

Real Time Water Quality Monthly Report for Vale Inco Newfoundland and Labrador Ltd. August & September 2009

General

- On August 8th, the Vale Inco staff was equipped with a helicopter and reinstalled three of the four Datasondes (Upper Reid Brook; Tributary to Lower Reid Brook and Camp Pond Brook) after having cleaned/calibrated the instruments. The final Datasonde was redeployed on August 9th at Lower Reid Brook.
- The real-time data (and subsequently the water quality graphs) logged, transmitted and graphed successfully for all four stations over the deployment period.
- This report interprets the real-time data collected over the deployment period from August 8th/9th until the instruments were removed for cleaning /calibration on September 12th.
- DOEC staff (Renee Paterson) travelled to Vosiey’s Bay on September 14th to assist with the cleaning/calibration and to ensure proper procedures were being followed.

Maintenance and Calibration of Instrumentation

- Vale Inco staff on-site removed instruments from all stations for cleaning/calibration on September 12th (after 35 day deployment period). Vale Inco staff and DOEC staff cleaned and calibrated the instruments and returned them to all four stations on September 15th.
- As part of the removal and reinstallation process, parameters are recorded from both the field sonde (in situ) and a similar, newly-calibrated QA sonde (placed side by side). The parameters from both instruments are compared and their variability is ranked as part of the QA/QC protocol (see Table 1).
- Upon reinstallation of the Datasondes at the beginning of August, QA/QC readings were not recorded with the QA sonde therefore rankings are not available.
- Upon removal of the Datasondes in mid-September, all parameters with the exception of dissolved oxygen ranked as either “Excellent” or “Good” at all stations. The dissolved oxygen rankings were “Marginal” at the Lower Reid Brook station where the silty river bed may have interfered with the DO sensor.

Table 1: QA/QC Data Comparison Rankings upon reinstallation on August 8th/9th, 2009 to September 12th, 2009.

Station	Date	Action	Instrument Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Upper Reid Brook	Aug 8/09	Installation	NA	NA	NA	NA	NA
	Sep 12/09	Removal	Excellent	Excellent	Excellent	Excellent	NA
Lower Reid Brook	Aug 9/09	Installation	NA	NA	NA	NA	NA
	Sep 12/09	Removal	Good	Excellent	Excellent	Marginal	NA
Camp Pond Brook	Aug 8/09	Installation	NA	NA	NA	NA	NA
	Sep 12/09	Removal	Excellent	Excellent	Good	Good	NA
Tributary to Lower Reid Brook	Aug 8/09	Installation	NA	NA	NA	NA	NA
	Sep 12/09	Removal	Excellent	Excellent	Good	Good	NA

NA – QA readings were not recorded therefore no ranking available

Data Interpretation

REID BROOK AT OUTLET OF REID POND (UPPER REID BROOK)

- The water temperature (**Figure 1**) decreased slightly throughout the deployment period. The water temperatures ranged from 7.67°C to 13.65°C.

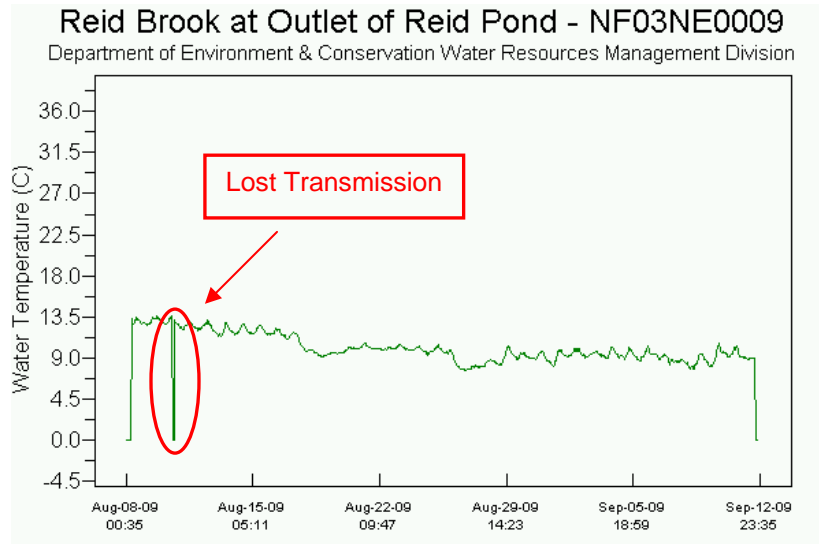


Figure 1

- The dissolved oxygen values (**Figure 2**) increased slightly throughout the deployment period corresponding to the above mentioned decrease in water temperature. The dissolved oxygen values ranged from 10.14 mg/L to 11.59 mg/L. All values recorded are within the acceptable range for dissolved oxygen concentration as stated by the CCME Guidelines for the Protection of Aquatic Life. The Guidelines state dissolved oxygen (for cold water) must be at least 9.5 mg/L for early life stages.

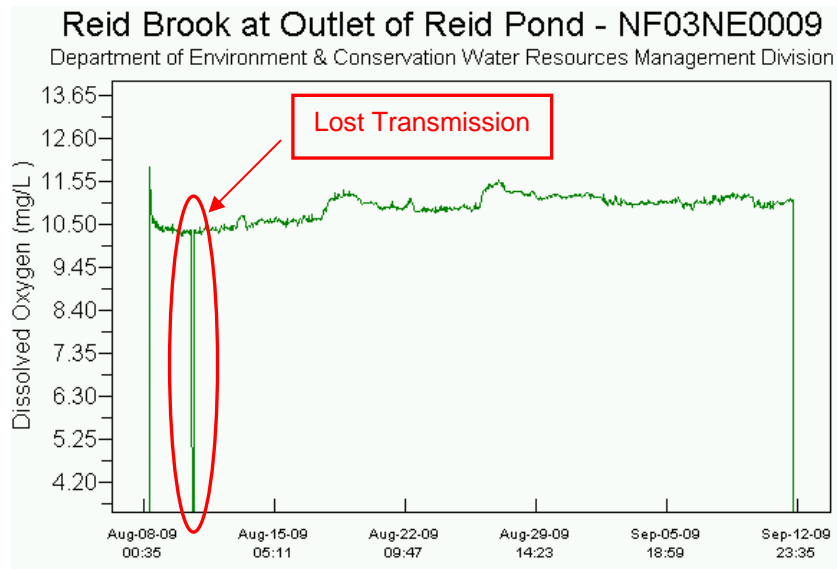


Figure 2

- The conductivity values (**Figure 3**) remained consistent throughout the deployment period at a very low background level ranging from 9.3 uS/cm to 9.899 uS/cm. The Upper Reid station is fairly pristine with very little development as seen by the naturally low specific conductivity values. There were no significant water quality events captured.

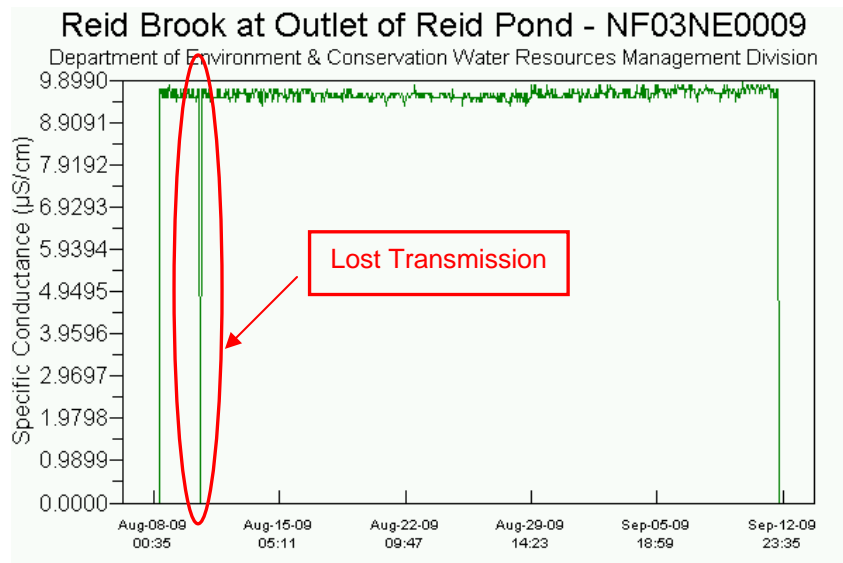
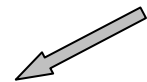


Figure 3



- The pH values (**Figure 4**) remained consistent throughout the deployment period. The pH values ranged from 6.61 to 7.01. The pH values are all within the recommended pH guidelines for the CCME Water Quality Guidelines for Aquatic Life.

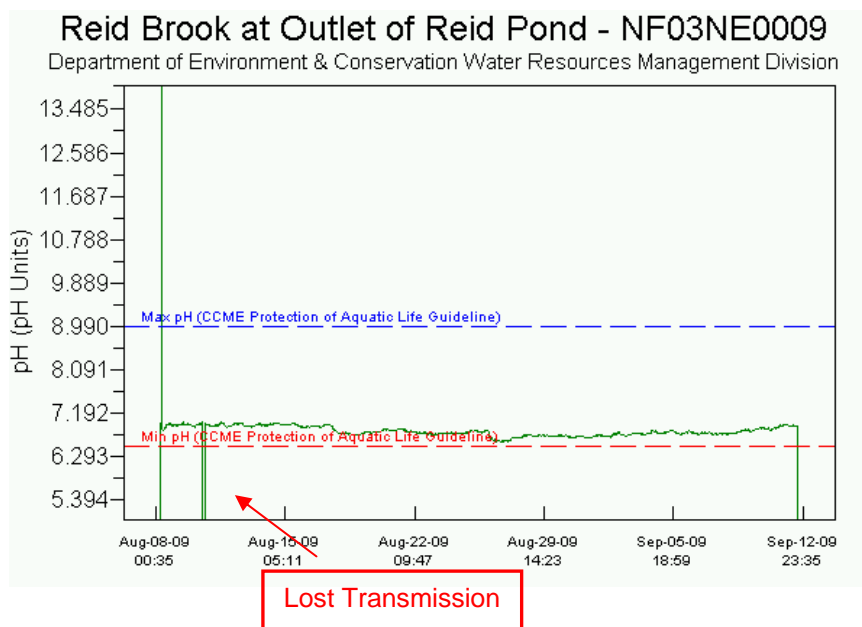
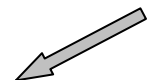


Figure 4



- Turbidity values (**Figure 5**) were at very low background levels throughout the deployment period. The values ranged from 0.0 NTU to 2.099 NTU throughout the deployment period. As can be seen from the stage graph (**Figure 6**), the increase in precipitation in late August did not impact the turbidity readings at this site.

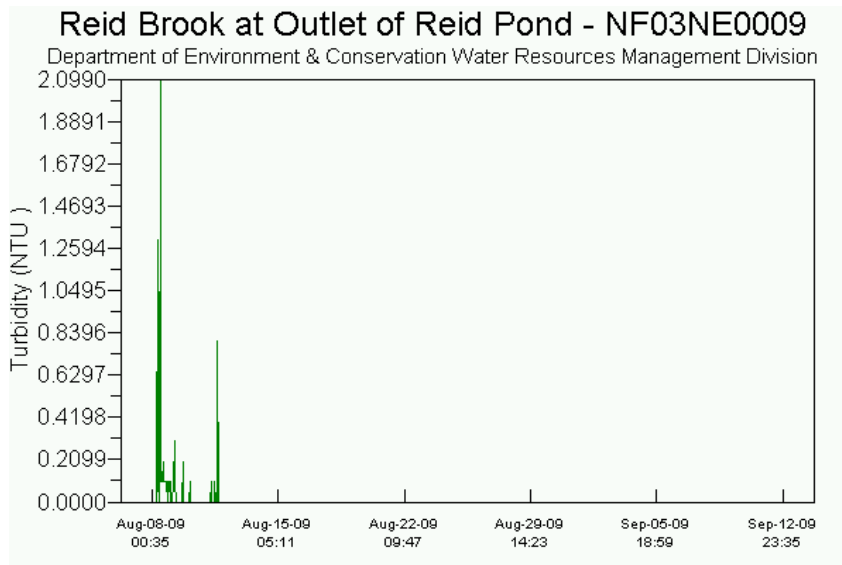


Figure 5

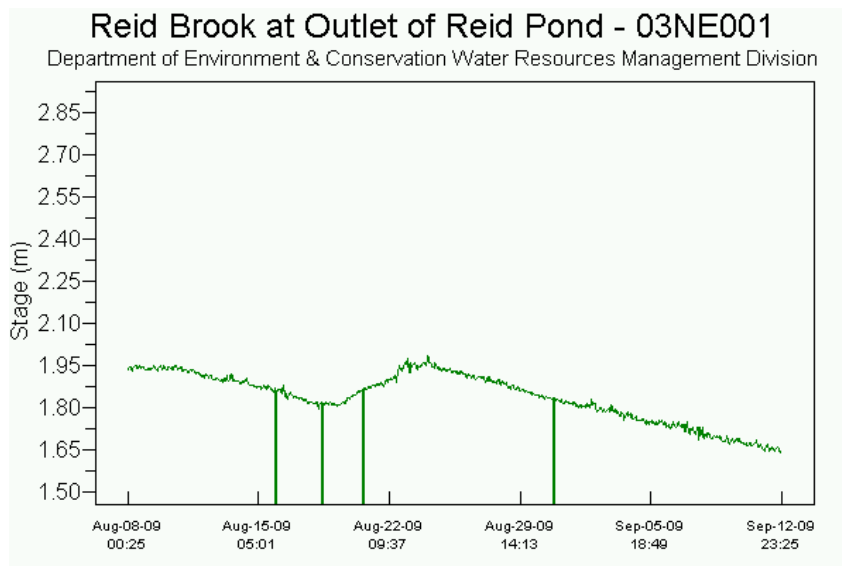
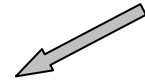
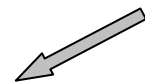


Figure 6



CAMP POND BROOK BELOW CAMP POND

- The water temperature (**Figure 7**) decreased slightly throughout the deployment period with clear diurnal patterns. The water temperatures ranged from 6.22°C to 16.39°C.

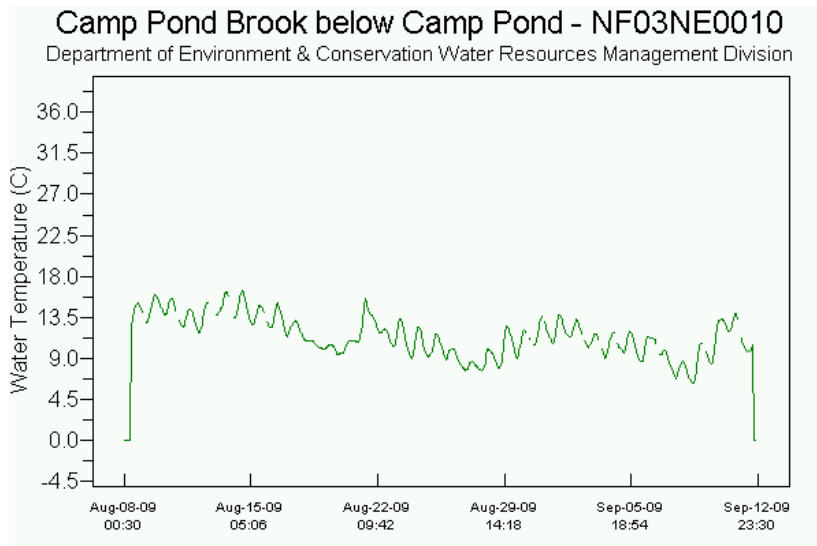
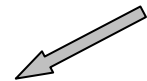


Figure 7



- The dissolved oxygen values (**Figure 8**) increased slightly throughout the deployment period corresponding to the above mentioned decrease in water temperature. The minimum dissolved oxygen value recorded was 8.69 mg/L.

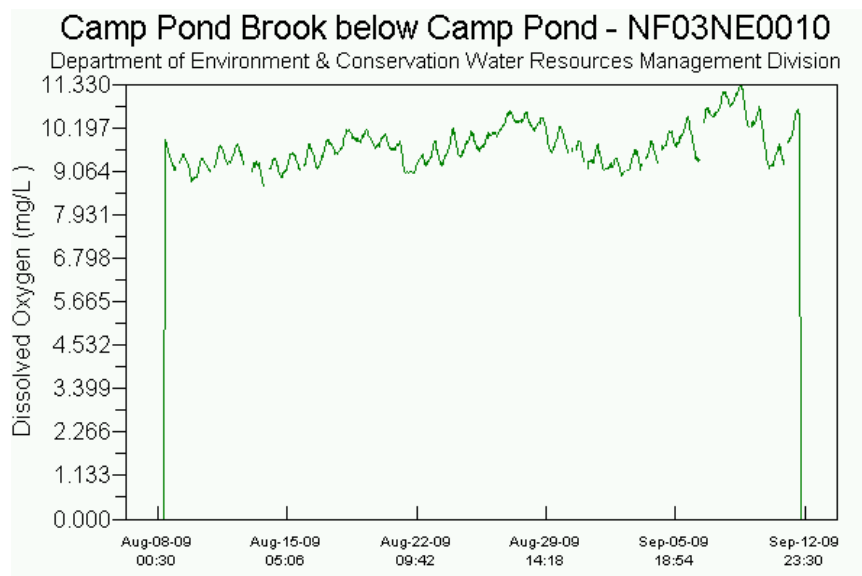
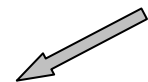


Figure 8



- The conductivity values (**Figure 9**) were very consistent throughout the deployment period with the exception of a water quality event around August 20th. The maximum value reached was 51.7 uS/cm. This increase in conductivity was a result of increased precipitation at that time (see **Appendix**) clearly depicted on the stage graph (**Figure 12**) below.

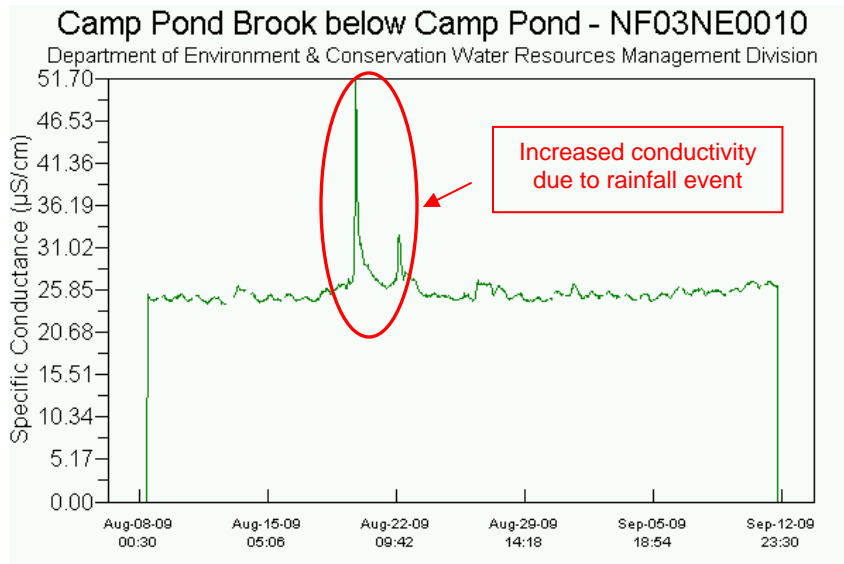
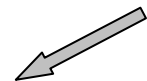


Figure 9



- The pH values (**Figure 10**) remained very consistent throughout the deployment period. The pH values ranged from 6.87 to 7.25. All the pH values fell within the recommended CCME Water Quality Guidelines for the Protection of Aquatic Life.

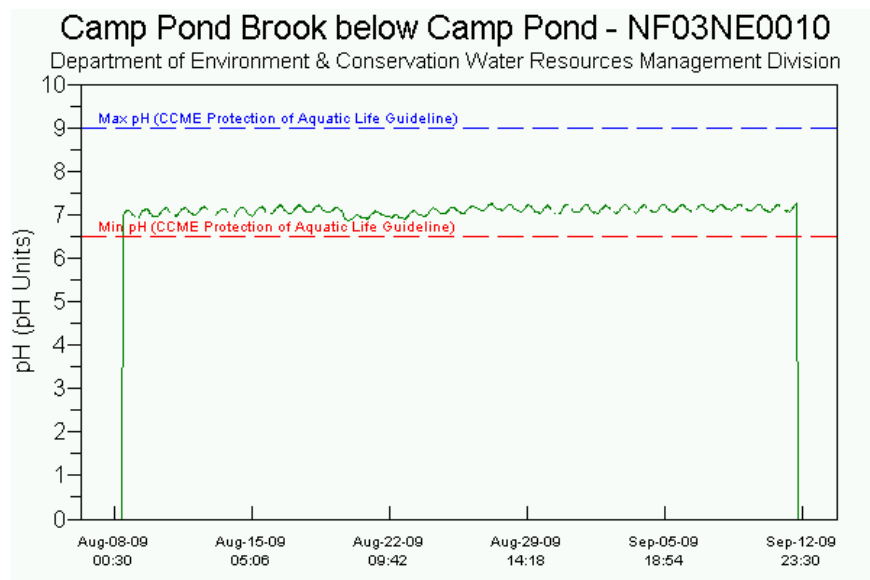
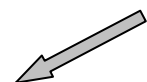


Figure 10



- Turbidity values (**Figure 11**) were variable over the deployment period ranging from 1.0 NTU to 63.4 NTU. The increases in turbidity values around August 20th appear to be related to an increase in precipitation (see **Appendix**) as can be seen in the stage graph (**Figure 12**). It is unclear what may have attributed to the remainder of the spikes in turbidity.

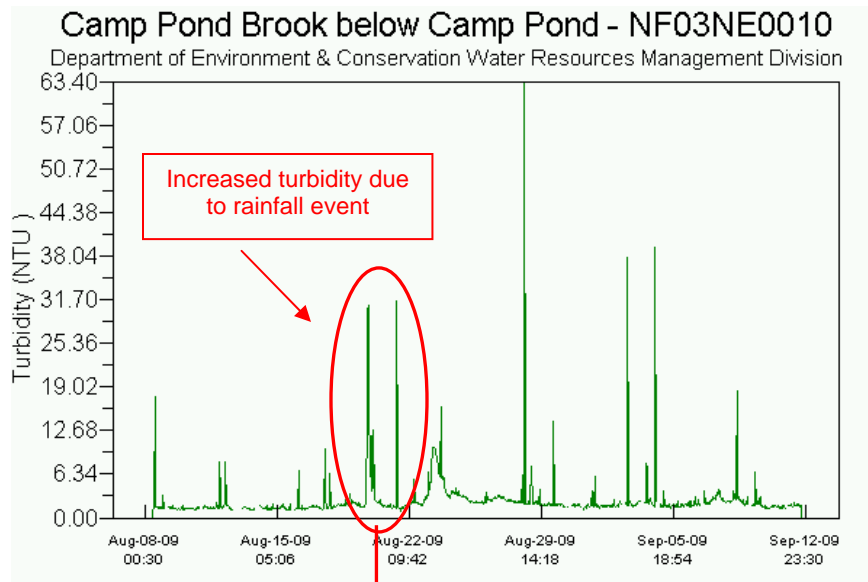


Figure 11

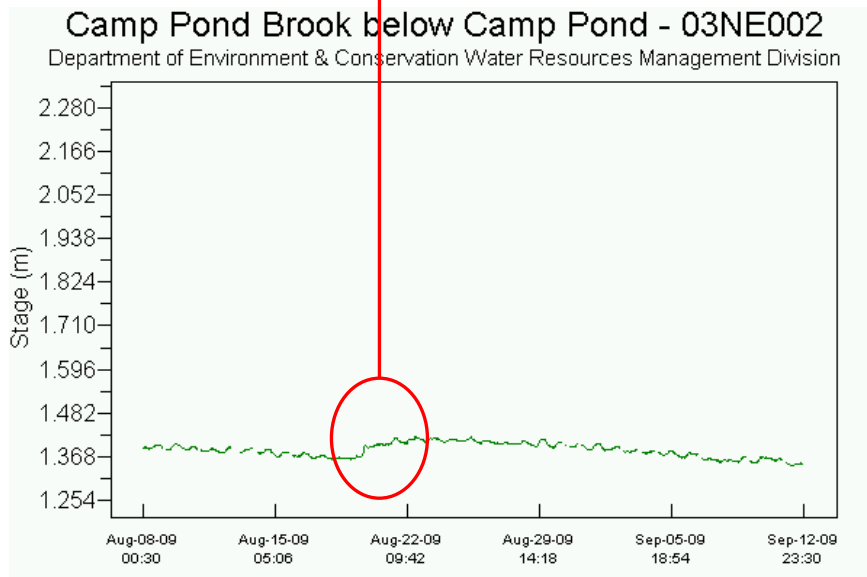
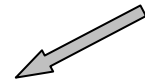
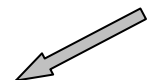


Figure 12



LOWER REID BROOK BELOW TRIBUTARY

- The water temperature (**Figure 13**) decreased slightly throughout the deployment period with clear diurnal patterns. The water temperatures ranged from 5.84°C to 13.95°C.

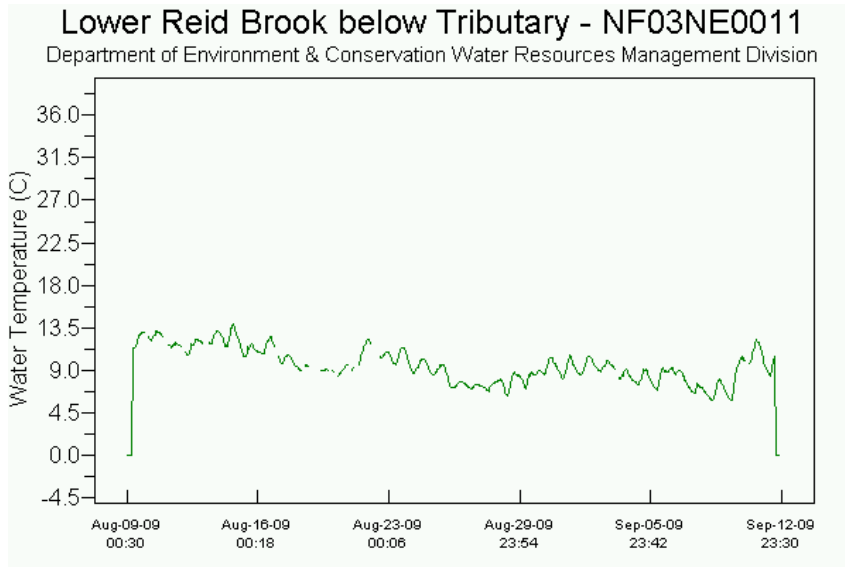
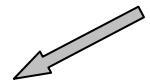


Figure 13



- The dissolved oxygen values (**Figure 14**) increased slightly throughout the deployment period corresponding to the above mentioned decrease in water temperature. The minimum dissolved oxygen value recorded was 8.88 mg/L.

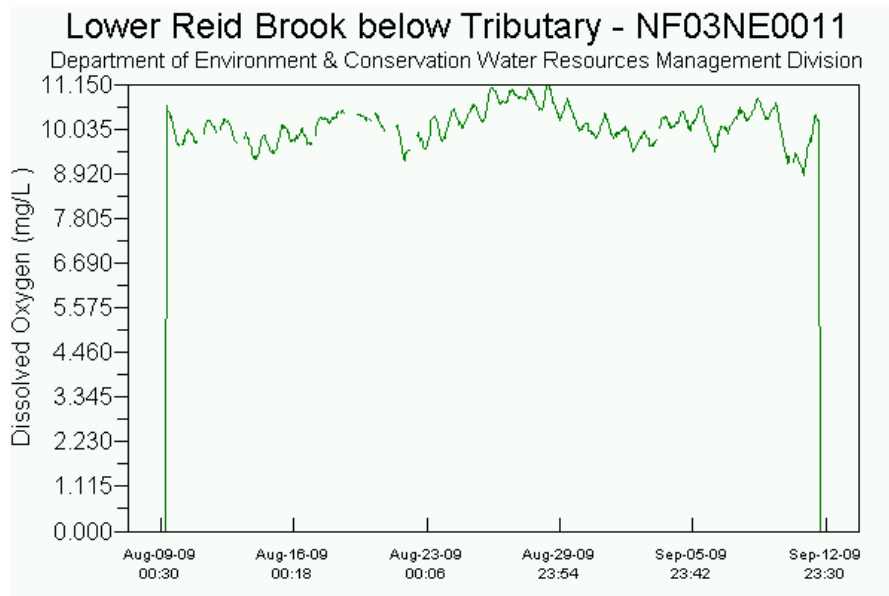
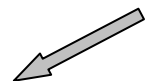


Figure 14



- The conductivity values (**Figure 15**) demonstrated an increasing trend throughout the deployment period. The conductivity values ranged from 24.0 uS/cm to 33.0 uS/cm. Around August 20th there was a decrease in conductivity values due to a dilution effect from a rainfall event at that time (see **Appendix**) clearly depicted on the stage graph (**Figure 18**).

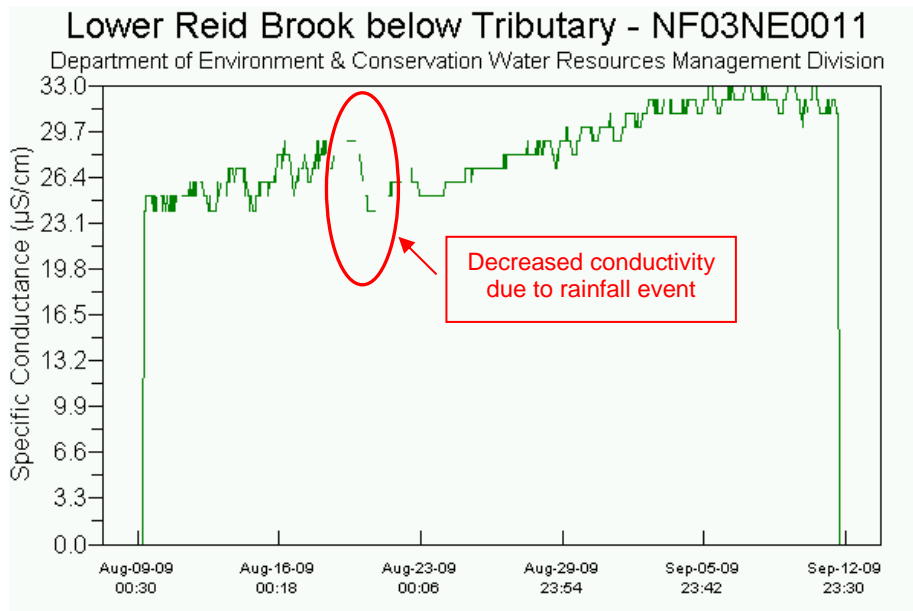
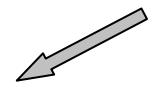


Figure 15



- The pH values (**Figure 16**) demonstrated a slightly increasing trend throughout the deployment period. The pH values ranged from 6.74 to 7.35. All the pH values fell within the recommended CCME Water Quality Guidelines for the Protection of Aquatic Life. There was a noticeable decrease in pH values around August 20th due to increased precipitation (see **Appendix**) clearly depicted on the stage graph (**Figure 18**).

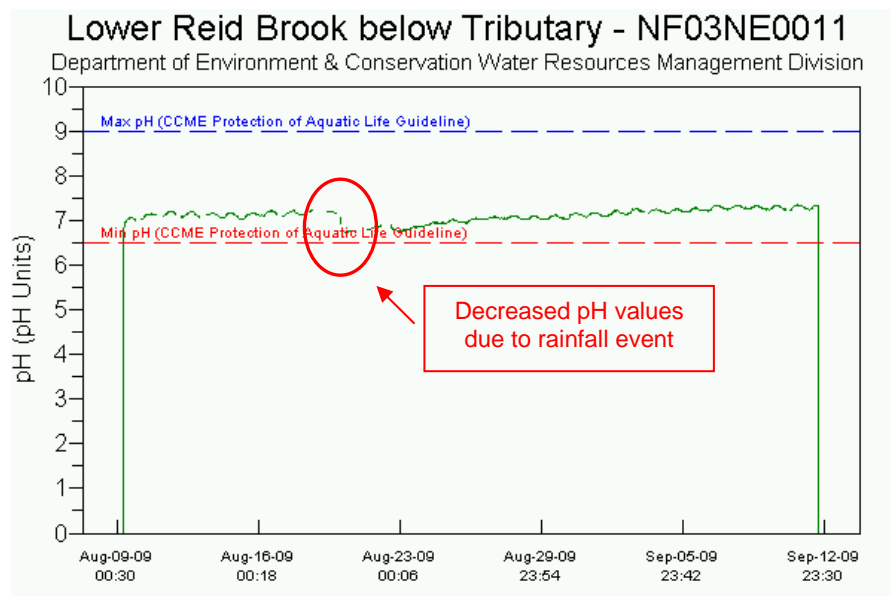
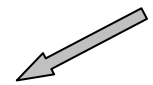


Figure 16



- Turbidity values (**Figure 17**) remained at 0 NTU throughout the deployment period with the exception of an increase in turbidity values around August 20th-22nd. The maximum turbidity value was recorded on August 20th at 38.9 NTU; the second large spike was recorded on August 22nd at 29.1 NTU. Both of these increases can be attributed to rainfall events (see **Appendix**) captured on the stage graph (**Figure 18**).

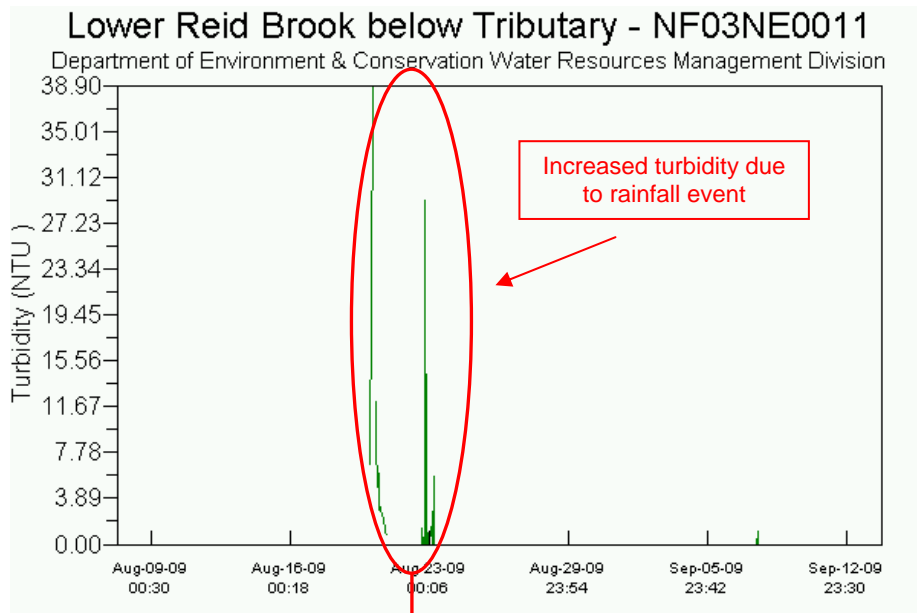


Figure 17

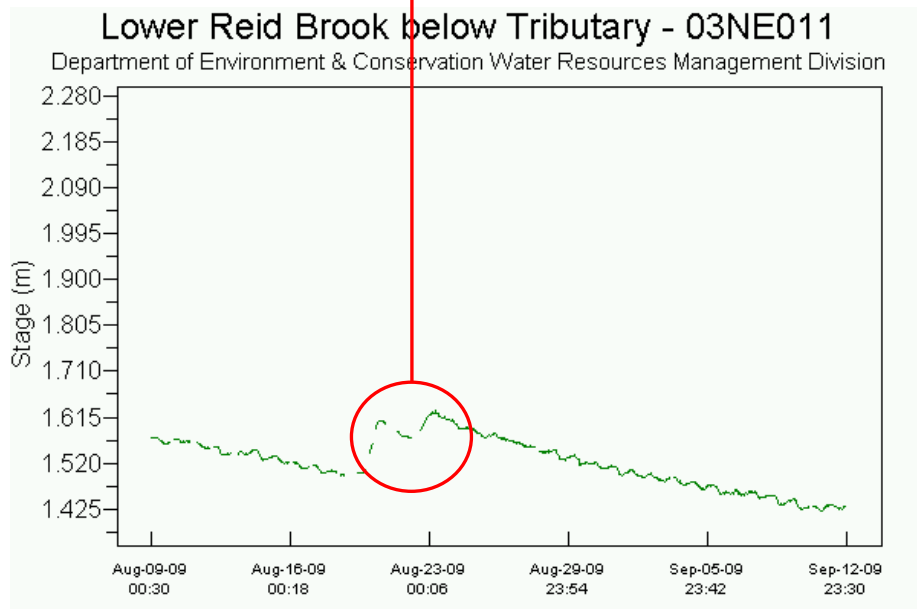
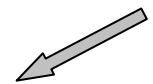
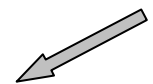


Figure 18



TRIBUTARY TO REID BROOK

- The water temperature (**Figure 19**) decreased slightly throughout the deployment period with clear diurnal patterns. The water temperatures ranged from 6.0°C to 13.2°C.

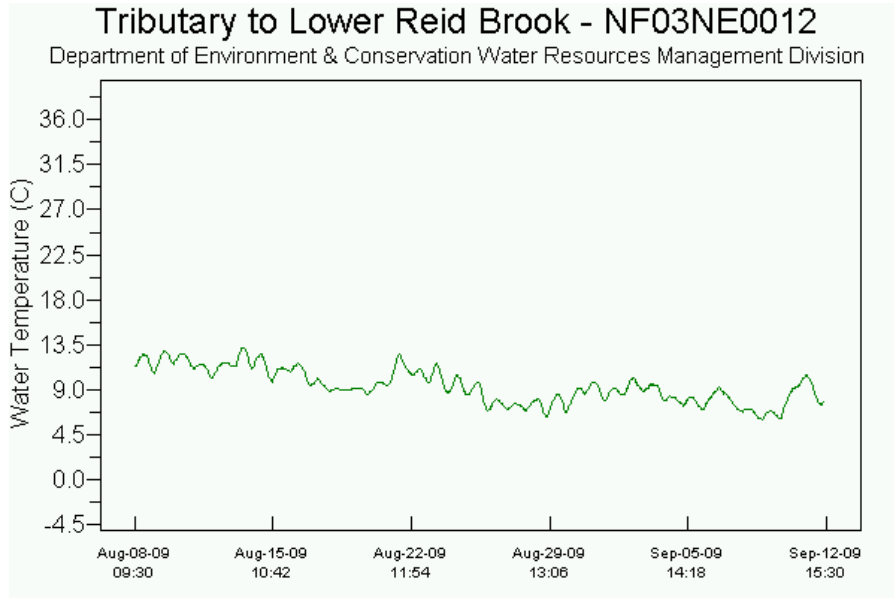
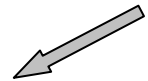


Figure 19



- The dissolved oxygen values (**Figure 20**) increased slightly throughout the deployment period corresponding to the above mentioned decrease in water temperature. The dissolved oxygen values ranged from 10.21 mg/L to 12.45 mg/L. All values recorded are within the acceptable range for dissolved oxygen concentration as stated by the CCME Guidelines for the Protection of Aquatic Life. The Guidelines state dissolved oxygen (for cold water) must be at least 9.5 mg/L for early life stages.

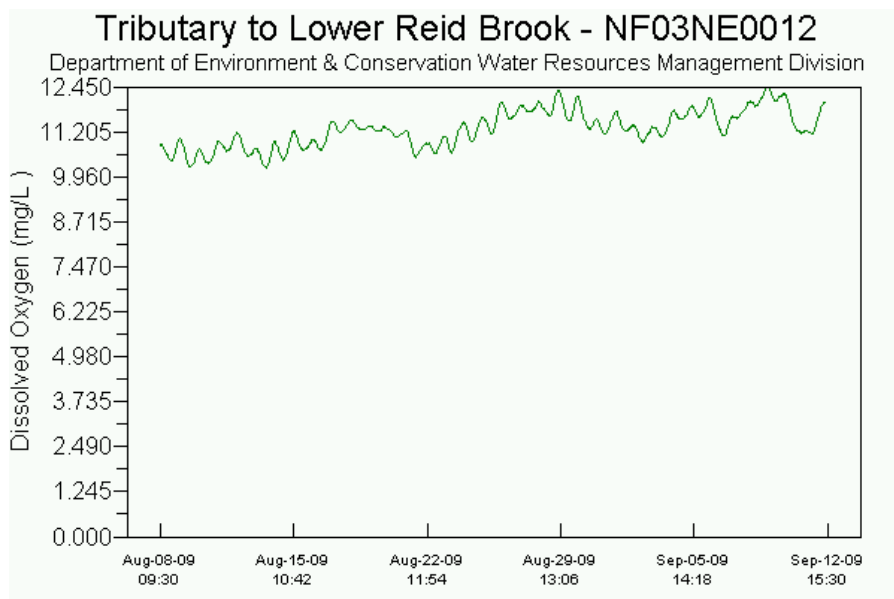
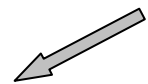


Figure 20



- The conductivity values (**Figure 21**) demonstrated a general increasing trend throughout the deployment period. The conductivity values ranged from 25.0 uS/cm to 36.6 uS/cm. Around August 20th, a rainfall event lead to a significant decrease in conductivity values (due to a diluting effect). This event is clearly indicated on the stage graph (**Figure 24** below).

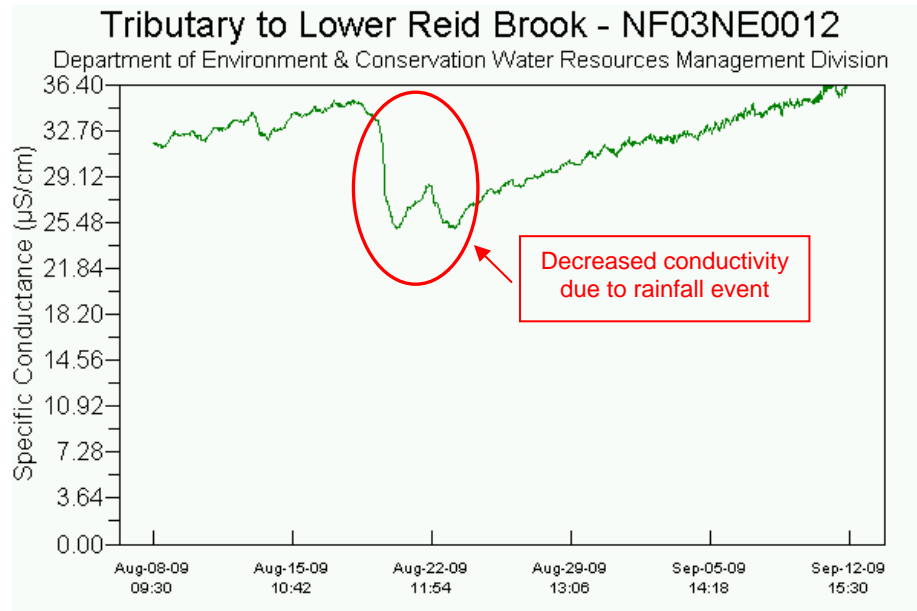
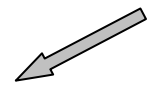


Figure 21



- The pH values (**Figure 22**) remained very consistent throughout the deployment period ranging from 6.52 to 7.12. All the pH values fell within the recommended CCME Water Quality Guidelines for the Protection of Aquatic Life. There was a precipitation event around August 20th (see **Appendix**) which led to a decrease in pH values. This event is clearly indicated on the stage graph (**Figure 24** below).

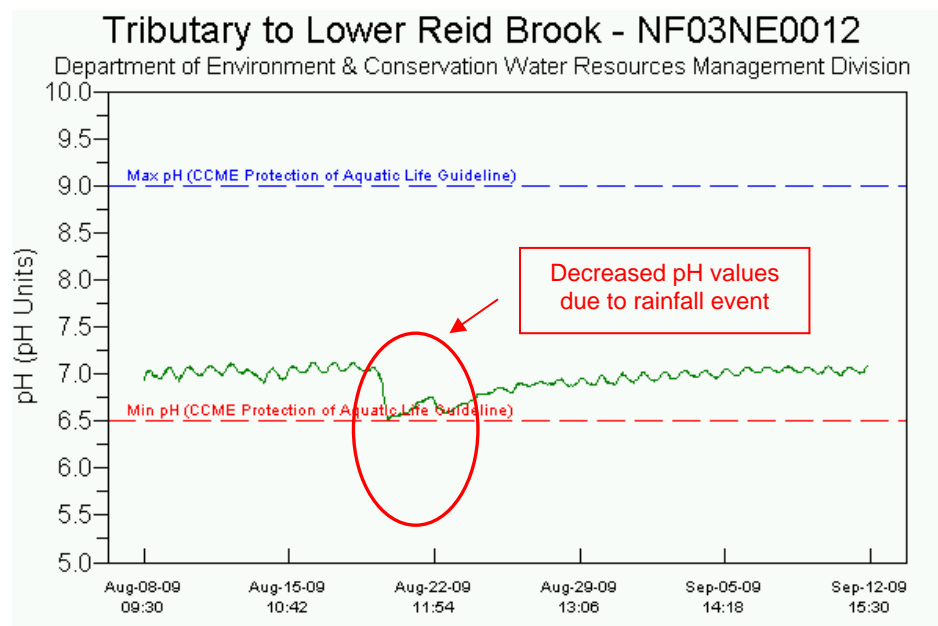
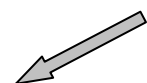


Figure 22



- Turbidity values (**Figure 23**) were variable over the deployment period ranging from 0.0 NTU to 48.6 NTU. The maximum increase (48.6 NTU) occurred on August 20th and was associated with increased rainfall amounts (see **Appendix**) clearly depicted on the stage graph (**Figure 24**). It is unclear what may have attributed to the remainder of the spikes in turbidity.

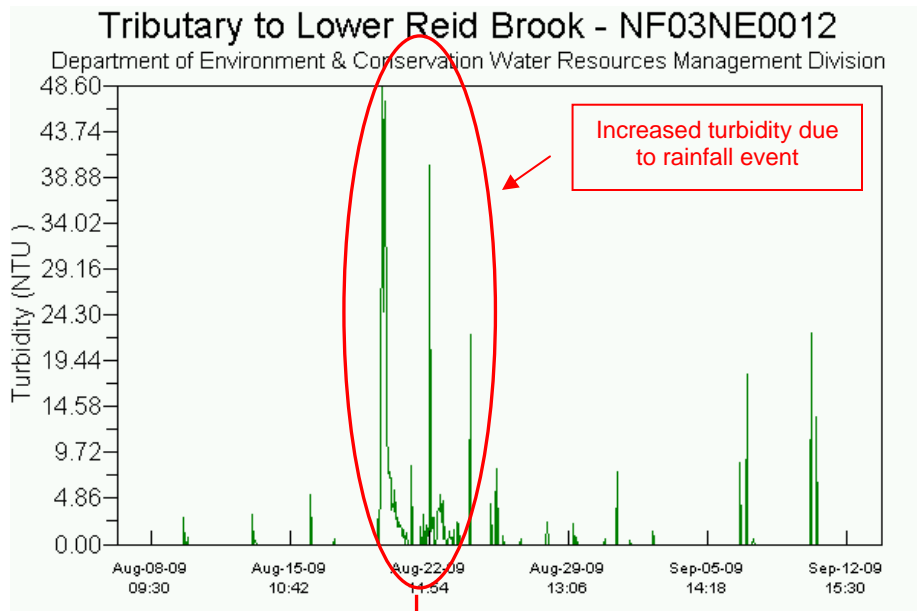


Figure 23

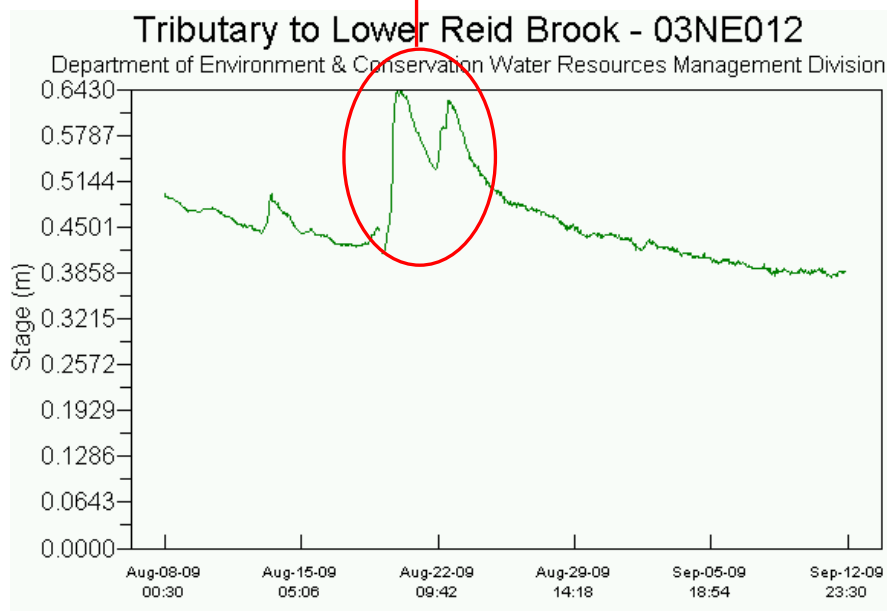
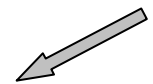
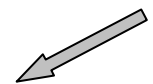


Figure 24



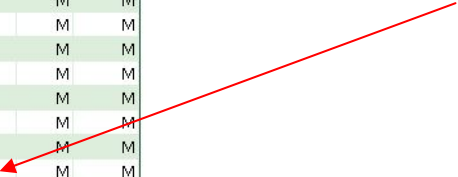
Prepared by: Renee Paterson
Senior Environmental Scientist
Department of Environment and Conservation

Appendix

Daily Data Report for August 2009

D a y	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†	10.7	7.5E	9.1E	8.9E	0.0E	M		2.0E		M	M
02†	11.8	4.0E	7.9E	10.1E	0.0E	M		0.2E		M	M
03†	13.7	6.7E	10.2E	7.8E	0.0E	M		9.0E		M	M
04†	24.6	7.8E	16.2E	1.8E	0.0E	M		1.2E		M	M
05†	18.6	9.7E	14.2E	3.8E	0.0E	M		8.2E		M	M
06†	20.2	12.9E	16.6E	1.4E	0.0E	M		2.0E		M	M
07†	14.1	10.1E	12.1E	5.9E	0.0E	M		2.8E		M	M
08†	15.2	9.7E	12.5E	5.5E	0.0E	M		0.0		M	M
09†	20.9	5.5E	13.2E	4.8E	0.0E	M		2.6E		M	M
10†	17.2	8.6E	12.9E	5.1E	0.0E	M		2.8E		M	M
11†	14.1	7.9E	11.0E	7.0E	0.0E	M		0.0		M	M
12†	17.1	8.3E	12.7E	5.3E	0.0E	M		2.6E		M	M
13†	22.9	7.4E	15.2E	2.8E	0.0E	M		3.8E		M	M
14†	17.8	10.9E	14.4E	3.6E	0.0E	M		0.0		M	M
15†	15.7	5.8E	10.8E	7.2E	0.0E	M		1.0E		M	M
16†	15.9	6.0E	11.0E	7.0E	0.0E	M		2.2E		M	M
17†	11.1	4.8E	8.0E	10.0E	0.0E	M		T		M	M
18†	8.5	3.7E	6.1E	11.9E	0.0E	M		7.2E		M	M
19†	7.2	5.0E	6.1E	11.9E	0.0E	M		25.4E		M	M
20†	7.9	3.0E	5.5E	12.5E	0.0E	M		6.0E		M	M
21†	13.3	6.4E	9.9E	8.1E	0.0E	M		1.2E		M	M
22†	14.6	5.6E	10.1E	7.9E	0.0E	M		9.8E		M	M
23†	16.7	8.4E	12.6E	5.4E	0.0E	M		0.0		M	M
24†	13.4	6.3E	9.9E	8.1E	0.0E	M		0.0		M	M
25†	13.2	7.0E	10.1E	7.9E	0.0E	M		0.0		M	M
26†	7.4	1.2E	4.3E	13.7E	0.0E	M		0.2E		M	M
27†	9.0	1.3E	5.2E	12.8E	0.0E	M		0.0		M	M
28†	9.1	0.1E	4.6E	13.4E	0.0E	M		T		M	M
29†	14.6	1.4E	8.0E	10.0E	0.0E	M		0.0		M	M
30†	16.6	3.2E	9.9E	8.1E	0.0E	M		0.4E			
31†	13.2	6.8E	10.0E	8.0E	0.0E	M		0.4E			
Sum				237.7E	0.0E	M	0.0	91.0E			
Avg	14.4	6.2E	10.31E								
Xtrm	24.6	0.1E									

Rainfall Event



Daily Data Report for September 2009

D a y	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†	15.5	2.5E	9.0E	9.0E	0.0E	M		0.6E		M	M
02†	17.3	7.0E	12.2E	5.8E	0.0E	M		0.0		M	M
03†	14.8	7.0E	10.9E	7.1E	0.0E	M		0.2E		M	M
04†	13.9	2.6E	8.3E	9.7E	0.0E	M		0.0		M	M
05†	13.7	1.1E	7.4E	10.6E	0.0E	M		0.0		M	M
06†	17.3	4.1E	10.7E	7.3E	0.0E	M		0.2E		M	M
07†	9.9	4.4E	7.2E	10.8E	0.0E	M		1.6E		M	M
08†	10.8	4.2E	7.5E	10.5E	0.0E	M		0.6E		M	M
09†	14.7	4.8E	9.8E	8.2E	0.0E	M		0.0		M	M
10†	24.0	3.6E	13.8E	4.2E	0.0E	M		0.0		M	M
11†	18.1	11.2E	14.7E	3.3E	0.0E	M		0.2E		M	M
12†	6.2	2.6E	4.4E	13.6E	0.0E	M		0.8E		M	M
13†	7.7	1.1E	4.4E	13.6E	0.0E	M		T		M	M
14†	4.7	0.9E	2.8E	15.2E	0.0E	M		2.4E		M	M
15†	5.9	2.6E	4.3E	13.7E	0.0E	M		0.0		M	M
16†	9.9	0.7E	5.3E	12.7E	0.0E	M		1.0E		M	M
17†	16.8	6.3E	11.6E	6.4E	0.0E	M		0.0		M	M
18†	16.8	7.5E	12.2E	5.8E	0.0E	M		1.2E		M	M
19†	7.7	3.1E	5.4E	12.6E	0.0E	M		0.6E		M	M
20†	12.9	2.9E	7.9E	10.1E	0.0E	M		2.0E		M	M
21†	21.6	4.3E	13.0E	5.0E	0.0E	M		0.0		M	M
22†	21.8	14.9E	18.4E	0.0E	0.4E	M		4.6E		M	M
23†	5.7	3.1E	4.4E	13.6E	0.0E	M		7.0E		M	M
24†	5.6	0.3E	3.0E	15.0E	0.0E	M		1.2E	T	M	M
25†	8.0	-0.9E	3.6E	14.4E	0.0E	M		0.0		M	M
26†	13.5	0.0E	6.8E	11.2E	0.0E	M		4.0E		M	M
27†	15.3	5.0E	10.2E	7.8E	0.0E	M		T		M	M
28†	8.0	4.0E	6.0E	12.0E	0.0E	M		2.6E		M	M
29†	7.4	4.8E	6.1E	11.9E	0.0E	M		4.6E		M	M
30†	6.7	3.2E	5.0E	13.0E	0.0E	M		2.8E		M	M
Sum				294.1E	0.4E	M	0.0	38.2E			
Avg	12.4	4E	8.18E								
Xtrm	24.0	-0.9E								M	M