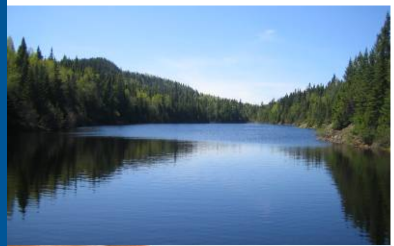







Waterford River
@
Kilbride

NF02ZM0009

December 2012 - January 2013

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
December 2012 - January 2013

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 December 5, 2012 to January 16, 2013 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 41 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
December 5, 2012	January 16, 2013

- 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 December 5, 2012

Deployment

Field Sonde to QAQC Sonde Comparisons

Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	5.68	5.64	0.04	Excellent
pH	7.31	7.29	0.02	Excellent
Specific Conductivity (µS/cm)	491.0	478.0	2.6	Excellent
Dissolved Oxygen (mg/l)	12.69	13.07	0.38	Good
Turbidity (NTU)	4.0	3.5	0.5	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 January 16, 2013

Removal

Field Sonde to QAQC Sonde Comparisons

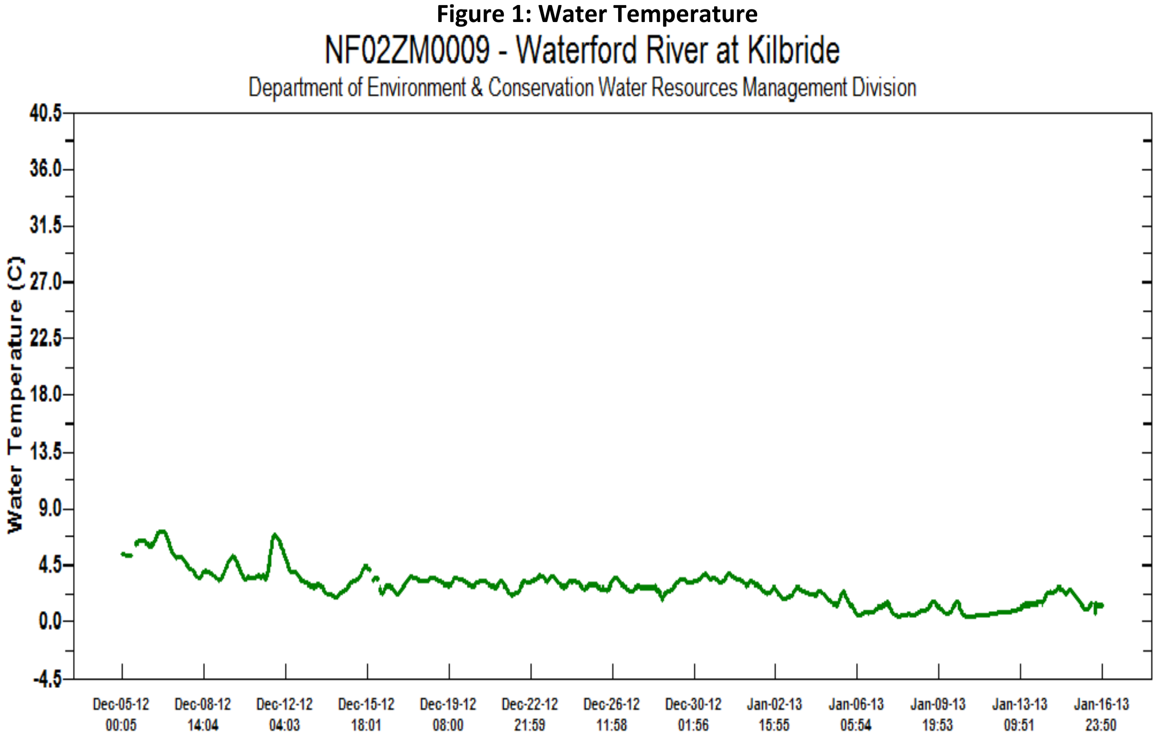
Parameter	Field Sonde	QAQC Sonde	Difference / % Difference	Ranking
Temperature ('C)	0.94	0.90	0.04	Excellent
pH	7.08	7.08	0.00	Excellent
Specific Conductivity (µS/cm)	664.0	695.0	4.7	Good
Dissolved Oxygen (mg/l)	14.31	14.73	0.42	Good
Turbidity (NTU)	3.5	0.2	3.3	Good

- **Removal rankings** of "excellent" and "good" for water temperature, pH, specific conductivity, dissolved oxygen and turbidity increase confidence that the data collected for these parameters over the duration of this deployment are reliable.

Data Interpretation

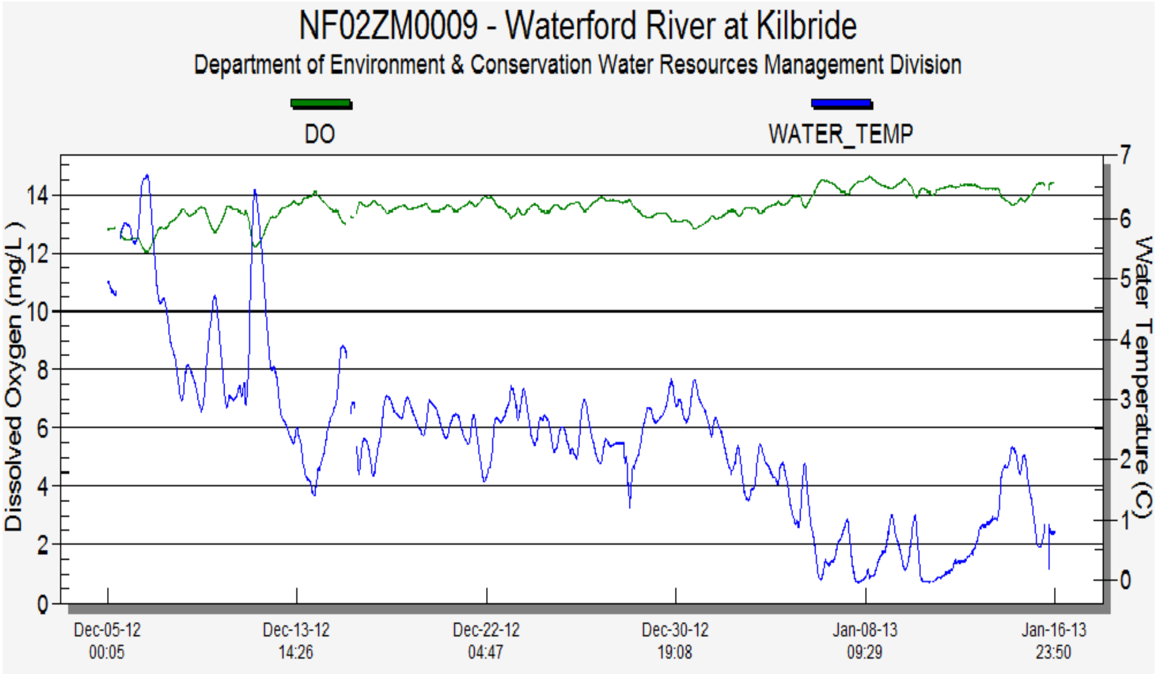
- **Water temperatures** fluctuated between -0.04 and 6.73^{o}C during this deployment period, displaying seasonal decreasing trend. Water temperature data are shown in green ink in **Figure 1**. The overall decreasing trend in water temperature corresponds to the seasonal decrease in air temperature, as shown in the Daily Climate Data for this period, in **Appendix 1** at the end of this report.

Figure 1: Water Temperature



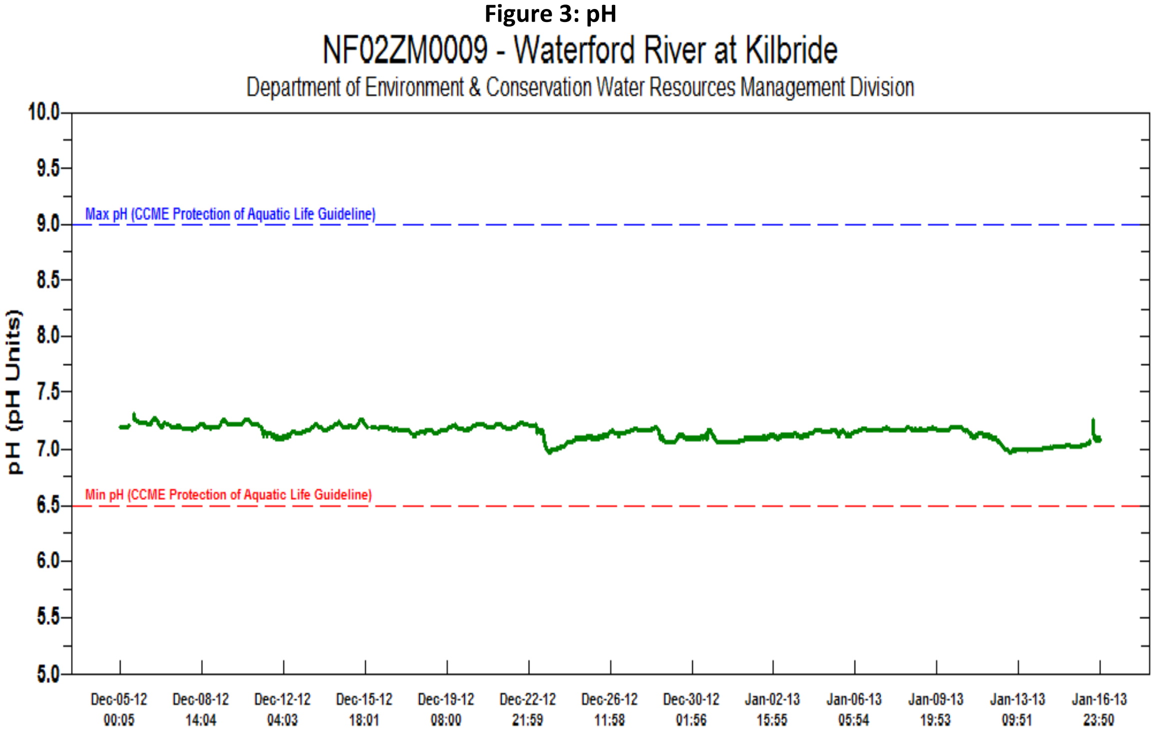
- **Dissolved Oxygen (DO)** values were within the range of 12.04 and 14.67 mg/L during this deployment, showing an increasing trend in response to the decreasing water temperatures. The solubility of oxygen is greater in colder water than in warmer water, thus as water temperatures decrease DO levels 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



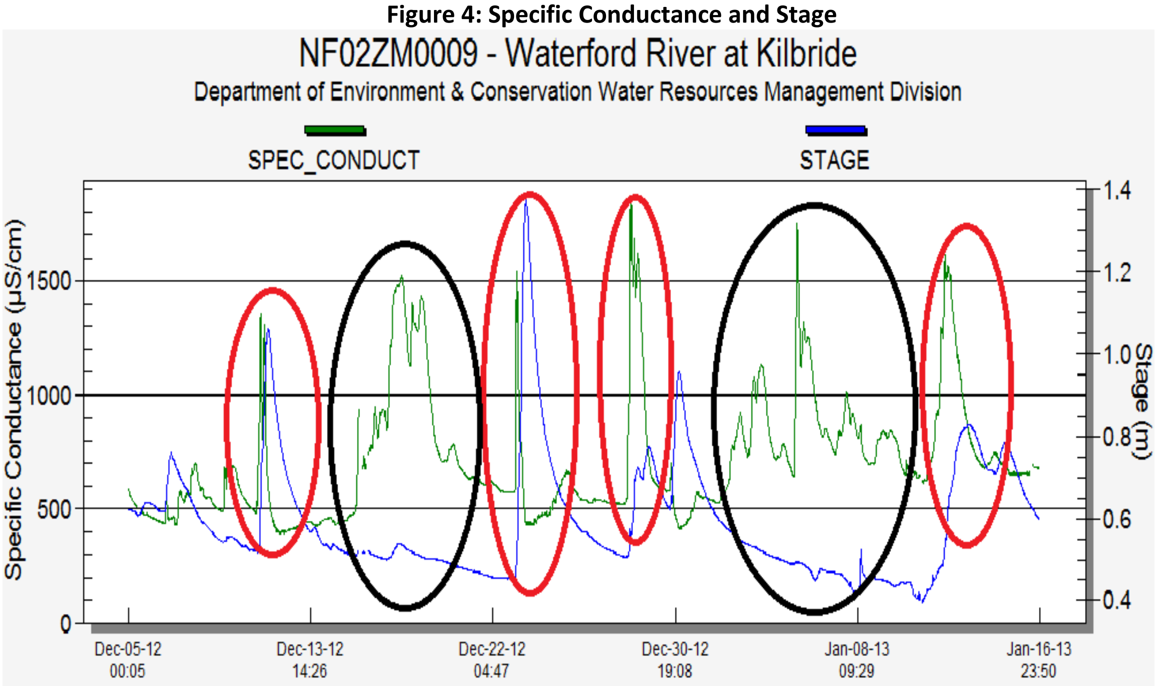
▪ **pH** values during this deployment period were fairly stable, showing mostly diurnal variation. pH values are typically lower (more acidic) at night, when photosynthesis is not occurring. During the daylight hours, the process of photosynthesis removes carbon dioxide, which readily forms carbonic acid in water, resulting in an increase in pH. pH values ranged from 6.97 to 7.31 during this deployment.

Figure 3: pH



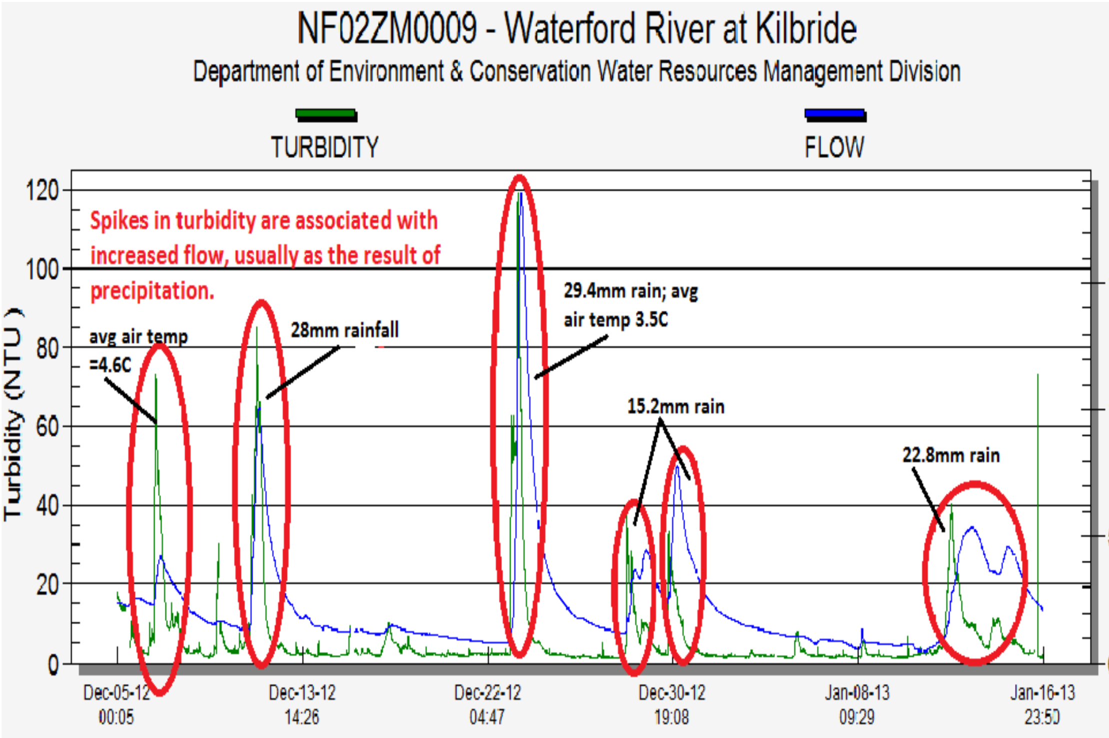
- **Specific conductivity (SpC)** values were within the expected range for an urban river at this time of year, ranging between 390 and 1850µS/cm, with a mean of 717.8µS/cm. Precipitation during the winter months usually results in an increase in specific conductivity when surface run-off, containing significant amounts of road salt, is washed into surface water bodies. This relationship is demonstrated in **Figure 4**, where specific conductivity is shown in green ink and stage height is shown in blue ink. The highest amounts of daily rainfall during this deployment period occurred on December 11, 23, 28 and January 12. These precipitation events correspond with spikes in stage and specific conductivity which also occurred on these dates, and are circled in red ink in **Figure 4**. Elevated levels of specific conductivity which occurred from December 15–19 and January 3–7 were not associated with increased stage height, but were probably still influenced by road salt entering the river upstream from the sampling station. These two periods of elevated conductivity are circled in black ink in **Figure 4**. Daily precipitation data for December 2012 and January 2013 are shown in **Appendix 1** at the end of this report.

Figure 4: Specific Conductance and Stage



- **Turbidity** generally increases as flow increases, due to higher levels of suspended particles and entrapped air in the water column. Increased flow can be caused by precipitation and/or a sudden rise in winter air temperatures that results in snowmelt. This relationship is seen below in **Figure 5**, where turbidity is shown in green ink and flow in blue ink. Periods of rainfall and days with air temperatures above zero correspond with peaks in turbidity and flow in Figure 5. Daily climate data is found in **Appendix 1** at the end of this report.

Figure 5: Turbidity and Flow



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

Daily Data Report for December 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
Sum				446.5*	0.0*	81.8*	8.7*	89.5*			
Avg	1.8*	-3.0*	-0.6*								
Xtrm	14.2*	-7.4*									91*

Summary, average and extreme values are based on the data above.

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‡	-2.6	-7.1	-4.9	22.9	0.0	0.0	0.0	0.0	11	M	65
02‡	-3.7	-7.4	-5.6	23.6	0.0	0.0	0.0	0.0	10	M	39
03‡	3.0	-3.8	-0.4	18.4	0.0	0.0	0.0	0.0	10	M	48
04‡	7.0	1.9	4.5	13.5	0.0	T	0.0	T	5	M	46
05‡	8.3	0.8	4.6	13.4	0.0	T	0.0	T	2	M	43
06‡	8.8	0.3	4.6	13.4	0.0	10.0	T	10.0		M	56
07‡	0.9	-1.6	-0.4	18.4	0.0	0.0	2.2	2.2	1	M	72
08‡	1.8	-4.0	-1.1	19.1	0.0	0.0	0.0	0.0	1	M	54
09‡	M	-4.8E	M	M	M	M		M	1	M	M
10‡	1.0	-2.1	-0.6	18.6	0.0	0.2	2.2	2.4	2	M	89
11‡	14.2	-0.2	7.0	11.0	0.0	28.0	0.0	28.0		M	91
12‡	1.2	-2.7	-0.8	18.8	0.0	0.0	0.0	0.0		M	78
13‡	0.0	-4.2	-2.1	20.1	0.0	0.0	0.0	0.0		M	72
14‡	-1.4	-5.9	-3.7	21.7	0.0	0.0	0.3	0.3		M	70
15											
16											

Daily Data Report for December 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
17‡	1.0	-0.7	0.2	17.8	0.0	0.0	2.0	1.8	22	M	70
18‡	-0.7	-2.9	-1.8	19.8	0.0	0.0	T	T	19	M	43
19‡	0.0	-2.6	-1.3	19.3	0.0	0.0	T	T	18	M	57
20‡	-0.8	-2.7	-1.8	19.8	0.0	0.0	0.2	0.2	18	M	61
21‡	-2.6	-5.8	-4.2	22.2	0.0	0.0	T	T	16	M	39
22‡	-0.7E	-5.8E	-3.3E	21.3E		M	M	0.0	15	M	M
23‡	6.5	0.4	3.5	14.5	0.0	29.4	0.2	29.4	10	M	85
24											
25‡	-0.4	-2.9	-1.7	19.7	0.0	0.0	T	T	2	M	82
26‡	0.2	-4.3	-2.1	20.1	0.0	0.0	T	T	2	M	63
27‡	-2.9	-4.1	-3.5	21.5	0.0	0.0	T	T	2	M	41
28‡	3.9	-3.1	0.4	17.6	0.0	14.2	1.6	15.2	1	M	74
29											
30											
31											

Daily Data Report for January 2013

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				281.9*	0.0*	25.2*	9.6*	30.4*			
Avg	-0.3*	-7.0*	-3.7*								
Xtrm	6.4*	-11.9*									78*

Summary, average and extreme values are based on the data above.

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											
02‡	-2.3	-6.5	-4.4	22.4	0.0	0.2	5.6	3.0	1	M	44
03‡	-1.9	-5.7	-3.8	21.8	0.0	0.0	0.6	T	5	M	48
04‡	-3.8	-7.6	-5.7	23.7	0.0	0.0	T	T	5	M	52
05‡	-0.6	-10.5	-5.6	23.6	0.0	0.0	2.6	2.0	6	M	61
06‡	-3.5	-11.8	-7.7	25.7	0.0	0.0	T	T	6	M	65
07‡	-3.4	-11.9	-7.7	25.7	0.0	0.0	0.2	T	6	M	76
08‡	0.0	-11.2	-5.6	23.6	0.0	0.0	0.6	0.4	6	M	78
09‡	-0.6	-11.0	-5.8	23.8	0.0	0.0	0.0	0.0	6	M	65
10											
11											
12‡	3.9	0.2	2.1	15.9	0.0	22.8	0.0	22.8	46	M	65
13‡	3.8	0.7	2.3	15.7	0.0	2.2	0.0	2.2	31	M	33
14‡	6.4	-1.1	2.7	15.3	0.0	T	0.0	T	25	M	69
15‡	3.6	-7.2	-1.8	19.8	0.0	T	0.0	T	18	M	50
16‡	-5.8	-7.9	-6.9	24.9	0.0	0.0	T	T	17	M	48

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