

**General**

- The Water Resources Management Division staff monitors the real-time web page on a daily basis.
- Vale Inco will be informed of any significant water quality events in the form of a monthly deployment report.
- This monthly deployment report interprets the data from the Rattling Brook River real-time water quality station for the period of August 11<sup>th</sup> to September 9<sup>th</sup>, 2009, a period of 28 days.
- Rattling Brook station experienced intermittent communication from 1830 on August 13 to 1130 on August 15. Communication appears to have returned to normal following this loss of contact. Hydrolab Datasonde 5X s/n 44604 was in place for this time period.
- A prolonged release of turbid water upstream of the station occurred at the end of the deployment period. See discussion regarding turbidity below.

**Maintenance and Calibration of Instrument**

- 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 installation of Datasonde 5X s/n 44604 on August 11<sup>th</sup>, 2009 all parameters were ranked as “Excellent” except Temperature and pH which were ranked as “Good”. During the removal on September 9<sup>th</sup>, 2009 Temperature and Conductivity ranked as “Good”. pH, Dissolved Oxygen and Turbidity ranked as “Excellent”.

**Table 1: QA/QC Data Comparison Rankings upon installation on August 11<sup>th</sup>, 2009 to September 9<sup>th</sup>, 2009.**

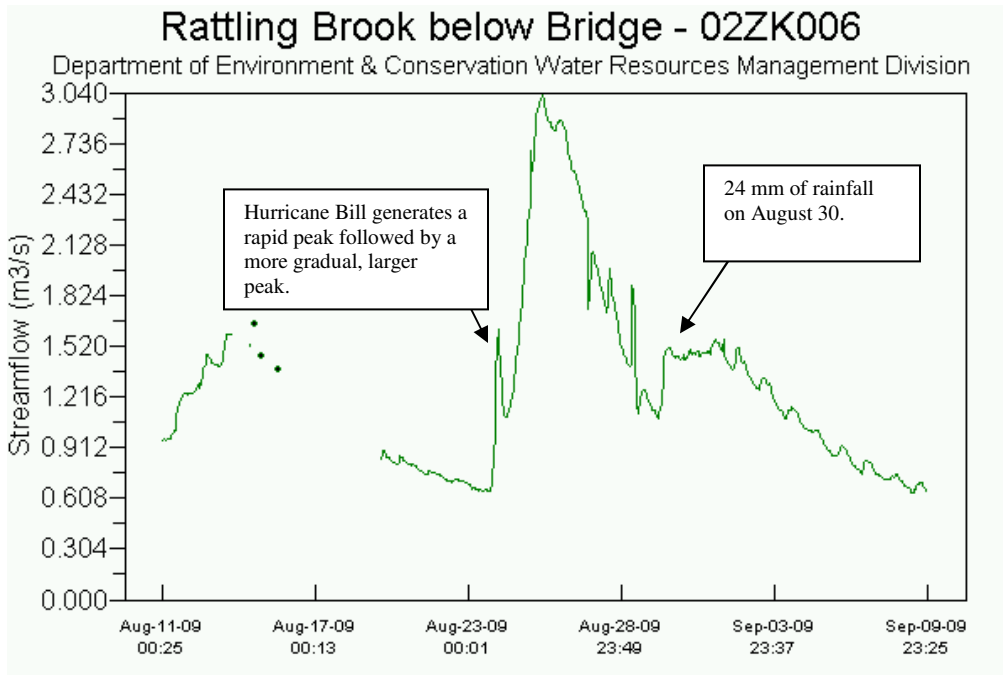
Station	Date	Action	Instrument Comparison Ranking				
			Temperature	pH	Conductivity	Dissolved Oxygen	Turbidity
Rattling Brook (Long Harbour)	August 11 <sup>th</sup> , 2009	Installation	Good	Good	Excellent	Excellent	Excellent
	September 9 <sup>th</sup> , 2009	Removal	Good	Excellent	Good	Excellent	Excellent

**Data Interpretation**

- Over the course of this deployment, water quality in Rattling Brook fluctuated due to environmental conditions and impact from construction at the Vale Inco site. Parameters such as temperature, pH, conductivity, and dissolved oxygen did not show obvious impact other than that caused by a few heavy rainfall periods. The elimination of a waterbody in the boundary of the construction site has led to turbid, overland flow running into Rattling Brook causing a sustained turbidity of  $\geq 1.8$  NTU from the morning of September 8 to the end of deployment on September 9. This event is still underway as of September 17 and has reached a low of 1.5 NTU on September 16.

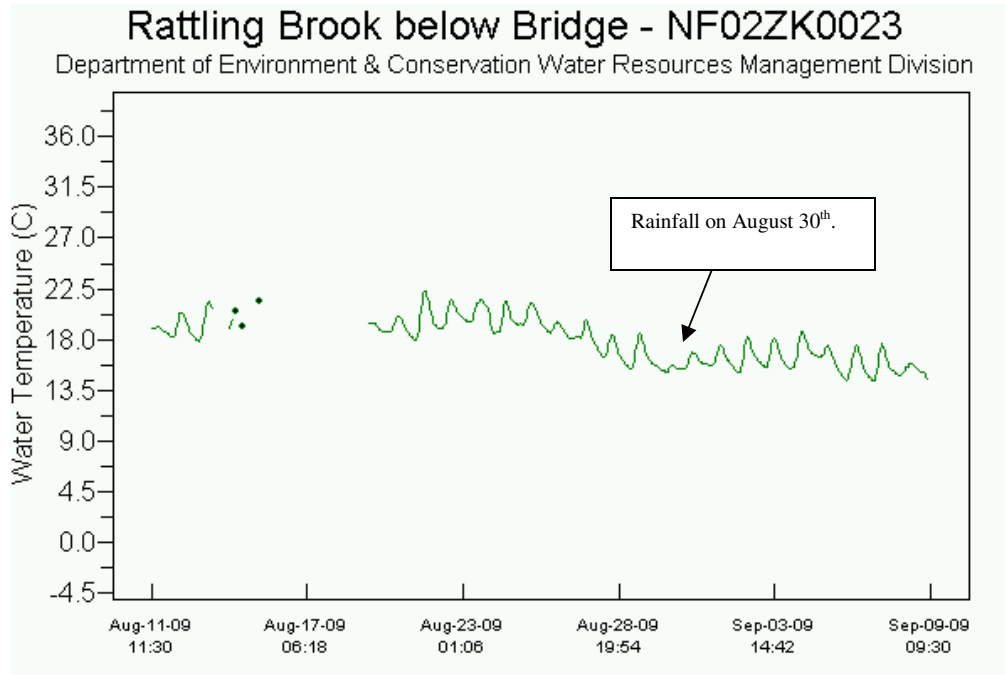
- Recently, Rattling Brook has been equipped with the capacity to calculate flow based on the measurement of stage. The effects of Hurricane Bill are obvious from Figure 1. A sharp peak occurs early on August 23 from heavy rainfall and drops quickly once the rain has passed. As water from the surrounding watershed reaches the gauging station another larger peak occurs. Such a peak drops off slowly over several days as groundwater flow returns to the baseflow condition.

**Figure 1: Streamflow at Rattling Brook from August 11, 2009 to September 9, 2009**



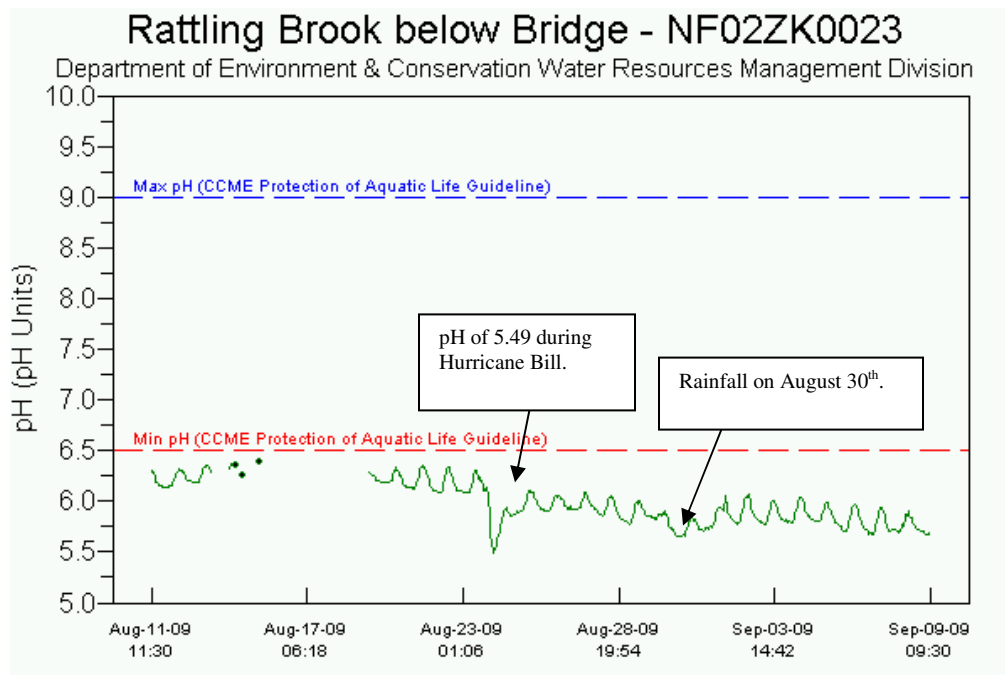
- The seasonal decline in water temperature is evident in the gradual slope of Figure 2. Perhaps due to the warm temperature of the Hurricane Bill temperature, no impact is noticed in the water temperature on August 23 (minimum air temperature recorded = 17.0°C). A depression in the diurnal cycle results from the 24 mm of rain on August 30 (minimum air temperature recorded = 9.7°C).

**Figure 2: Water Temperature at Rattling Brook from August 11, 2009 to September 9, 2009**



- Two noticeable impacts in pH are seen at Rattling Brook during the rainfall on August 23<sup>rd</sup> and August 30<sup>th</sup>. During the rainfall of Hurricane Bill a transient acidification is seen as the pH drops to 5.49 and rebounds following the cessation of precipitation.

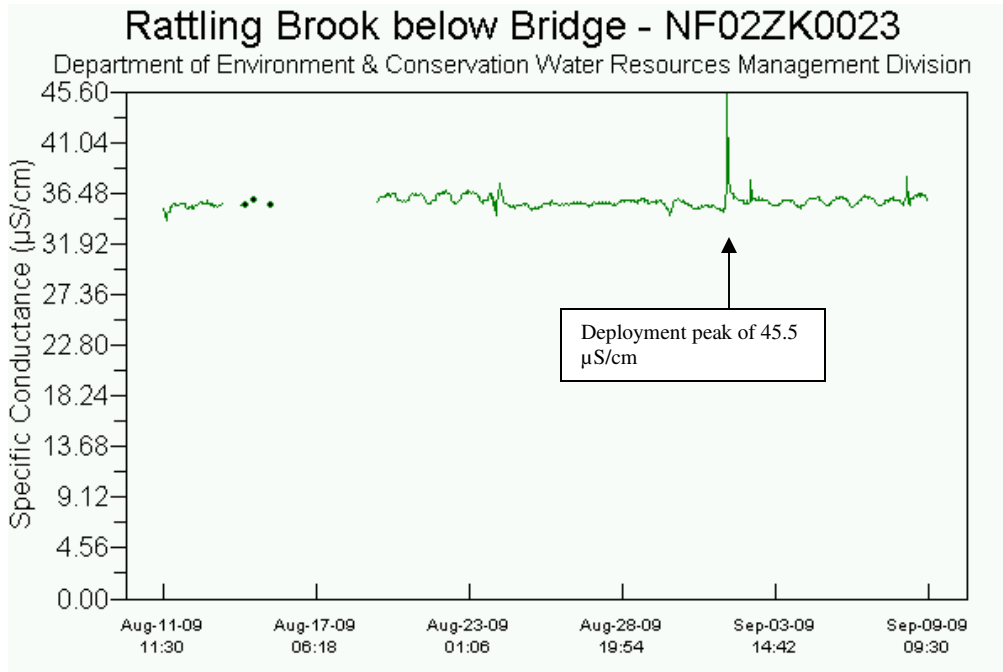
**Figure 3: pH at Rattling Brook from August 11, 2009 to September 9, 2009**



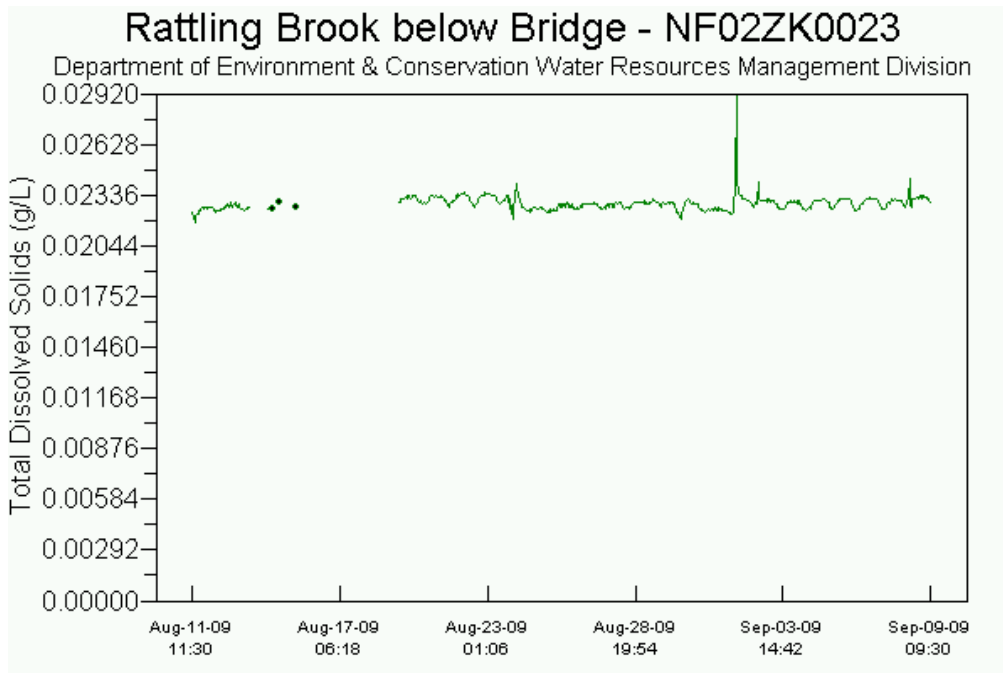
- Specific conductivity at Rattling Brook ranged from 34.0 to 45.6  $\mu\text{S}/\text{cm}$  during the deployment period of August 11<sup>th</sup> to September 9<sup>th</sup>. A deployment high of 45.6  $\mu\text{S}/\text{cm}$  occurred on September 1<sup>st</sup> despite the lack

of precipitation in the preceding 24 hours. This jump in specific conductivity also occurred during a peak in turbidity and TDS (Figure 5) suggesting an unusual influx of sediment into Rattling Brook.

**Figure 4: Specific Conductance at Rattling Brook from August 11, 2009 to September 9, 2009**



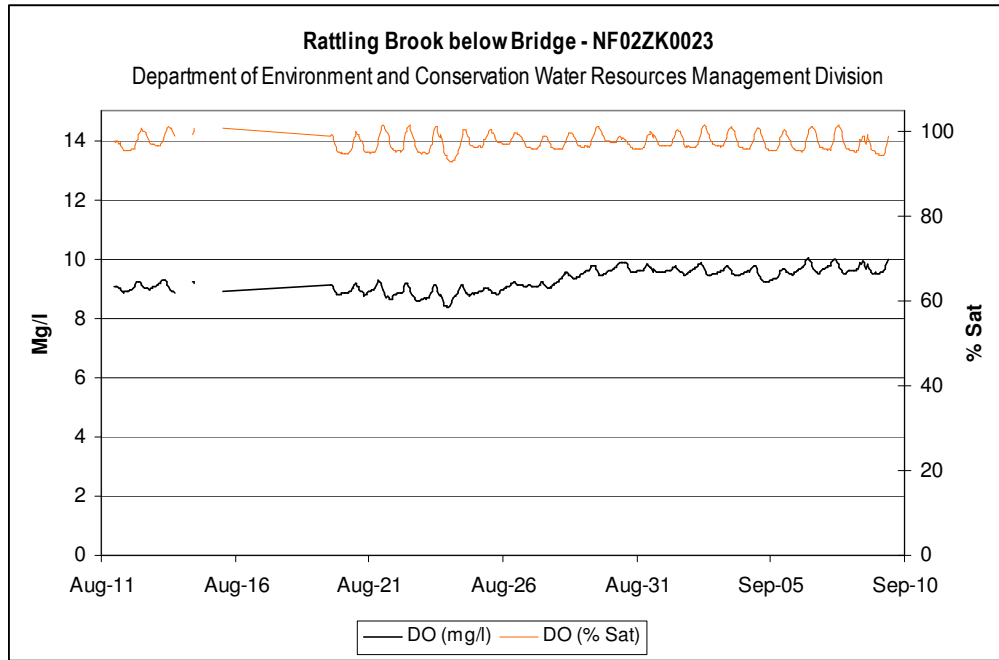
**Figure 5: Total Dissolved Solids at Rattling Brook from August 11, 2009 to September 9, 2009**



- The saturation of dissolved oxygen at Rattling Brook during the deployment period remains near 100% while the dissolved concentration in mg/l rises gradually. This is expected as water temperature declines

allowing more oxygen to dissolve in the water. Slight perturbations in the diurnal cycle of DO are seen during precipitation on August 23<sup>rd</sup> and August 30<sup>th</sup>.

**Figure 6: Dissolved Oxygen at Rattling Brook from August 11, 2009 to September 9, 2009**



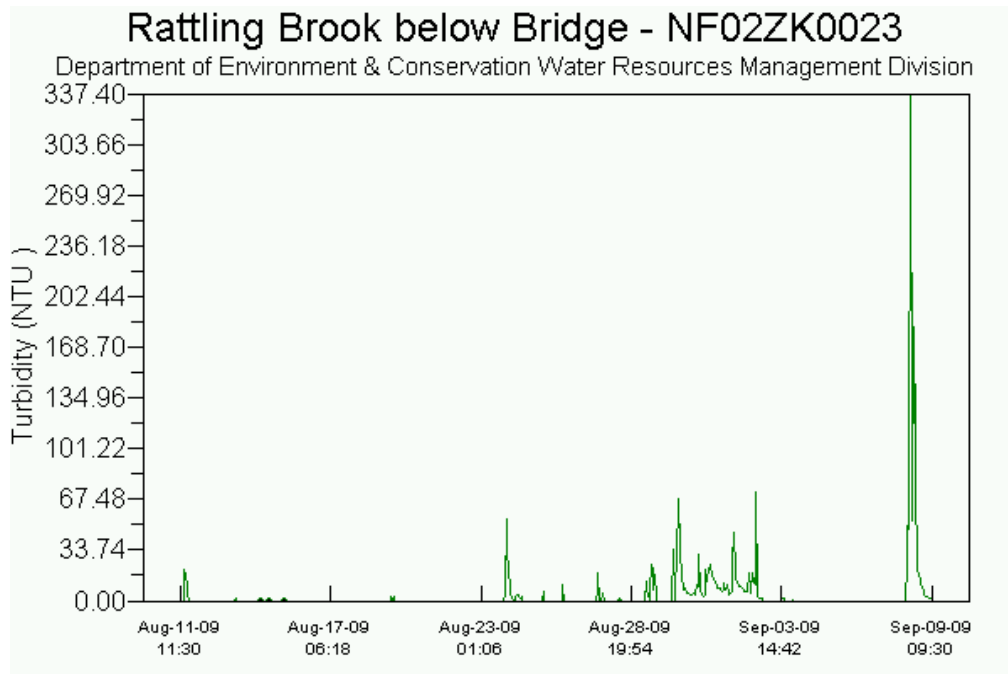
- This deployment witnessed a series of prolonged turbidity events. The first began on August 30 and lasted until September 2 reaching a high of 72 NTU. A second event began on September 8 and continues at the time of this writing (September 17<sup>th</sup>, 2009). These events can be considered unusual as turbidity at Rattling Brook is generally very low (0 NTU) between precipitation events. In heavy precipitation turbidity will often increase; however, the event is of short duration (< 5 hours).
- A briefing from the turbidity event beginning on September 8<sup>th</sup> by Vale Inco environmental staff reads as follows:

While conducting monitoring of site, water flowing through Crossing # 8 was noticed to be extremely murky. Environmental Personnel walked to mouth of stream from Forgotten pond and traced the sedimentation back to the opposite end. Water which was being pumped from Pond 25 and flowing across approximately 300m of vegetated area was flowing directly into Forgotten Pond, flowing down through Rattling Brook.

PHC personnel at Crossing #8 had not informed Pennecon/Atcon Environmental personnel about the increased murkiness of water.

...Turbidity at Continuous Monitoring station Averaged 47 NTU. Maximum 337 NTU.

**Figure 7: Turbidity at Rattling Brook from August 11, 2009 to September 9, 2009**



## Appendix

Daily Data Report for August 2009											
<u>D</u> <u>a</u> <u>y</u>	<u>Max</u> <u>Temp</u> °C	<u>Min</u> <u>Temp</u> °C	<u>Mean</u> <u>Temp</u> °C	<u>Heat</u> <u>Deg</u> <u>Days</u> °C	<u>Cool</u> <u>Deg</u> <u>Days</u> °C	<u>Total</u> <u>Rain</u> mm	<u>Total</u> <u>Snow</u> cm	<u>Total</u> <u>Precip</u> mm	<u>Snow</u> <u>on</u> <u>Grnd</u> cm	<u>Dir of</u> <u>Max</u> <u>Gust</u> 10's Deg	<u>Spd of</u> <u>Max</u> <u>Gust</u> km/h
<a href="#">01†</a>	17.9	15.6	16.8	1.2	0.0	M	M	2.2		21	44
<a href="#">02†</a>	22.2	13.8	18.0	0.0	0.0	M	M	0.0		26	43
<a href="#">03†</a>	22.7	13.7	18.2	0.0	0.2	M	M	3.0		13	54
<a href="#">04†</a>	18.6	15.5	17.1	0.9	0.0	M	M	0.0		20	35
<a href="#">05†</a>	21.0	14.8	17.9	0.1	0.0	M	M	0.0		23	39
<a href="#">06†</a>	18.1	16.0	17.1	0.9	0.0	M	M	0.0		20	39
<a href="#">07†</a>	18.3	16.5	17.4	0.6	0.0	M	M	24.2			<31
<a href="#">08†</a>	18.6	15.2	16.9	1.1	0.0	M	M	1.0		24	43
<a href="#">09†</a>	20.3	16.0	18.2	0.0	0.2	M	M	1.2		28	44
<a href="#">10†</a>	19.7	15.5	17.6	0.4	0.0	M	M	0.0		21	41
<a href="#">11†</a>	19.7	15.1	17.4	0.6	0.0	M	M	19.6		15	52
<a href="#">12†</a>	20.6	12.2	16.4	1.6	0.0	M	M	0.0		3	37
<a href="#">13†</a>	19.6	12.6	16.1	1.9	0.0	M	M	0.0		25	35
<a href="#">14†</a>	19.6	15.9	17.8	0.2	0.0	M	M	0.0		21	35
<a href="#">15†</a>	20.3	15.9	18.1	0.0	0.1	M	M	0.0		20	41
<a href="#">16†</a>	22.8	14.7	18.8	0.0	0.8	M	M	0.0		23	41
<a href="#">17†</a>	20.8	13.6	17.2	0.8	0.0	M	M	0.0		10	37
<a href="#">18†</a>	18.0	13.0	15.5	2.5	0.0	M	M	3.3		13	56
<a href="#">19†</a>	18.5	15.9	17.2	0.8	0.0	M	M	0.0		21	41
<a href="#">20†</a>	18.2	16.7	17.5	0.5	0.0	M	M	3.2		26	39
<a href="#">21†</a>	21.2	16.5	18.9	0.0	0.9	M	M	0.0		27	32
<a href="#">22†</a>	20.7	16.3	18.5	0.0	0.5	M	M	0.0		20	50
<a href="#">23†</a>	23.7	17.0	20.4	0.0	2.4	M	M	30.6		20	95
<a href="#">24†</a>	20.8	15.1	18.0	0.0	0.0	M	M	0.0		32	72
<a href="#">25†</a>	18.9	10.1	14.5	3.5	0.0	M	M	0.0		26	35
<a href="#">26†</a>	19.2	9.5	14.4	3.6	0.0	M	M	0.0		20	69
<a href="#">27†</a>	18.2	13.2	15.7	2.3	0.0	M	M	0.7		27	76
<a href="#">28†</a>	14.7	11.7	13.2	4.8	0.0	M	M	0.0		26	70
<a href="#">29†</a>	16.9	10.7	13.8	4.2	0.0	M	M	0.0		27	52
<a href="#">30†</a>	18.9	9.7	14.3	3.7	0.0	M	M	24.0		15	87
<a href="#">31†</a>	15.6	13.1	14.4	3.6	0.0	M	M	0.0		24	39
<b>Sum</b>				<b>39.8</b>	<b>5.1</b>	<b>M</b>	<b>M</b>	<b>113.0</b>			
<b>Avg</b>	<b>19.5</b>	<b>14.2</b>	<b>16.86</b>								
<b>Xtrm</b>	<b>23.7</b>	<b>9.5</b>								<b>20</b>	<b>95</b>

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†	16.7	10.1	13.4	4.6	0.0	M	M	0.0		25	41
02†	15.6	9.0	12.3	5.7	0.0	M	M	0.0		22	41
03†	16.2	13.0	14.6	3.4	0.0	M	M	0.0		21	54
04†	15.6	13.4	14.5	3.5	0.0	M	M	0.0		22	43
05†	17.2	6.4	11.8	6.2	0.0	M	M	0.0		6	33
06†	15.2	5.8	10.5	7.5	0.0	M	M	0.0			<31
07†	15.2	10.7	13.0	5.0	0.0	M	M	0.0		24	65
08†	15.7	13.4	14.6	3.4	0.0	M	M	0.0		24	56
09†	15.7	7.3	11.5	6.5	0.0	M	M	0.0		35	48
10†	16.0	7.1	11.6	6.4	0.0	M	M	0.0		34	44
11†	16.6	12.4	14.5	3.5	0.0	M	M	0.0		26	48
12†	18.4	9.7	14.1	3.9	0.0	M	M	0.0		14	46
13†	18.7	10.0	14.4	3.6	0.0	M	M	4.1		13	48
14†	18.1	12.1	15.1	2.9	0.0	M	M	3.3		19	82
15†	15.5	10.7	13.1	4.9	0.0	M	M	0.0		22	44
16†	12.8	7.9	10.4	7.6	0.0	M	M	0.0		4	41
<b>Sum</b>				<b>78.6*</b>	<b>0.0*</b>	<b>M</b>	<b>M</b>	<b>7.4*</b>			
<b>Avg</b>	<b>16.2*</b>	<b>9.9*</b>	<b>13.1*</b>								
<b>Xtrm</b>	<b>18.7*</b>	<b>5.8*</b>								<b>19*</b>	<b>82*</b>

Prepared by:  
 Ryan Pugh  
 Regional Water Quality Officer  
 Department of Environment and Conservation  
 Water Resources Management Division  
 Phone: 709.729.1681  
 Fax: 709.729.3020