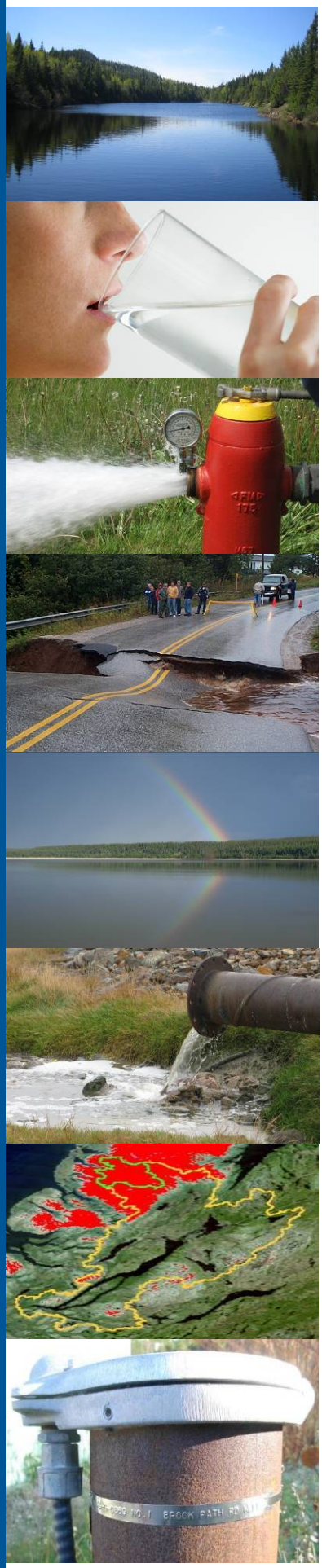


Waterford River @ Kilbride

NF02ZM0009

November 2012

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
November, 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 November 5 to December 5 was an YSI 6600 series multi-probe, which continuously measured water temperature, dissolved oxygen, pH, specific conductivity and turbidity. The duration of the deployment was 30 days.

Maintenance and Calibration of Instrumentation

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

Table 1: Table of Water Quality Probe Installation and Removal

Date Deployed	Date Removed
November 5, 2012	December 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.

Table 2: Comparison rankings for deployment of RTWQ instrument on November 5, 2012

Deployment

Field Sonde to QAQC Sonde Comparisons

Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	11.12	11.13	0.01	Excellent
pH	7.23	7.10	0.13	Excellent
Specific Conductivity (µS/cm)	359.0	324.0	9.7	Good
Dissolved Oxygen (mg/l)	10.85	11.12	0.27	Excellent
Turbidity (NTU)	2.2	2.4	0.2	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 December 5, 2012

Removal

Field Sonde to QAQC Sonde Comparisons

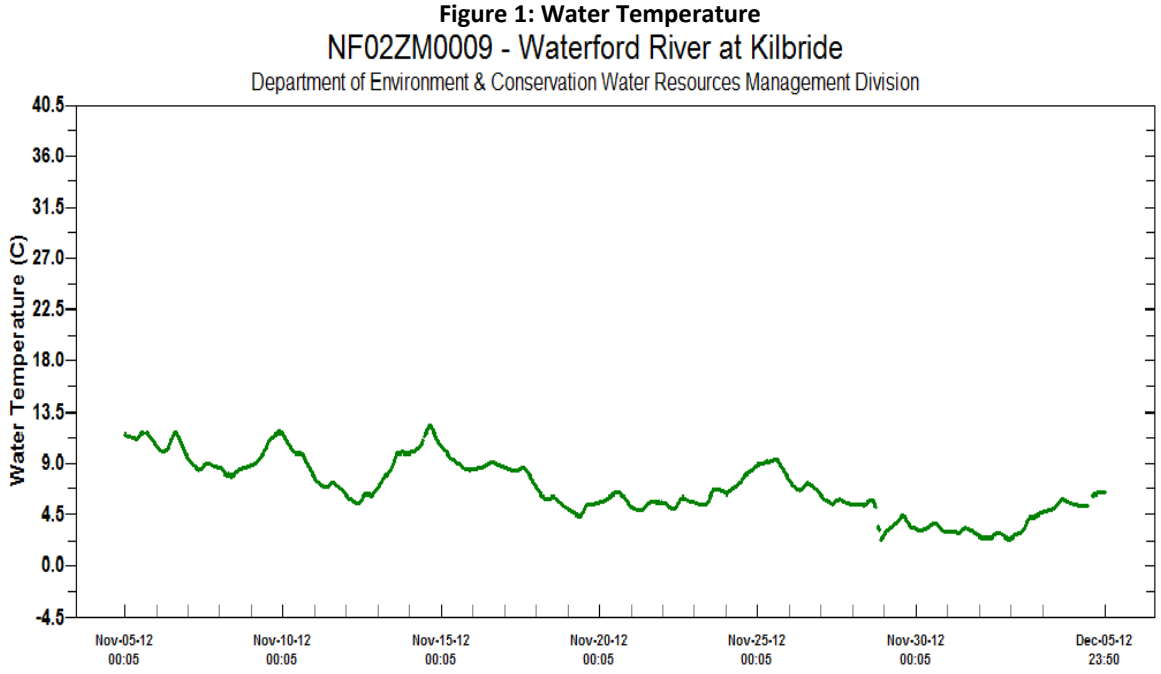
Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	4.80	4.77	0.03	Excellent
pH	7.21	7.20	0.01	Excellent
Specific Conductivity (µS/cm)	507.0	503.0	0.8	Excellent
Dissolved Oxygen (mg/l)	12.88	13.41	0.53	Fair
Turbidity (NTU)	13.9	13.2	0.7	Excellent

- **Removal rankings** of "excellent" for water temperature, pH, specific conductivity 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 dissolved oxygen (DO) indicates that this sensor may have become slightly fouled, most likely towards the end of the deployment period, but the DO data are deemed reliable for the duration of the deployment.

Data Interpretation

- **Water temperatures** fluctuated between 1.81 and 11.81^{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.

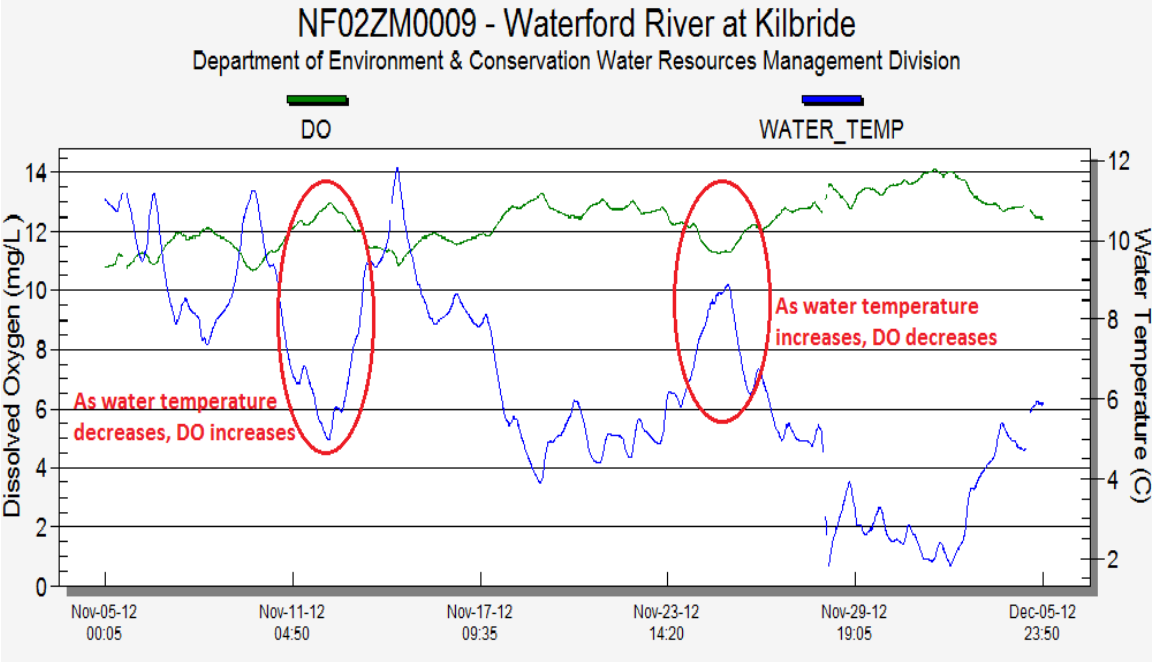
Figure 1: Water Temperature



- **Dissolved Oxygen (DO**) values were within the range of 10.68 and 14.11 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

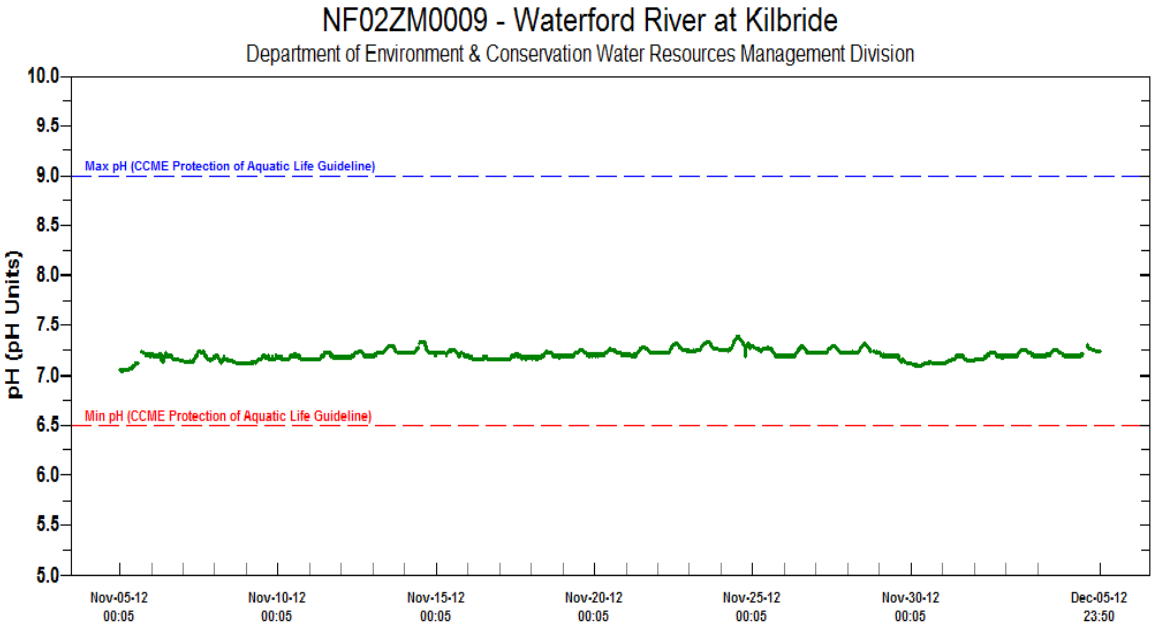
inverse relationship, as shown in **Figure 2**. DO data are shown in green ink and water temperature in blue ink. DO levels during this period were generally above the minimum guidelines recommended by the CCME for the protection of freshwater aquatic life, of 6.5 mg/L for early life stages and 9.5 mg/L for other life stages in cold water systems.

Figure 2: Dissolved Oxygen



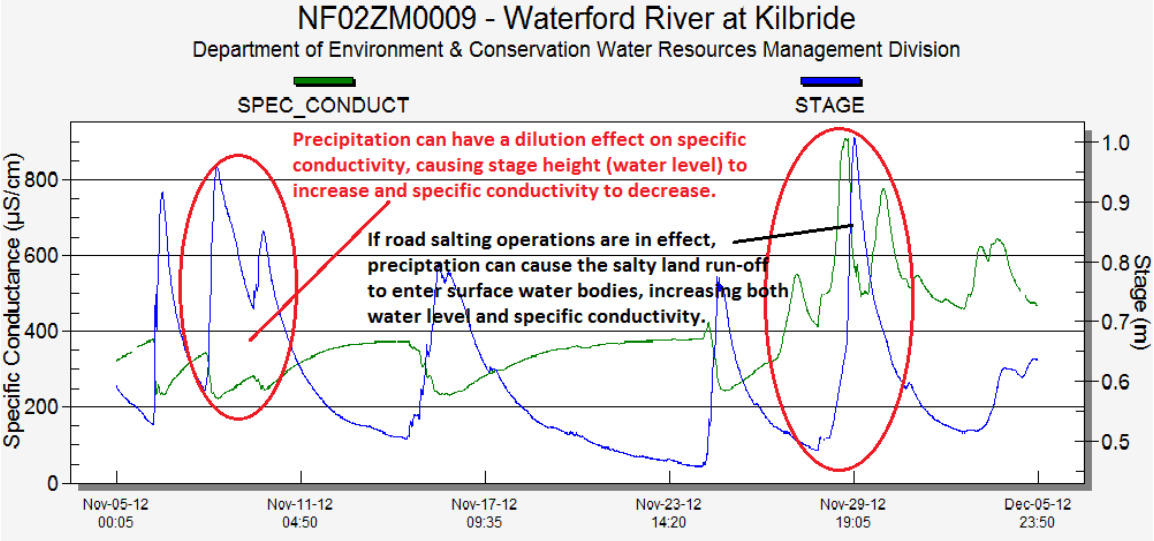
- **pH** values during this deployment period were fairly stable, showing mostly diurnal variation. pH values are typically lower (more acidic) at night, when photosynthesis is not occurring. During the daylight hours, the process of photosynthesis removes carbon dioxide, which readily forms carbonic acid in water, resulting in an increase in pH. pH values ranged from 7.10 to7.38 during this deployment.

Figure 3: pH



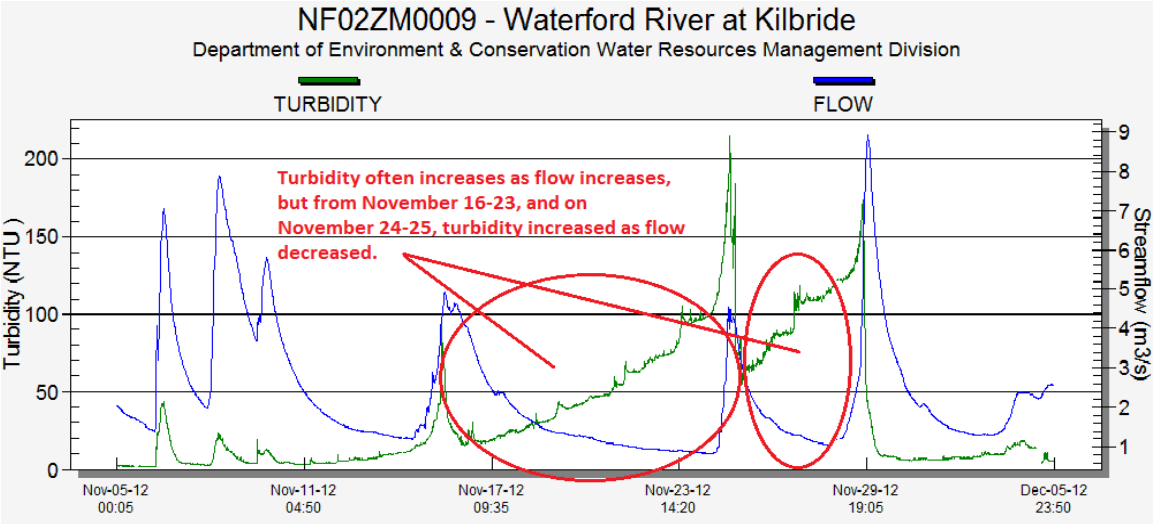
▪ **Specific conductivity (SpC)** values were within the expected range for an urban river at this time of year, ranging between 221 and 909µS/cm. Precipitation can have a dilution effect on specific conductivity during the summer and early fall, when rainfall events cause increased stage height (water level) and decreased conductivity. However, once air temperatures fall to 0°C in late fall and winter and road salting operations are in effect, precipitation events can cause salty surface water run-off to enter surface water bodies, increasing both water levels and specific conductivity. This relationship is demonstrated in **Figure 4**, where specific conductivity is shown in green ink and stage height is shown in blue ink. Air temperatures for the month of November 2012 are shown in Appendix 1, at the end of this report.

Figure 4: Specific Conductance and Stage



▪ **Turbidity** generally increases when flow increases, as a result of an increase in suspended particles and entrapped air in the water column. However, there were two periods during this deployment, November 16-23 and 24-25, when turbidity increased as flow decreased. Turbidity levels are shown in green ink in **Figure 5** and flow levels are shown in blue ink. Increased turbidity during both of these periods may be the result of land based activity in the upstream watershed.

Figure 5:Turbidity and Flow



Appendix 1: Environment Canada Climate Data, St. John's International Airport

Daily Data Report for November 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‡				325.1*	0.0*	142.0*	0.2*	142.2*			
02‡	8.6*	2.4*	5.5*								
03‡	16.0*	-4.9*									83*
04‡											
05‡											
06‡	8.9	6.3	7.6	10.4	0.0	3.4	0.0	3.4		M	57
07‡	12.6	8.9	10.8	7.2	0.0	10.2	0.0	10.2		M	61
08‡	16.0	10.3	13.2	4.8	0.0	13.0	0.0	13.0		M	54
09‡	14.3	9.2	11.8	6.2	0.0	0.2	0.0	0.2		M	57
10‡	12.1	5.4	8.8	9.2	0.0	3.2	0.0	3.2		M	33
11‡	14.8	2.9	8.9	9.1	0.0	24.2	0.0	24.2		M	83
12‡	7.0	0.8	3.9	14.1	0.0	3.6	0.2	3.8		M	44
13‡	6.9	3.0	5.0	13.0	0.0	23.8	0.0	23.8		M	59
14‡	15.9	6.9	11.4	6.6	0.0	7.6	0.0	7.6		M	69
15‡	8.0	1.2	4.6	13.4	0.0	T	0.0	T		M	78
16‡	4.7	-0.7	2.0	16.0	0.0	0.0	0.0	0.0		M	82
17‡	8.4	-1.9	3.3	14.7	0.0	0.0	0.0	0.0		M	59
18‡	14.7	8.4	11.6	6.4	0.0	0.0	0.0	0.0		M	67
19‡	15.9	5.0	10.5	7.5	0.0	5.6	0.0	5.6		M	61
20‡	5.7	4.0	4.9	13.1	0.0	24.0	0.0	24.0		M	52
21‡	7.3	3.7	5.5	12.5	0.0	5.0	0.0	5.0		M	44
22‡	4.4	-2.5	1.0	17.0	0.0	M	0.0	M		M	35
23‡	0.3	-3.9	-1.8	19.8	0.0	0.0	0.0	0.0		M	52
24‡	4.8	-4.2	0.3	17.7	0.0	0.0	0.0	0.0		M	67
25‡	4.2	-1.9	1.2	16.8	0.0	0.0	T	T		M	50
26	2.0	-0.9	0.6	17.4	0.0	0.0	0.0	0.0		M	44
27	5.1	-2.9	1.1	16.9	0.0	M	0.0	M		M	48
28	9.1	2.1	5.6	12.4	0.0	T	0.0	T		M	56
29	9.1	4.4	6.8	11.2	0.0	7.4	0.0	7.4		M	70
30‡	11.9	2.4	7.2	10.8	0.0	10.8	0.0	10.8		M	70

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