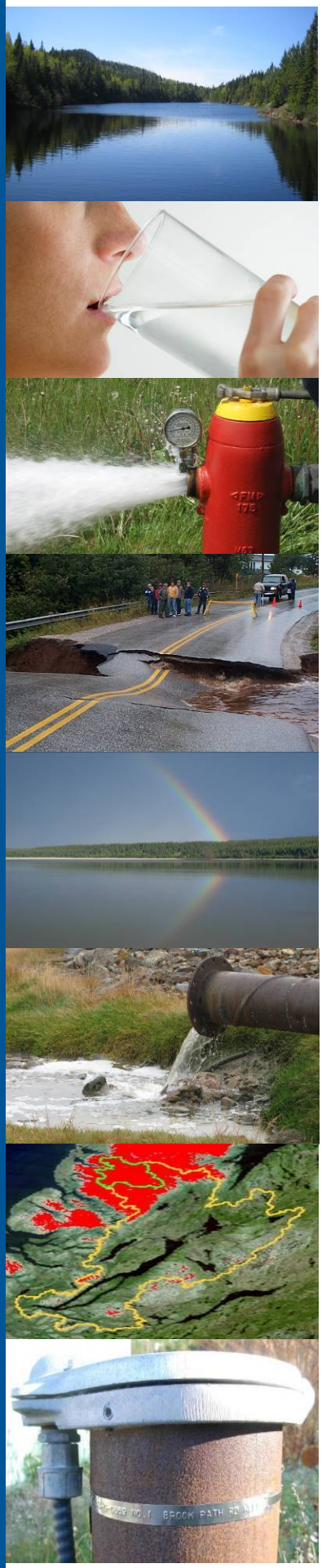


Waterford River @ Kilbride

NF02ZM0009

February 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
January 23 – March 2, 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 January 23rd until March 2nd was a YSI 6600 series multi-probe, which continuously measured water temperature, pH, specific conductivity, dissolved oxygen and turbidity. The duration of the deployment was 39 days.
- The Waterford River real-time water quality (RTWQ) monitoring station resumed data transmission on February 12, 2012 after experiencing transmission failure and undergoing repairs since December 2011.
- Even though this deployment period began on January 23, 2012, the water quality graphs displayed in this report capture the data beginning on February 12, 2012, when real time transmissions from the repaired transmission system resumed.

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 Installed	Date Removed
January 23, 2012	March 2, 2012

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

Quality Assurance and Quality Control (QAQC)

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

Table 2: Comparison rankings for Waterford @ Kilbride station January 23rd to March 2nd, 2012

Date	Action	Comparison Ranking				
		Temp	pH	SpC	DO	Turb
January 23, 2012	Deployment Ranking	Excellent	Excellent	Excellent	Excellent	Excellent
March 2, 2012	Removal Ranking	Excellent	Excellent	Poor	Poor	Excellent

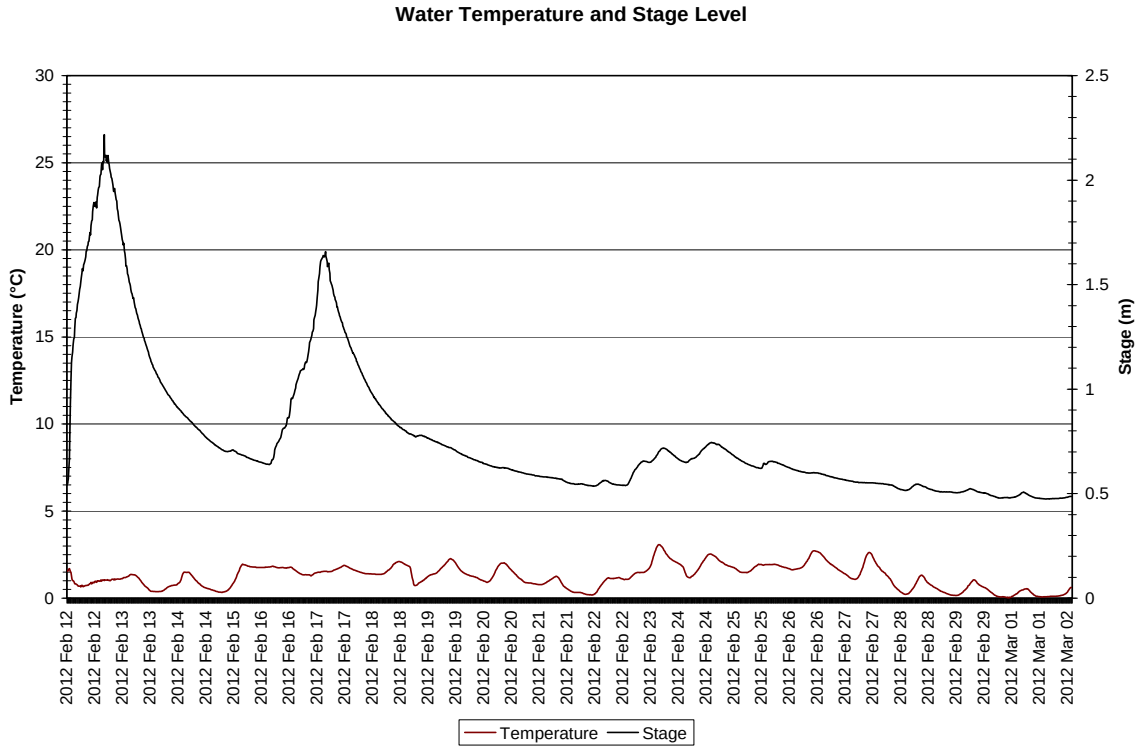
- **Deployment rankings** of "excellent" for water temperature, pH, specific conductivity, dissolved oxygen and turbidity indicate successful cleaning and calibration, which should enable these sensors to produce reliable data during the subsequent deployment period.
- **Removal rankings** of "excellent" for water temperature, pH and turbidity increase confidence that the data collected for these parameters over the duration of this

deployment are reliable. Removal rankings of "poor" for specific conductivity and dissolved oxygen indicate that significant sensor fouling or impairment may have occurred during the deployment period, or that the sensor may be malfunctioning, and data for these parameters may not be reliable throughout the duration of the deployment period.

Data Interpretation

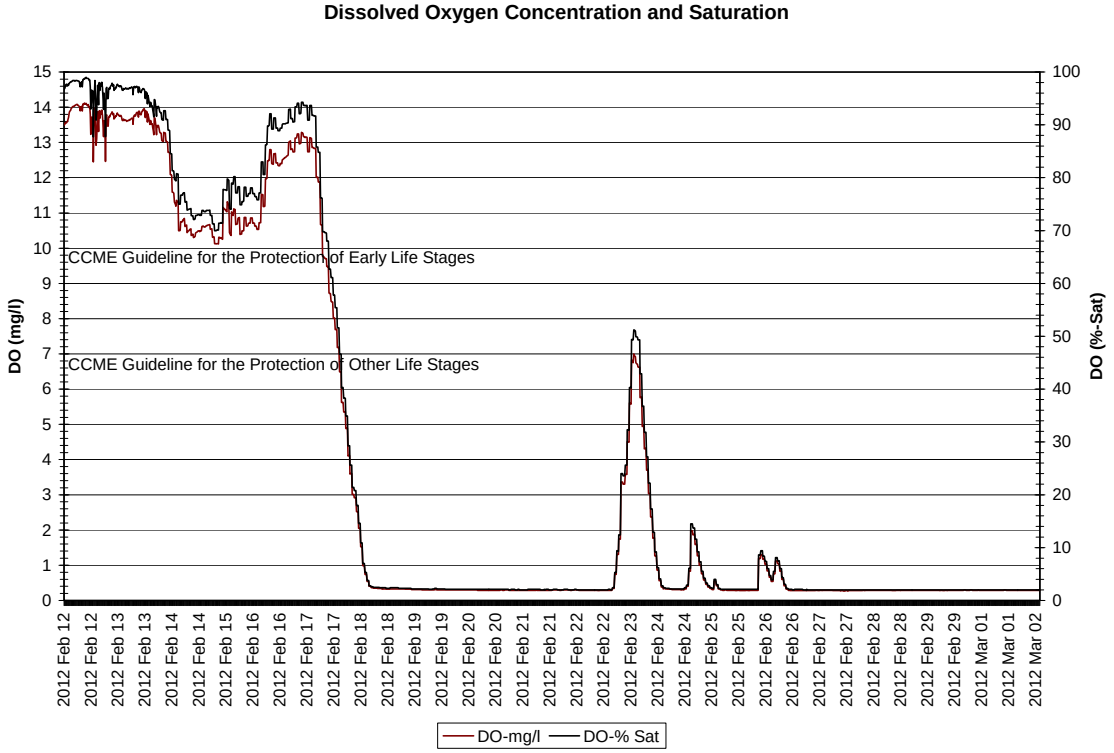
- **Water temperatures** remained fairly constant near the freezing mark during this deployment period ranging between from 0.04^{o}C up to 3.08 ^{o}C. Water temperature data are shown in brown ink in **Figure 1** below. Stage level (water height) is shown in black ink. The constant water temperatures during this deployment are reflective of the fairly constant air temperatures during this period, which had a daily average ranging between -7.3 and -1.6^{o}C. A table of daily air temperatures in the St. John's region for the month of February 2012, as recorded by Environment Canada, is found in appendix 1 at the end of this report.

Figure 1: Water Temperature



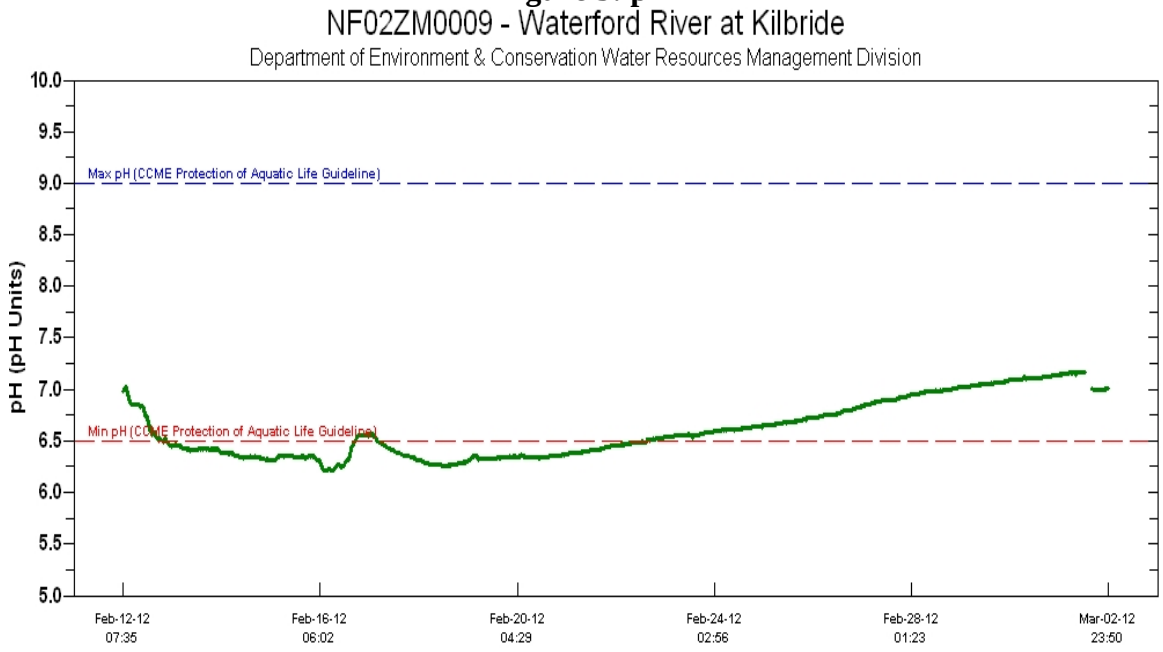
- **The Dissolved Oxygen (DO**) sensor values plummeted on February 18 as can be seen in **Figure 2** below. Inspection of this sensor during removal of the instrument on March 2 indicated that this sensor had become surrounded by heavy slush and ice which impaired its ability to accurately measure dissolved oxygen concentrations in the flowing water. As a result, DO values from February 18 to March 2 are deemed unreliable.

Figure 2: Dissolved Oxygen



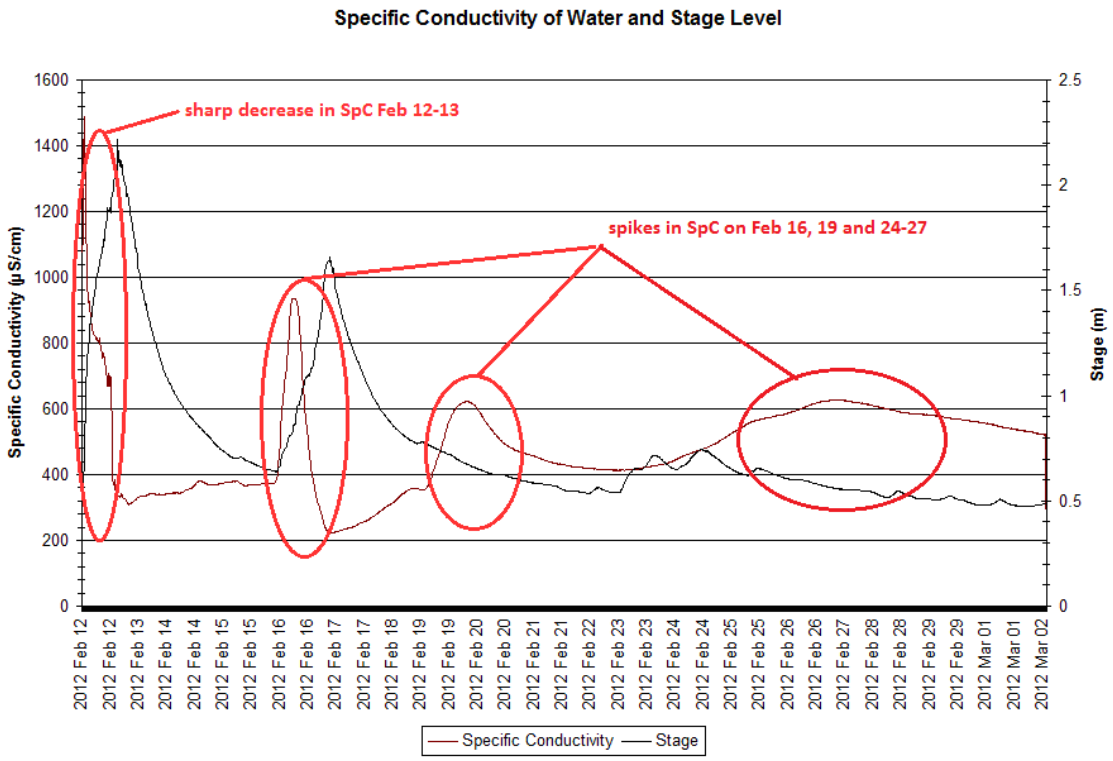
- **pH** levels ranged between 6.21 and 7.17 pH units during this deployment period, at times falling just below the CCME recommended minimum pH guideline for the Protection of Aquatic Life, of 6.5. pH levels during this deployment period are shown in green ink in **Figure 3**, below. It is not unusual for the pH level of surface water bodies in this province to fall below the CCME recommended minimum guideline of 6.5 pH units, due to the acidic nature and abundance of bog land. Surface water also tends to be more acidic during the winter months when photosynthetic activity decreases in response to the seasonal decrease in daylight hours.

Figure 3: pH



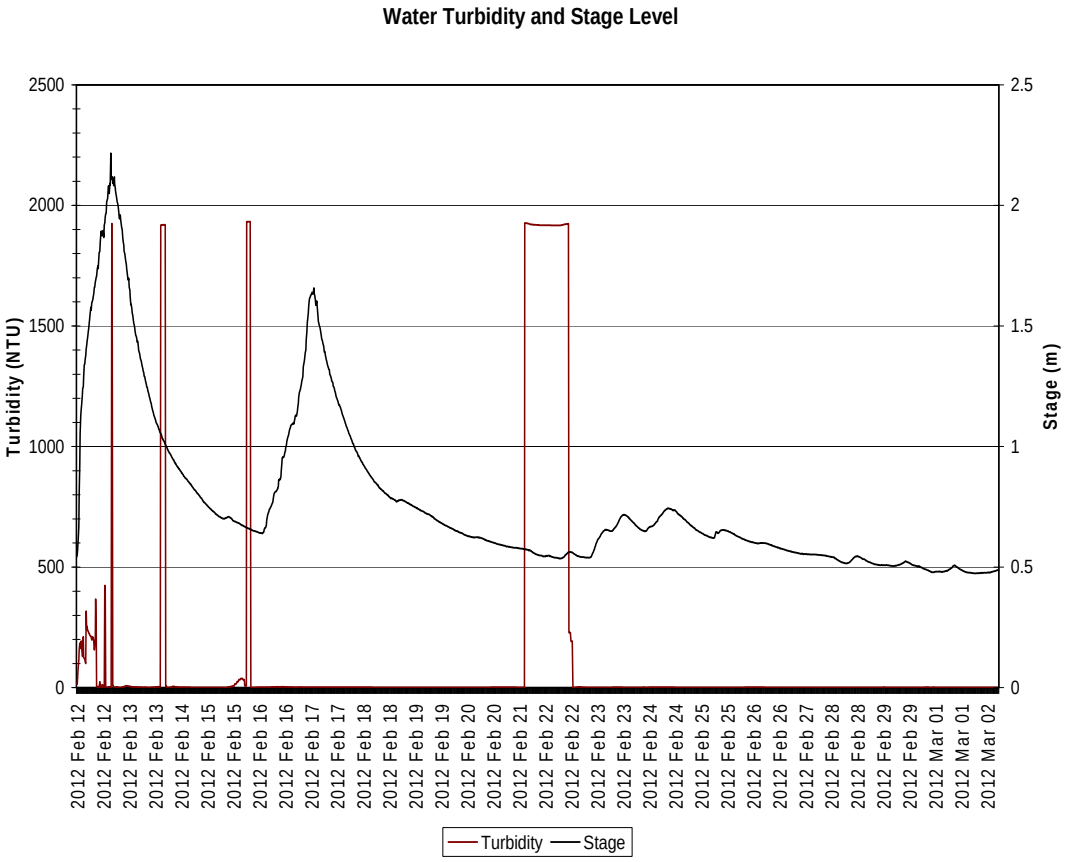
- **Specific conductivity (SpC)** levels showed significant fluctuation during this deployment period, ranging between 73 and 1488 µS/cm as shown in brown ink in **Figure 4** below. It is difficult to ascertain whether or not high values in the 1400 µS/cm range recorded on February 12 are true representations of water quality, or are a result of the instrument stabilizing as electronic transmissions resumed on this day after being out-of-service since December 2011. Environment Canada daily climate data for the St. John's region for February 2012 (shown in **Appendix 1)** indicates a significant snowfall accumulation of 55cm from February 8-11, which may have had a dilution effect on SpC. Snowfall itself does not cause surface run-off, but does increase the volume of water in a surface water body, as can be seen in the increase in stage height in Waterford River on February 12. Stage height is shown in black ink in **Figure 4** below. Spikes in SpC occurred on February 16 and 19 within 24 hours of air temperatures climbing above zero degrees, resulting in snow melt and surface run-off. It is expected that surface run-off contains a significant concentration of road salt at this time of year, causing spikes in conductivity. It is interesting to note that despite air temperatures reaching 4 degrees above zero on February 15, 13.8cm of snow also fell during that day, and the resulting rise and fall in conductivity is seen in the spike in **Figure 4** on February 15. Spikes in conductivity that occurred from February 19-20 and 24-27 are not short in duration and do not appear to be weather related. These spikes may be indicative of land use events, that may have occurred in the immediate vicinity or upstream from this monitoring station, that impacted conductivity values.

Figure 4: Specific Conductance and Stage



- **Turbidity** concentrations remained at background levels for the majority of this deployment period, with the exception of four spikes that occurred on February 12, 13, 15 and 21. Turbidity concentrations are shown in brown ink in **Figure 5** below. The spikes that occurred on the 12, 13 and 15 were of short duration and may be indicative of ice, slush or some other suspended debris passing by the turbidity sensor. The spike on the 21st is of longer duration and its occurrence coincides with water temperatures approaching 0°C. Water temperatures are shown in **Figure 1**, above. It is possible that slush and ice formed in the instrument cage surrounding the sensors during these near-freezing water temperatures, and quickly dissipated or moved on as water temperatures climbed above 3°C on February 23.

Figure 5: Turbidity and Flow



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Appendix 1

Environment Canada Daily Climate Data for St. John's, NL: February 2012

Daily Data Report for February 2011

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
Sum				629.0	0.0	30.2	134.0	135.4			
Avg	-1.6	-7.3	-4.5								
Xtrm	4.6	-12.8								29	104
Summary, average and extreme values are based on the data above.											
01	-8.3	-11.7	-10.0	28.0	0.0	0.0	1.4	0.8	18	30E	54E
02	-4.7	-10.8	-7.8	25.8	0.0	0.0	12.8	11.0	23	36E	33E
03	-5.4	-12.2	-8.8	26.8	0.0	0.0	10.2	7.6	40	11E	46E
04	-2.5	-12.6	-7.6	25.6	0.0	0.0	T	T	41	26E	54E
05	-1.5	-4.3	-2.9	20.9	0.0	0.0	T	T	38		<31
06	2.7	-3.5	-0.4	18.4	0.0	0.8	10.6	7.2	37	31E	85E
07	-0.8	-3.7	-2.3	20.3	0.0	0.0	T	T	38	33E	70E
08	-2.1	-8.9	-5.5	23.5	0.0	0.0	25.4	21.8	38	8E	74E
09	-0.5	-8.8	-4.7	22.7	0.0	0.0	9.6	6.6	62	30E	76E
10	-5.0	-9.4	-7.2	25.2	0.0	0.0	13.8	10.2	62	29E	63E
11	-6.9	-12.8	-9.9	27.9	0.0	0.0	6.2	4.8	70	32E	57E
12	-3.3	-11.9	-7.6	25.6	0.0	0.0	T	T	72	31E	41E
13	-1.7	-10.7	-6.2	24.2	0.0	0.0	4.0	2.0	75	29E	89E
14	-5.6	-12.8	-9.2	27.2	0.0	0.0	T	T	74	29E	59E
15	4.1	-6.3	-1.1	19.1	0.0	1.6	13.8	13.6	76	14E	65E
16	0.1	-4.7	-2.3	20.3	0.0	0.0	2.8	2.4	70	36E	95E
17	-0.4	-5.0	-2.7	20.7	0.0	0.0	0.4	0.4	70	30E	74E
18	0.8	-3.4	-1.3	19.3	0.0	0.0	0.0	0.0	70	31E	70E
19	-0.6	-2.9	-1.8	19.8	0.0	0.0	5.0	3.8	70	8E	56E
20	0.1	-0.6	-0.3	18.3	0.0	T	7.6	5.6	75	8E	56E
21	0.6	-1.4	-0.4	18.4	0.0	T	1.2	1.2	73	34E	44E
22	0.0	-2.0	-1.0	19.0	0.0	0.0	3.4	2.8	68		<31
23	0.5	-2.2	-0.9	18.9	0.0	0.0	5.6	5.6	69	2E	65E
24	-1.5	-5.4	-3.5	21.5	0.0	0.0	T	T	71	35E	41E
25	2.1	-5.1	-1.5	19.5	0.0	0.8	T	0.8	71	19E	59E
26	4.6	-7.9	-1.7	19.7	0.0	27.0	0.2	27.2	61	29E	104E
27	-4.7	-9.6	-7.2	25.2	0.0	0.0	T	T	50	29E	70E
28	-6.1	-12.3	-9.2	27.2	0.0	0.0	T	T			