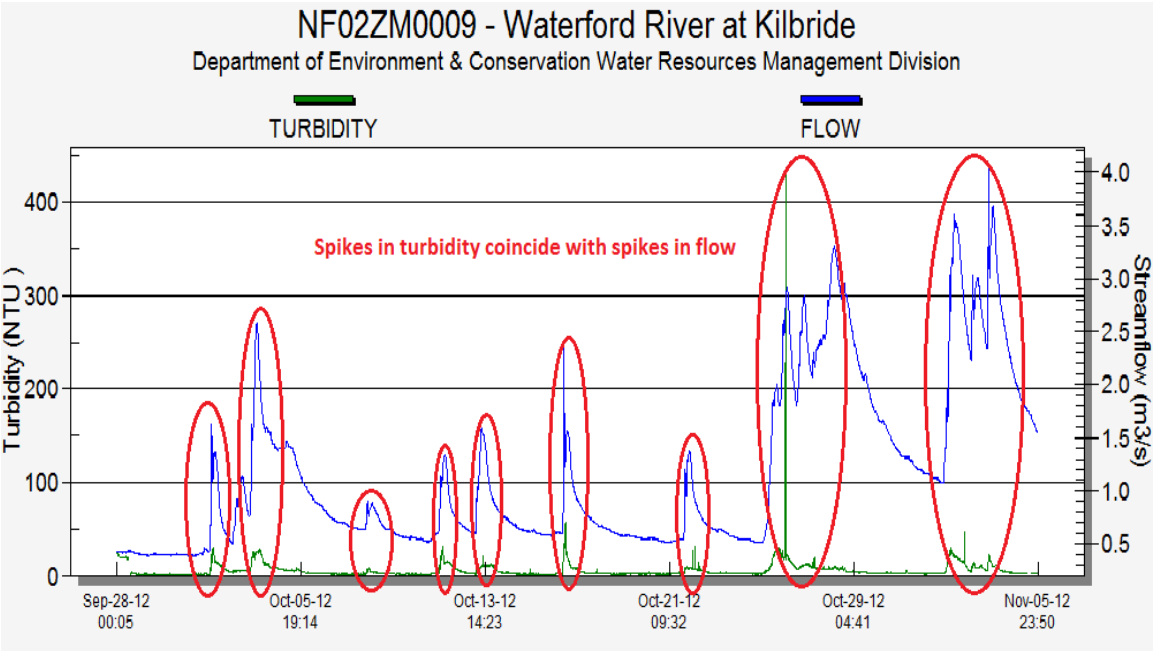
rainfall events cause increased stage height (water level), resulting in decreased conductivity. This relationship is demonstrated in **Figure 4**, where specific conductivity is shown in green ink and stage height is shown in blue ink. This relationship may not be true during the winter season when road salt is used, because precipitation events may result in increased land run-off road and salt deposition in surface water bodies, causing specific conductivity to increase.

Figure 4: Specific Conductance and Stage



- **Turbidity** data showed numerous spikes during the deployment period, most of which correspond with rainfall events and increased flow. Turbidity levels are shown in green ink in **Figure 5** and flow levels are shown in blue ink. Precipitation data for this deployment period are shown below in **Appendix 1**, as recorded by the Provincial Department of Environment and Conservation Weather Station at Pippy Park in St. John's.

Figure 5:Turbidity and Flow



Appendix1: Environment Canada Climate Data, St. John's International Airport

Daily Data Report for October 2012

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days	Cool Deg Days	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10s deg	Spd of Max Gust km/h
01‡	16.5	10.1	13.3	4.7	0.0	11.8	0.0	11.8		M	46
02‡	17.3	11.9	14.6	3.4	0.0	8.2	0.0	8.2		M	57
03‡	14.3	9.5	11.9	6.1	0.0	24.6	0.0	24.6		M	61
04‡	10.5	9.2	9.9	8.1	0.0	6.6	0.0	6.6		M	76
05‡	11.4	8.3	9.9	8.1	0.0	2.0	0.0	2.0		M	39
06‡	14.3	5.3	9.8	8.2	0.0	0.4	0.0	0.4		M	<31
07‡	16.6	6.8	11.7	6.3	0.0	0.0	0.0	0.0		M	48
08‡	18.4	9.3	13.9	4.1	0.0	3.2	0.0	3.2		M	69
09‡	9.9	6.8	8.4	9.6	0.0	0.0	0.0	0.0		M	41
10‡	11.4	4.9	8.2	9.8	0.0	0.0	0.0	0.0		M	35
11‡	14.0	7.7	10.9	7.1	0.0	11.0	0.0	11.0		M	76
12‡	12.4	6.9	9.7	8.3	0.0	0.0	0.0	0.0		M	80
13‡	12.4	1.9	7.2	10.8	0.0	11.6	0.0	11.6		M	65
14											
15‡	8.1	3.0	5.6	12.4	0.0	2.4	0.0	2.4		M	46
16‡	20.8	6.3	13.6	4.4	0.0	3.6	0.0	3.6		M	78
17‡	18.2	6.6	12.4	5.6	0.0	0.8	0.0	0.8		M	59
18‡	10.7	1.9	6.3	11.7	0.0	0.0	0.0	0.0		M	50
19‡	11.6	1.6	6.6	11.4	0.0	0.0	0.0	0.0		M	35
20‡	14.8	4.2	9.5	8.5	0.0	0.0	0.0	0.0		M	<31
21‡	14.3	6.5	10.4	7.6	0.0	6.8	0.0	6.8		M	65
22‡	15.3	8.6	12.0	6.0	0.0	1.0	0.0	1.0		M	69
23‡	13.7	4.9	9.3	8.7	0.0	0.0	0.0	0.0		M	37
24‡	10.5	2.7	6.6	11.4	0.0	0.0	0.0	0.0		M	33
25											
26‡	9.2	5.7	7.5	10.5	0.0	14.8	0.0	14.8		M	70
27‡	9.9	6.8	8.4	9.6	0.0	7.4	0.0	7.4		M	63
28‡	10.2	7.9	9.1	8.9	0.0	2.4	0.0	2.4		M	63
29‡	9.9	6.5	8.2	9.8	0.0	1.0	0.0	1.0		M	41
30‡	7.9	5.1	6.5	11.5	0.0	0.2	0.0	0.2		M	37
31‡	8.0	5.2	6.6	11.4	0.0	1.0	0.0	1.0		M	<31

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