



Annual Weather Station Maintenance Report

2020



Government of Newfoundland & Labrador
Department of Environment, Climate Change, and
Municipalities
Water Resources Management Division

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Overview

The Department of Environment, Climate Change, and Municipalities, Water Resources Management Division (WRMD) operates and maintains a network of automated weather stations across the province. Reliable weather data is needed to support water resources management decisions and policy development. This network (see table below) is maintained by staff within the WRMD.

Automated Weather/Camera Stations in Operation (2020)

	Camera	Snow Monitoring	Meteorological
Pippy Park in St. John's			✓
Exploits River at Badger East of Stadium	✓		✓
Sandy Lake near Birchy Narrows (Camp 55)	✓	✓	✓
Humber River At Humber Village Bridge	✓		✓
Upper Humber River above Black Brook		✓	✓
Churchill River at End of Mud Lake Road	✓		✓
Muskrat Falls MET	✓		✓
Metchin River near TLH		✓	✓
TLH between Churchill Falls and Lab City		✓	✓
Mud Lake Road MET			✓
Exploits below Noel Paul's Brook MET			✓
Vale LH1 MET			✓
Waterford River at Kilbride	✓		
Exploits River at Badger Steps	✓		
Steady Brook 470 meters above Confluence to Humber River	✓		
Churchill River at end of Mud Lake Road - Level	✓		
Churchill River below Traverspine River	✓		
Goose River at Bridge	✓		
Mud Lake Outlet Tributary at Mud Lake	✓		
Churchill River above Grizzle Rapids	✓		
Exploits River at Bishop's Falls Trestle	✓		
Humber River at Nicholville at Bridge	✓		

Purpose

Annual maintenance and accuracy checks are necessary to ensure not only the longevity of the equipment, but more importantly, to ensure the accuracy and validity of the data that is being reported by the stations. This is necessary to ensure ongoing program reliability, effectiveness and delivery of high quality results for the existing automated weather station network.

Pippy Park Weather Station

Station Details:

- Station Identification: NLENCL0001
- Station Installed: August 2004
- Parameters measured every fifteen minutes and updated every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Pilot weather station test site, verified that this particular technology can be integrated without issues within our existing infrastructure. A microclimate exists at this site due to the height of surrounding trees and development in close proximity to the weather station.
- Date Visited: Throughout 2020
- Location: N 47° 35' 16.7" W 52° 44' 1.3"
- Elevation: 101.2 m

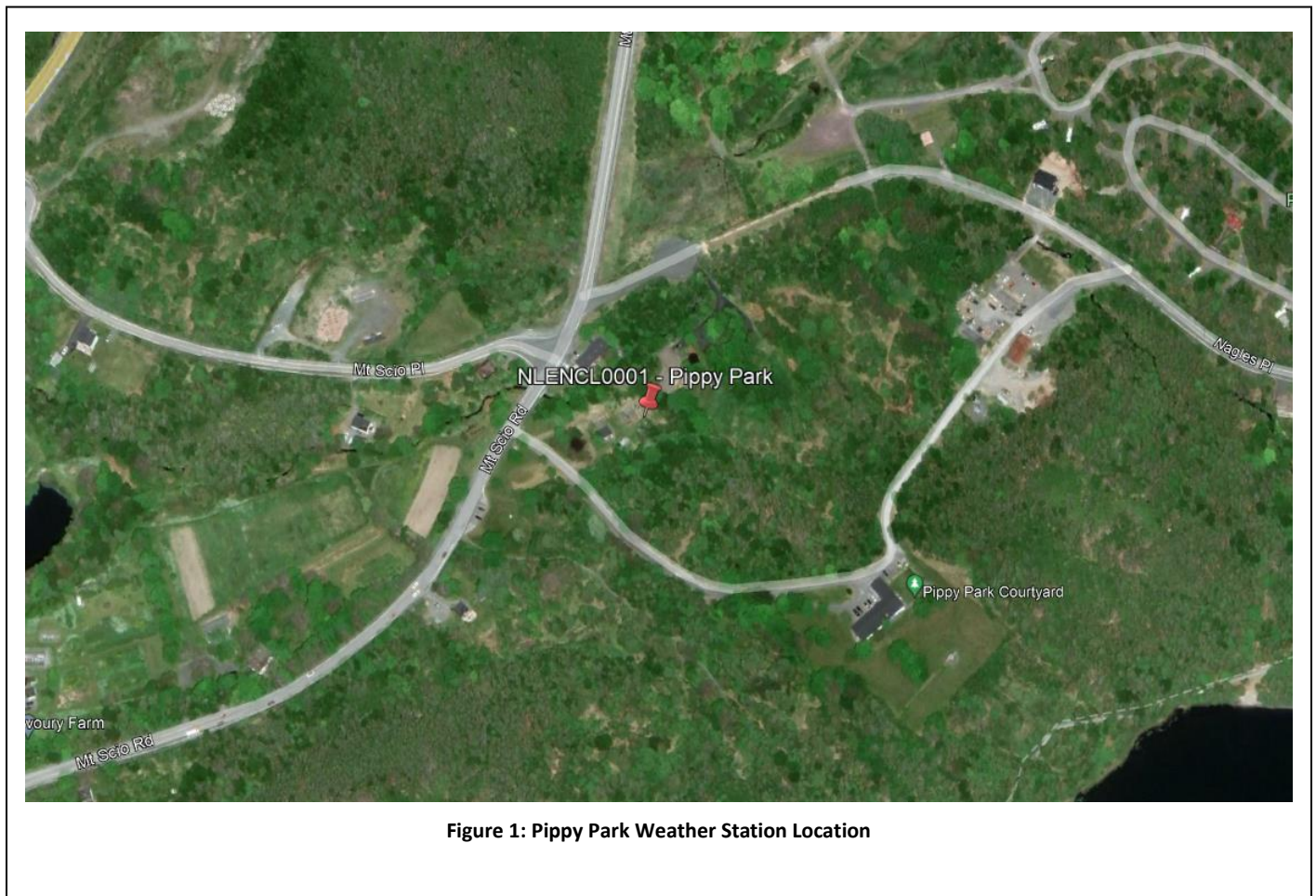


Figure 1: Pippy Park Weather Station Location

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Tasks accomplished:

- Installed brand new equipment onto FTS dog-style tower
- DataLogger:
 - Model: CR1000X
 - Newly installed
- Anemometer:
 - Model: 05103-10 RM Young
 - Serial: 57031
 - Newly installed
- Temperature/Relative Humidity:
 - Model: HygroVUE10
 - Serial: E1337
 - Newly installed
- Barometric Pressure:
 - Model: CS106
 - Serial: BP06403
 - Newly installed
- Precipitation:
 - TE525WS Texas Electronics
 - Newly installed
- Solar Radiation:
 - Model: SPLite 2
 - Serial: 194492
 - Newly installed

Follow-up tasks required:

- Troubleshoot modem and have station reporting automatically
- Regular scheduled maintenance
- Capture sensor siting measurements

Exploits River at Badger East of Stadium

Station Details:

- Station Identification: NLENCL0002
- Station Installed: September 2008
- Camera image taken and transmitted every hour during the day time
- Parameters measured every fifteen minutes and updated every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Weather information collected at this site feeds into a flood forecast modelling system for the community of Badger.
- Date Visited: July 7th, 2020
- Location: N 48° 58' 29.83" W 56° 2' 4.43"
- Elevation: 88.1 m



Figure 2: Exploits River at Badger Weather Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Serial: 13443
 - Replaced desiccant
- Camera:
 - Model: CC640
 - Cleaned enclosure and lens, replaced desiccant
 - Cleared vegetation obstructing camera view of river
- Anemometer:
 - Model: RM Young 05103-10-L
 - Serial: 58072
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: HMP45C
 - Serial: C3046
 - Sensor chip was in good working order – no need to be replaced
 - Chip was calibrated using Vaisala relative humidity calibration salts
- Snow Depth Sensor:
 - Model: SR50A Sonic Ranger
 - Serial: 31665
 - Checked transducer for pitting and replaced with less robust model
- Barometric Pressure:
 - Model: Young 61205V
 - Serial: BP05005
 - Model 61205V barometer requires no regular maintenance
- Precipitation
 - Model: Texas Electronics TE525WS
 - Serial: 44701-1007
 - Cleared funnel and bucket portion of the unit of debris
 - Removed snowfall adapter
- Solar Radiation
 - Model: Kipp & Zonen SP LITE Pyranometer
 - Serial: 080135
 - Cleaned lens
- Compound
 - Took sensor siting measurements for summer/fall students projects

Follow-up tasks required:

- Regular scheduled maintenance
- Replace platform for tipping bucket with concrete anchor (Chris Gilliam)
- Check battery voltage over the course of the year and see if it needs replacing
- New camera to be installed with new mount that allows staff to work on camera from ground level and avoid ladder work in close vicinity to overhead power lines. Approximately 25 m of cable and electrical conduit required to connect new camera to datalogger.
- Retake some sensor siting measurements.

Humber River at Humber Village Bridge

Station Details:

- Station Identification: NLENCL0003
- Station Installed: September 2009
- Image taken hourly and transmitted three times daily
- Parameters measured every hour and downloaded three times daily*:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Weather information collected at this site is used for flood forecast monitoring of communities along the Humber River.
- Date Visited: July 21st-22nd, 2020
- Location: N 48° 58' 58.21" W 57° 45' 38.04"
- Elevation: 7.6 m

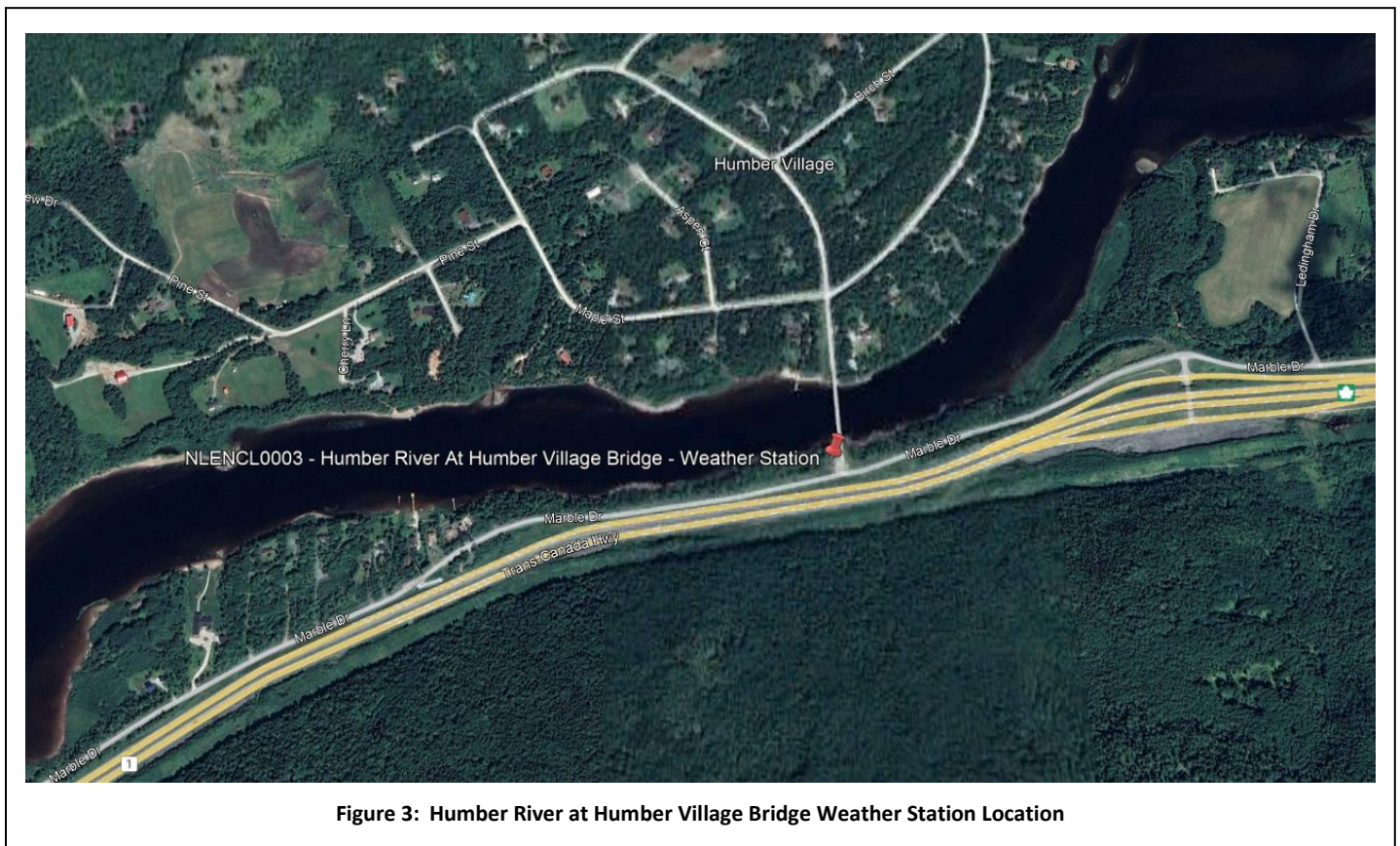


Figure 3: Humber River at Humber Village Bridge Weather Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Serial: 22355
 - Replaced desiccant
- Camera:
 - Model: CC640
 - Serial: 01511
 - Cleaned enclosure window and lens, replaced desiccant
- Anemometer:
 - Model: RM Young 05103-10
 - Serial: 130198
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: HMP45C
 - Serial: C1407
 - Calibrated Temperature/Relative Humidity element using Vaisala calibration salts
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: C13213
 - Replaced SR50 transducer due to pitting and peeling
- Barometric Pressure:
 - Model: 61205V
 - Serial: BP05888
 - Model 61205V barometer requires no regular maintenance
- Precipitation
 - Model: TE525WS Texas Electronics
 - Serial: 49063-109
 - Cleared funnel and bucket portion of the unit of debris
 - Removed snowfall adapter
- Solar Radiation
 - Model: Kipp & Zonen SP LITE Pyranometer
 - Serial: 080395
 - Cleaned lens
- Compound
 - Took sensor siting measurements for summer/fall students projects

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Follow-up tasks required:

- Regular scheduled maintenance
- Regular checks of battery level to determine if batteries may need to be changed on next annual maintenance trip
- Retake some sensor siting measurements.

Churchill River at End of Mud Lake Road (retiring)

Station Details:

- Station Identification: NLENCL0004
- Station Installed: July 2010
- Image taken and transmitted every hour during the day time
- Parameters measured every fifteen minutes and downloaded hourly:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Station provides essential information for flood forecasting, hydropower generation, ice monitoring, wildlife studies, and for the study of climate change adaptation. The station also captures images of an ice road between Happy Valley – Goose Bay and the Town of Mud Lake, and provides weather data for interpreting water quality data collected along the Churchill River.
- Date Visited: Oct. 6th 2020
- Location: N 53° 20' 15.95" W 60° 11' 21.44"
- Elevation: 1.2 m

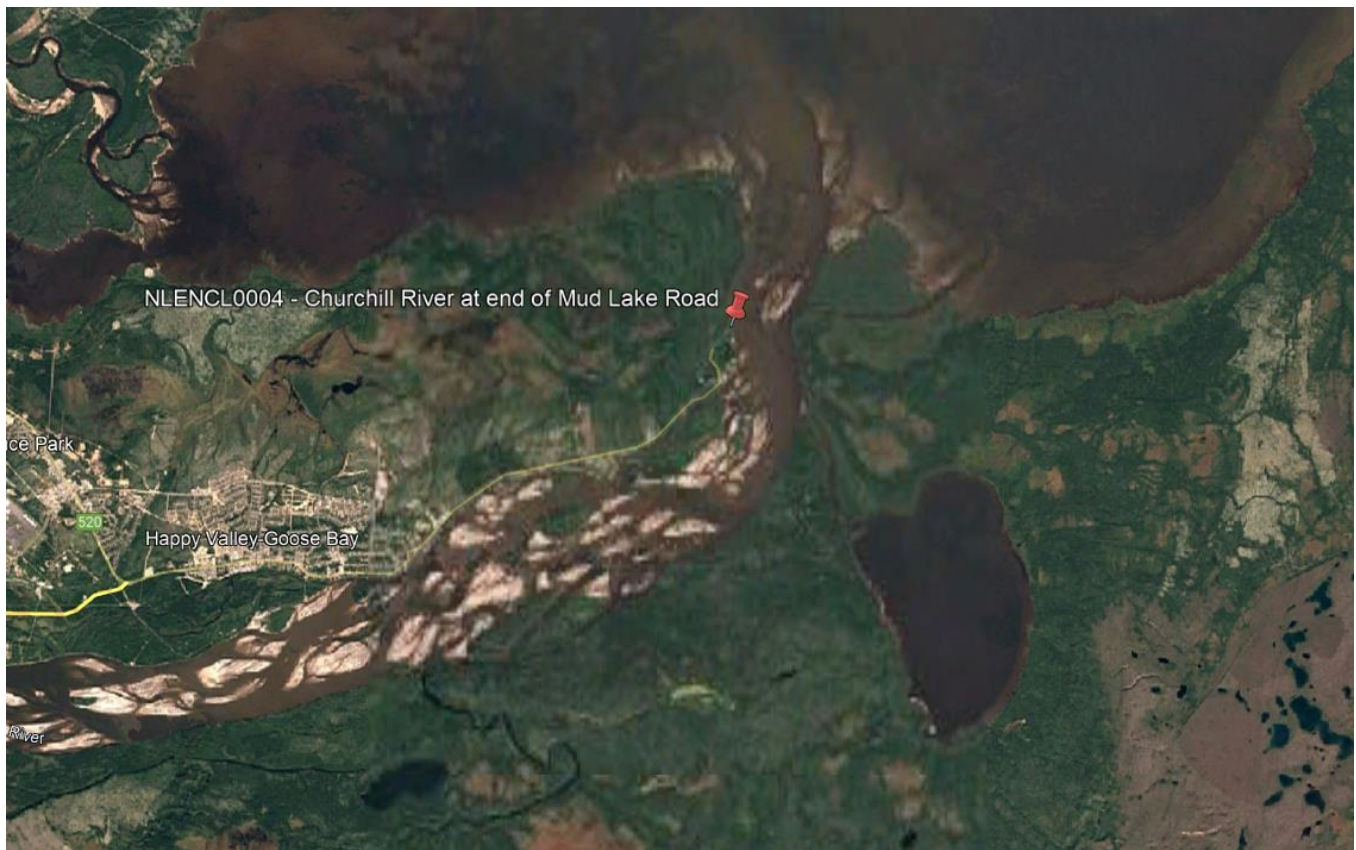


Figure 4: Churchill River at end of Mud Lake Road Weather Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Serial: 29931
- Camera:
 - Model: CC640
 - Serial: AAW-TZ49
- Anemometer:
 - Model: 05103AP-10-L RM Young Alpine Version
 - Serial: 127033
- Temperature/Relative Humidity:
 - Model: CS215
 - Serial: E17154
 - Removed secondary temperature sensor to install on new Mud Lake MET station
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: 3000
- Barometric Pressure:
 - Model: 61302V
 - Serial: BPA1406
 - The 61302V is not field serviceable nor can it be field calibrated
- Precipitation
 - Model: Texas Electronics TE-525WS
 - Serial: 43229-210
- Solar Radiation
 - Model: Kipp & Zonen SP LITE Pyranometer
 - Serial: 091170
- Soil Moisture
 - Model: Hydra-Probe II
 - Serial: 253660
 - Removed soil moisture sensor to install on new Mud Lake MET station

Follow-up tasks required:

- Monitor site degradation due to erosion caused by nearby ocean and river processes.

Sandy Lake near Birchy Narrows (Camp 55)

Station Details:

- Station Identification: NLENCL0005
- Station Installed: November 2010
- Image taken and transmitted every hour during the day time
- Parameters measured every fifteen minutes and updated hourly:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Snow Water Equivalent (TI)
 - Snow Water Equivalent (K)
 - Soil Moisture
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Weather data collected at this site is used in flood forecasting operations for communities along the Humber River that are at risk of flooding during springtime snowmelt.
- Date Visited: July 21st-22nd 2020
- Location: N 49° 16' 28.30" W 56° 51' 5.80"
- Elevation: 119.8 m

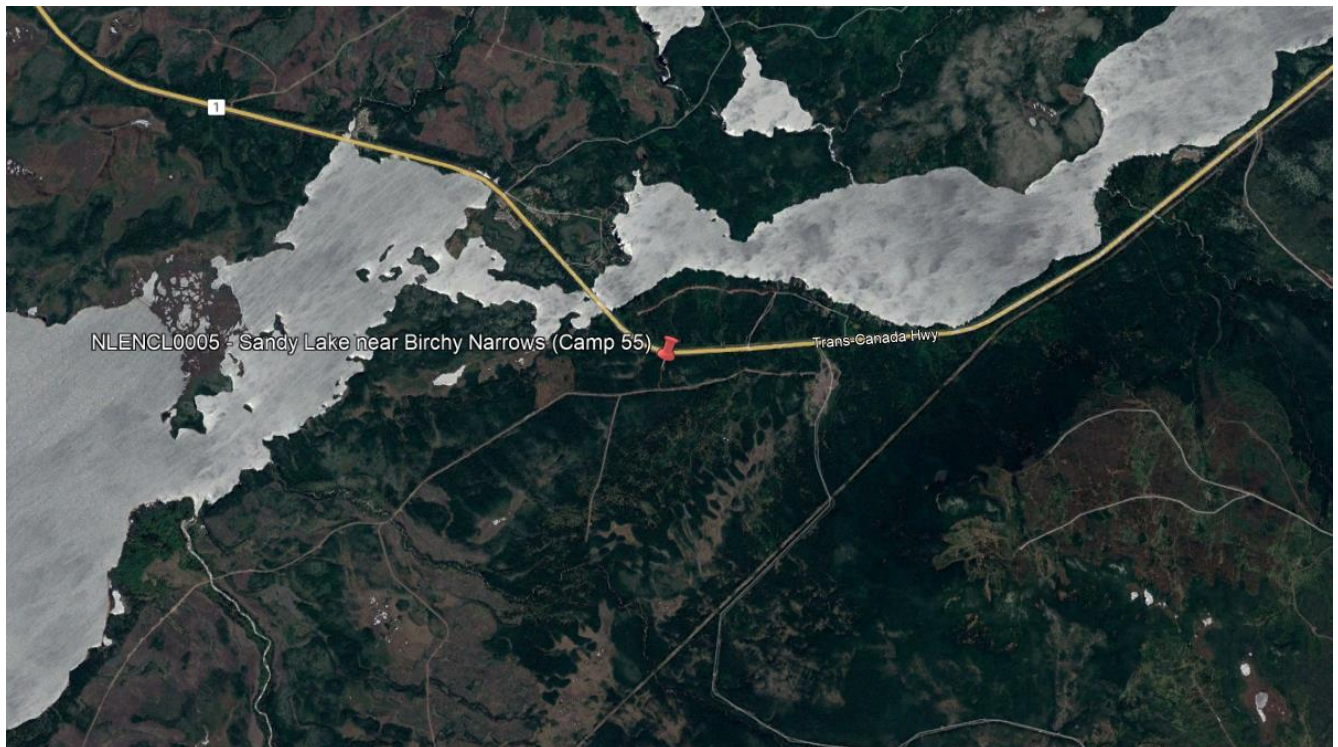


Figure 5: Sandy Lake near Birchy Narrows (Camp 55) Snow Monitoring Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Serial: 24833
 - Replaced desiccant
- Camera:
 - Model: CC640
 - Serial: 01654
 - Cleaned enclosure window and lens, replaced desiccant
- Anemometer:
 - Model: 05103AP-10-L RM Young Wind Monitor Alpine Version
 - Serial: 83400
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: HC-S3
 - Serial: 61468628
 - Swapped sensor cap/element for an already calibrated one from CampbellSci
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: 2999
 - Replaced SR50 transducer due to pitting and peeling
- Barometric Pressure:
 - Model: Young 61302V
 - Serial: BPA1405
 - The 61302V is not field serviceable nor can it be field calibrated
- Precipitation
 - Model: Texas Electronics TE525WS
 - Serial: 42377-1009
 - Cleared funnel and bucket portion of the unit of debris
 - Removed snowfall adapter
- Solar Radiation
 - Model: Kipp & Zonen SP LITE Pyranometer
 - Serial: 091169
 - Cleaned lens
- Snow Water Equivalent:
 - Model: CS725
 - The CS725 was field calibrated on this trip during July 21st to the 22nd. Hourly K counts were 9525 (Good - Should maintain specified operating characteristics) and hourly Tl counts were 1865 (Good - Should maintain specified operating characteristics)
- Compound
 - Took sensor siting measurements for summer/fall students projects

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Follow-up tasks required:

- Regular scheduled maintenance
- Update station programming to reflect Soil Moisture correctly
- Replace HC-S3 relative humidity/temperature sensor with HygroVUE10 as HC-S3 replacement caps/elements can no longer be purchased. Reflect change in programming
- Tree removal operations needed to open tree canopy to the south for better solar power exposure.
- Retake some sensor siting measurements

Muskrat Falls MET

Station Details:

- Station Identification: NLENCL0006
- Station Installed: July 2014
- Parameters measured every fifteen minutes and downloaded hourly:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Wind Chill
 - Humidex
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Provides essential meteorological information for construction site operations, water level analysis, flood forecasting, hydropower generation, wildlife studies, and climate change adaptation in the province. Provides weather data for accurate interpretation of water quality data and related events along the Churchill River
- Date Visited: Sept. 22nd 2020 and Nov. 3rd 2020
- Location: N 53° 14' 43.64" W 60° 46' 42.15"
- Elevation: 11.9 m

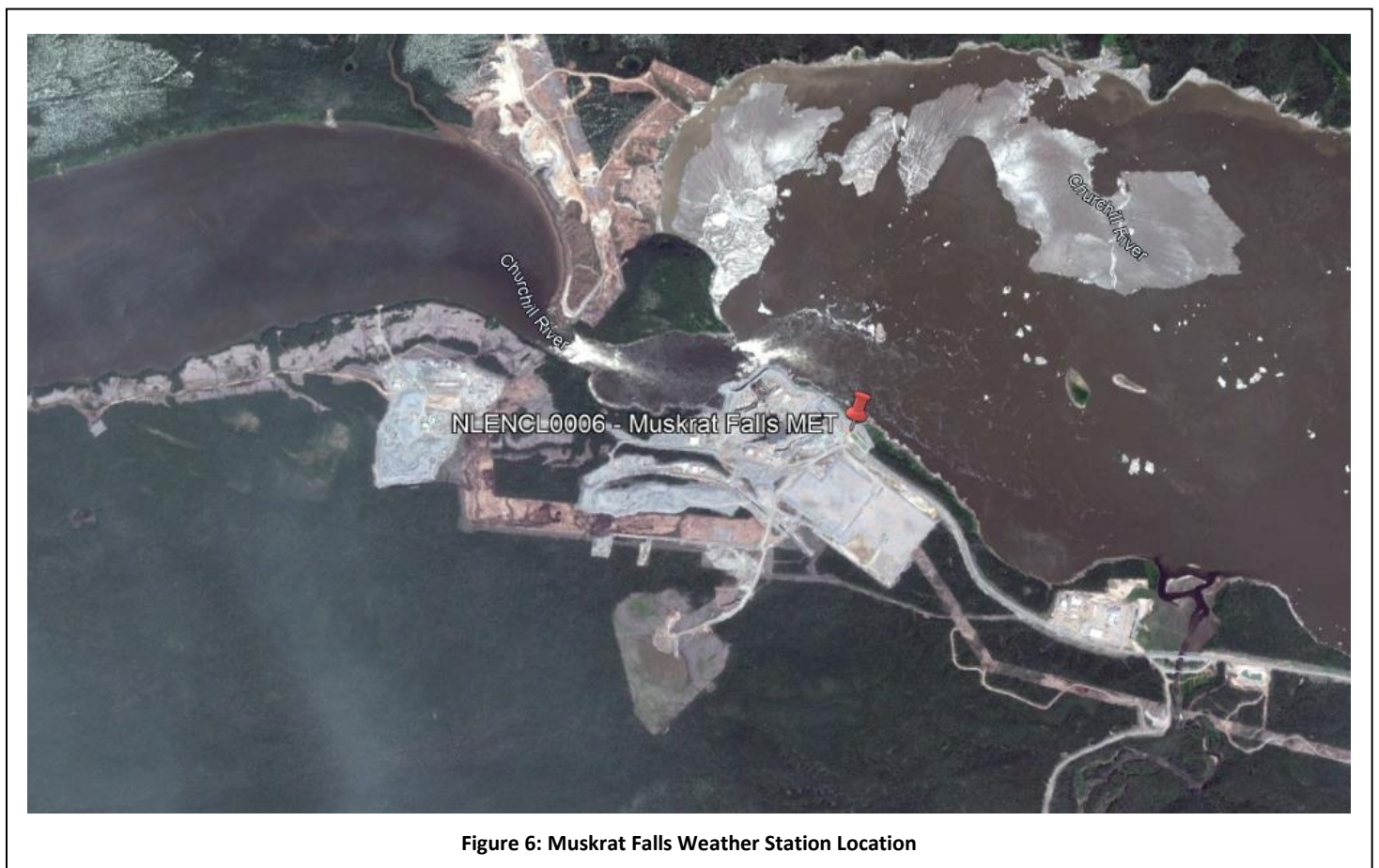


Figure 6: Muskrat Falls Weather Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Serial: 56808
 - Replaced desiccant and indicator card
 - Updated datalogger programming to fix minor errors
- Cameras:
 - Model: CC5MPX
 - Serial: 01317, 01314
 - Cleaned both camera lens
- Anemometer:
 - Model: 05130AP-10-L RM Young Alpine
 - Serial: 98398
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: HC2-S3-L
 - Serial: 61081111
 - Replaced sensor element/cap with new precalibrated one
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: 6755
 - Replaced entire sensor and cable to troubleshoot erroneous values
- Barometric Pressure:
 - Model: CS106
 - Serial: J1660083
 - This sensor is not field serviceable nor can it be field calibrated
- Precipitation
 - Model: Texas Electronics TE-525WS
 - Serial: 53322-1012
 - Cleared funnel and bucket portion of the unit of debris
 - Installed snowfall adapter
- Solar Radiation
 - Model: Kipp & Zonen SP LITE2 Pyranometer
 - Serial: 136646
 - Cleaned lens
- Compound:
 - Took sensor siting measurements for summer/fall students projects

Follow-up tasks required:

- Regular scheduled maintenance
- Replace batteries
- Retake some sensor siting measurements

Upper Humber River above Black Brook

Station Details:

- Station Identification: NLENCL0007
- Station Installed: September 30th 2015
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Snow Water Equivalent (TI)
 - Snow Water Equivalent (K)
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Weather data collected at this site is used in flood forecasting operations for communities along the Humber River that are at risk of flooding during springtime snowmelt.
- Date Visited: July 22nd-23rd, 2020
- Location: N 49° 37' 6.24" W 57° 17' 41.20"
- Elevation: 302.4 m

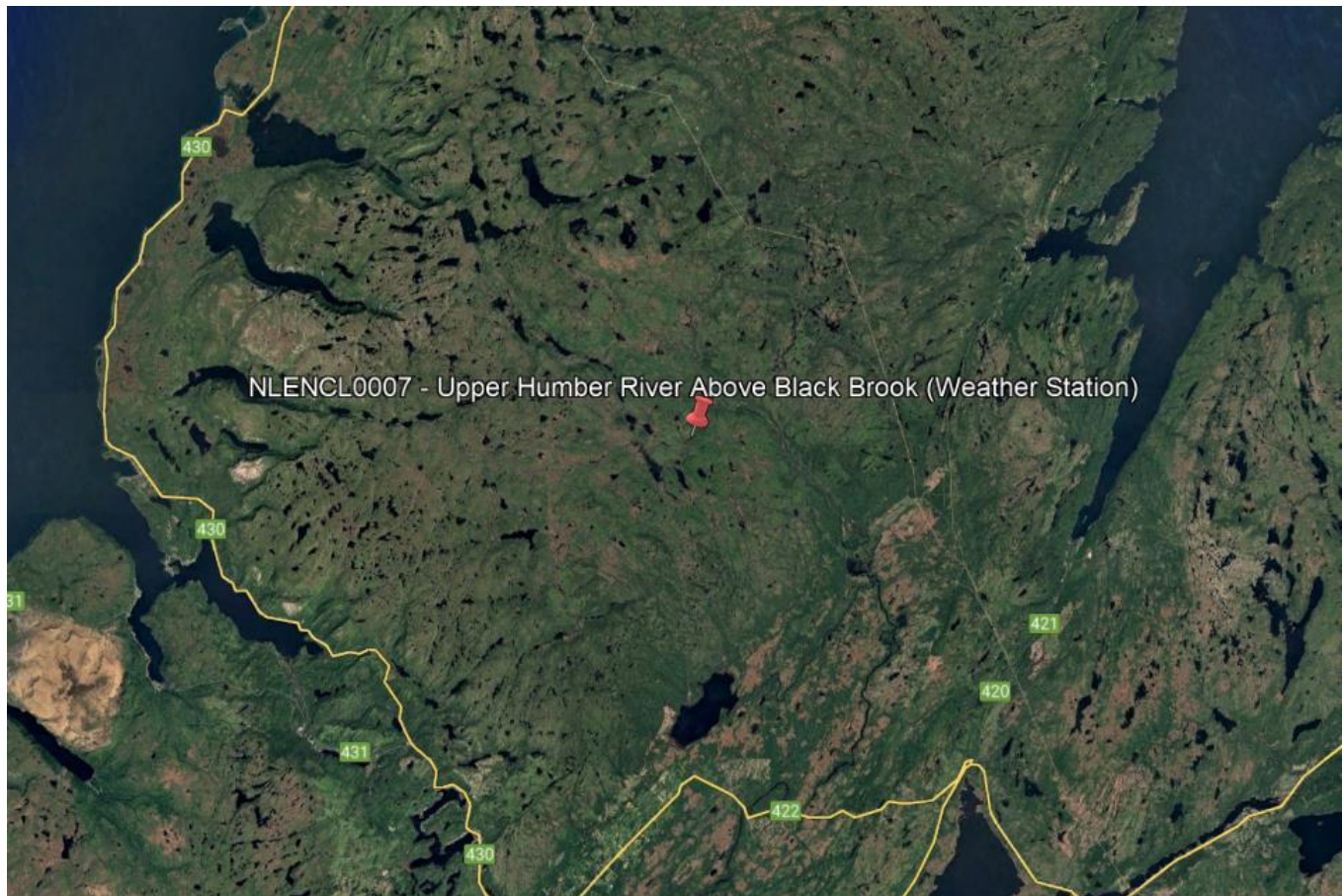


Figure 7: Upper Humber River above Black Brook Snow Monitoring Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Replaced desiccant
- Anemometer:
 - Model: 05103AP-10-L RM Young Wind Monitor Alpine Version
 - Serial: 98399
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: HC-S3
 - Serial: 6122441
 - Swapped sensor head for an already calibrated one from CampbellSci
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: 1670
 - Replaced SR50 transducer due to pitting and peeling
- Barometric Pressure:
 - Model: 61302V
 - Serial: BPA140
 - The 61302V is not field serviceable nor can it be field calibrated
- Precipitation
 - Model: Texas Electronics TE525WS
 - Serial: 432-30-210
 - Cleared funnel and bucket portion of the unit of debris
- Solar Radiation
 - Model: Kipp & Zonen SP LITE Pyranometer
 - Serial: 091168
 - Cleaned lens
- Snow Water Equivalent:
 - Model: CS725
 - Performed 24hr sensor calibration. Hourly K counts were 8182 (Good - Should maintain specified operating characteristics) and hourly TI counts were 886 (Unusable - May experience large errors for higher SWE values)
 - Changed datalogger programming to create a data table that outputs information about the CS725 for troubleshooting purposes
- Compound
 - Took sensor siting measurements for summer/fall students projects

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Follow-up tasks required:

- Regular scheduled maintenance
- Follow up with CS725 troubleshooting
- CS725 Sensor will be sent back to CampbellSci for repairs/calibration after the annual snow melt
- Update station programming to reflect Soil Moisture correctly
- Replace HC-S3 relative humidity/temperature sensor with HygroVUE10 as HC-S3 replacement caps/elements can no longer be purchased. Reflect change in programming.
- Retake some sensor siting measurements

TLH between Churchill Falls and Lab City

Station Details:

- Station Identification: NLENCL0008
- Station Installed: October 2017
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Snow Water Equivalent (TI)
 - Snow Water Equivalent (K)
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: This station provides information for hydropower generation operations and flood forecast monitoring for the Churchill River
- Date Visited: Sept. 23rd 2020, Oct. 7th 2020, and Nov. 4th 2020
- Location: N 53° 21' 35.23" W 65° 33' 41.27"
- Elevation: 542.8 m

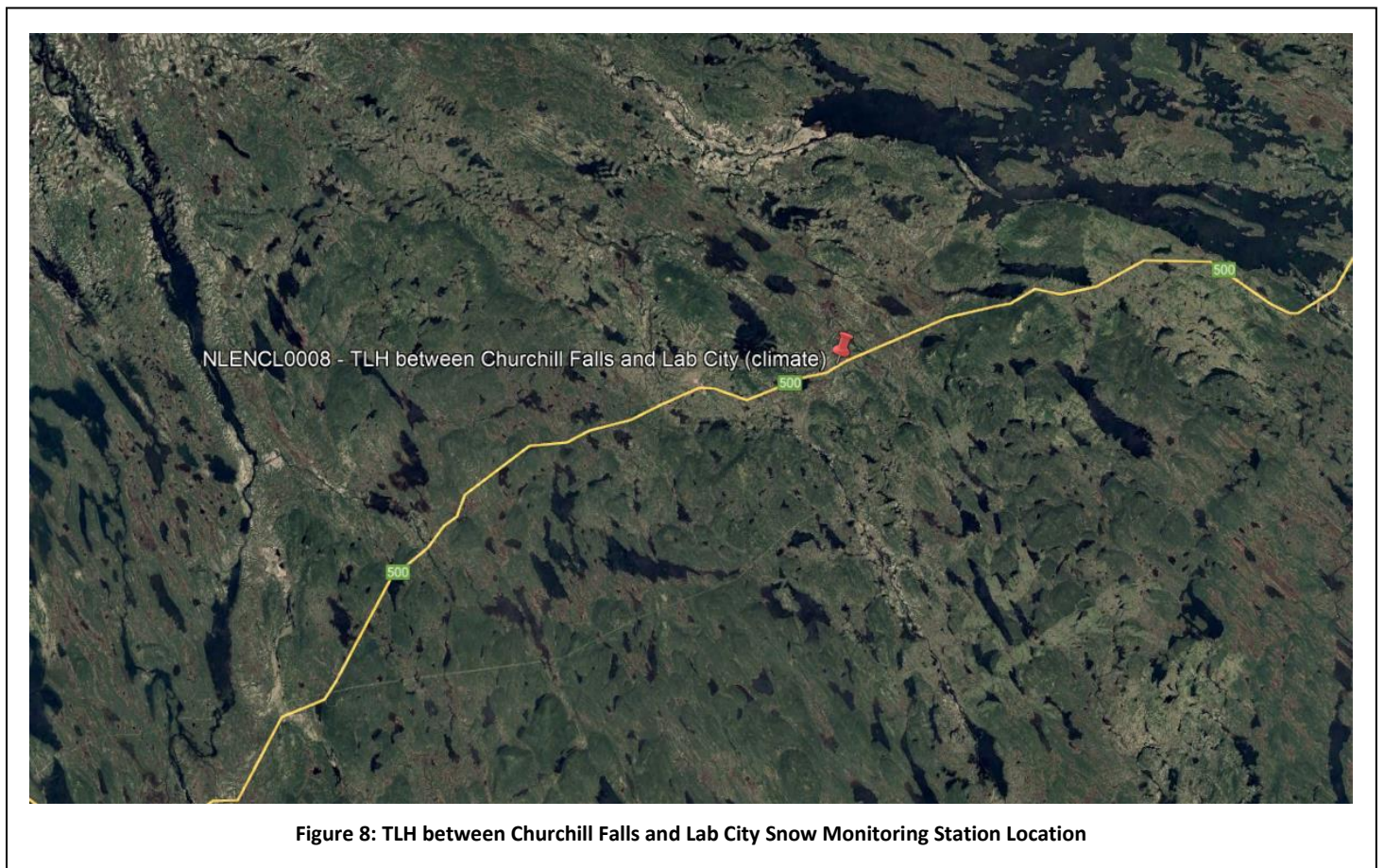


Figure 8: TLH between Churchill Falls and Lab City Snow Monitoring Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Replaced desiccant and indicator card
- Anemometer
 - Model: 05103AP-10-L RM Young Alpine Version
 - Serial: 113751
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: CS215-L
 - Serial: E18210
 - Replaced old CS215 chip with new already calibrated chip
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: 9170
 - Replaced transducer due to pitting and peeling
- Barometric Pressure:
 - Model: CS106
 - Serial: N2250425
 - This sensor is not field serviceable nor can it be field calibrated.
- Precipitation:
 - Model: TB4-L
 - Cleared funnel and bucket portion of the unit of debris
- Solar Radiation:
 - Model: Kipp & Zonen SP LITE2 Pyranometer
 - Cleaned lens
- Communication:
 - Model: TX321-G GOES Transmitter
 - Replaced old TX321-G
 - Aimed EON CS2 GOES Antenna toward nearest satellite
- Compound:
 - Took sensor siting measurements for summer/fall students projects
 - Changed batteries
 - Fastened grounding nut to foot of tower

Follow-up tasks required:

- Resolve wind gust reporting issue
- Regular scheduled maintenance
- Still experiencing infrequent drop outs – troubleshoot
- Retake some sensor siting measurements
- Fix solar panels to face optimal direction

Metchin River near TLH

Station Details:

- Station Identification: NLENCL0009
- Station Installed: October 2017
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Snow Water Equivalent (TI)
 - Snow Water Equivalent (K)
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: This station provides information for hydropower generation operations and flood forecast monitoring for the Lower Churchill River
- Date Visited: Sept. 24th 2020
- Location: N 53° 26' 10.12" W 63° 14' 1.38"
- Elevation: 329.8 m

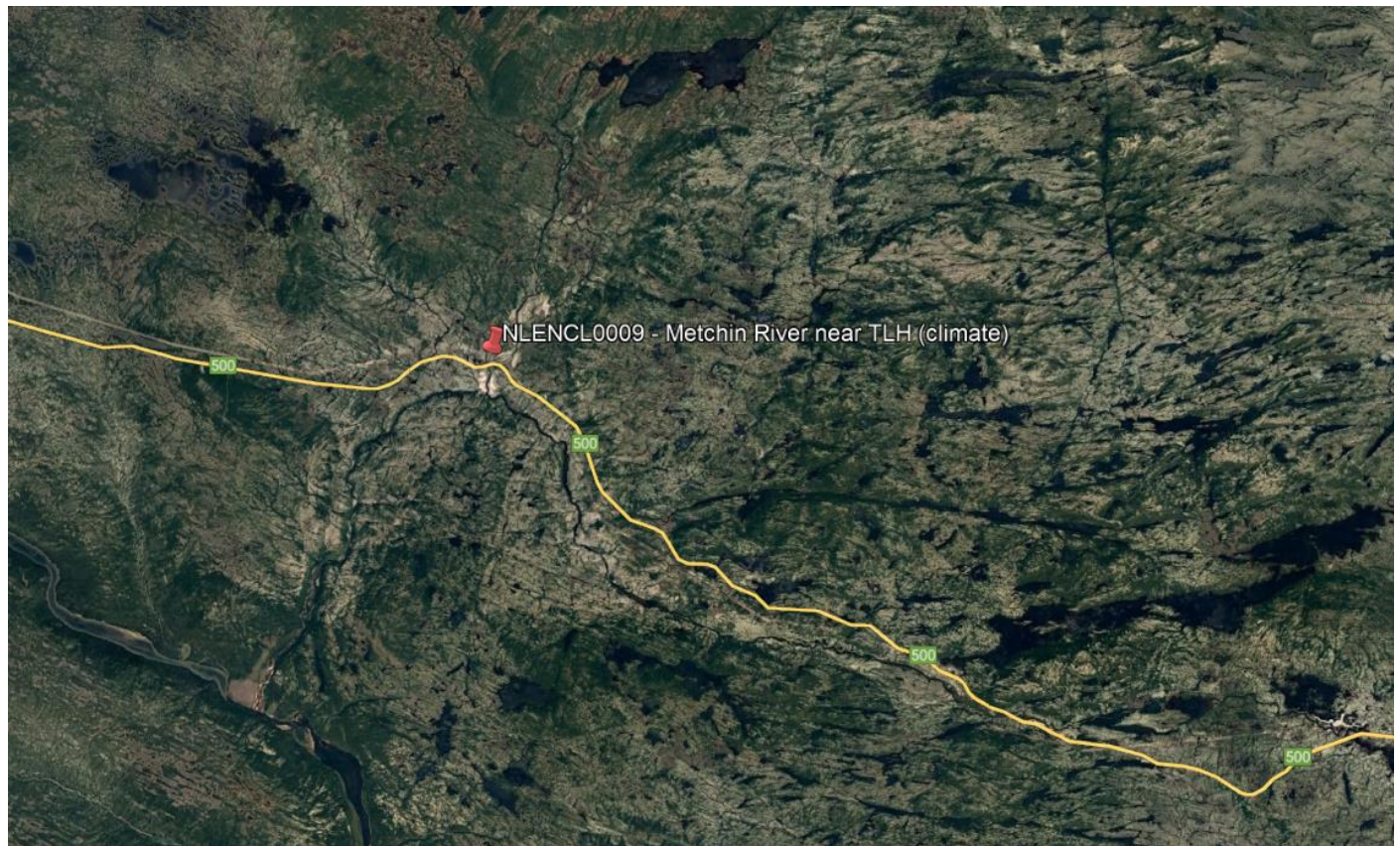


Figure 9: Metchin River near TLH Snow Monitoring Station Location

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Replaced desiccant and indicator card
- Anemometer
 - Model: 05103AP-10-L RM Young Alpine Version
 - Serial: 152871
 - Replaced speed bearings
- Temperature/Relative Humidity:
 - Model: CS215-L
 - Serial: E18487
 - Replaced old CS215 chip with new already calibrated chip
- Snow Depth Sensor:
 - Model: Sonic Ranger SR50A
 - Serial: 9171
 - Replaced transducer due to pitting and peeling
- Barometric Pressure:
 - Model: CS106
 - Serial: N2250424
 - This sensor is not field serviceable nor can it be field calibrated.
- Precipitation:
 - Model: TB4-L
 - Cleared funnel and bucket portion of the unit of debris
- Solar Radiation:
 - Model: Kipp & Zonen SP LITE2 Pyranometer
 - Serial: 173211
 - Cleaned lens
- Compound:
 - Took sensor siting measurements for summer/fall students projects

Follow-up tasks required:

- Resolve wind gust reporting issue
- Regular scheduled maintenance
- Change batteries
- Retake sensor siting measurements
- Fix solar panels to face optimal direction

Exploits below Noel Paul's Brook MET

Station Details:

- Station Identification: NLENCL0010
- Station Installed: November 2020
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: Nov. 23rd-26th 2020
- Location: N 48° 50' 40.8" W 56° 16' 9.9"
- Elevation: 125.6 m

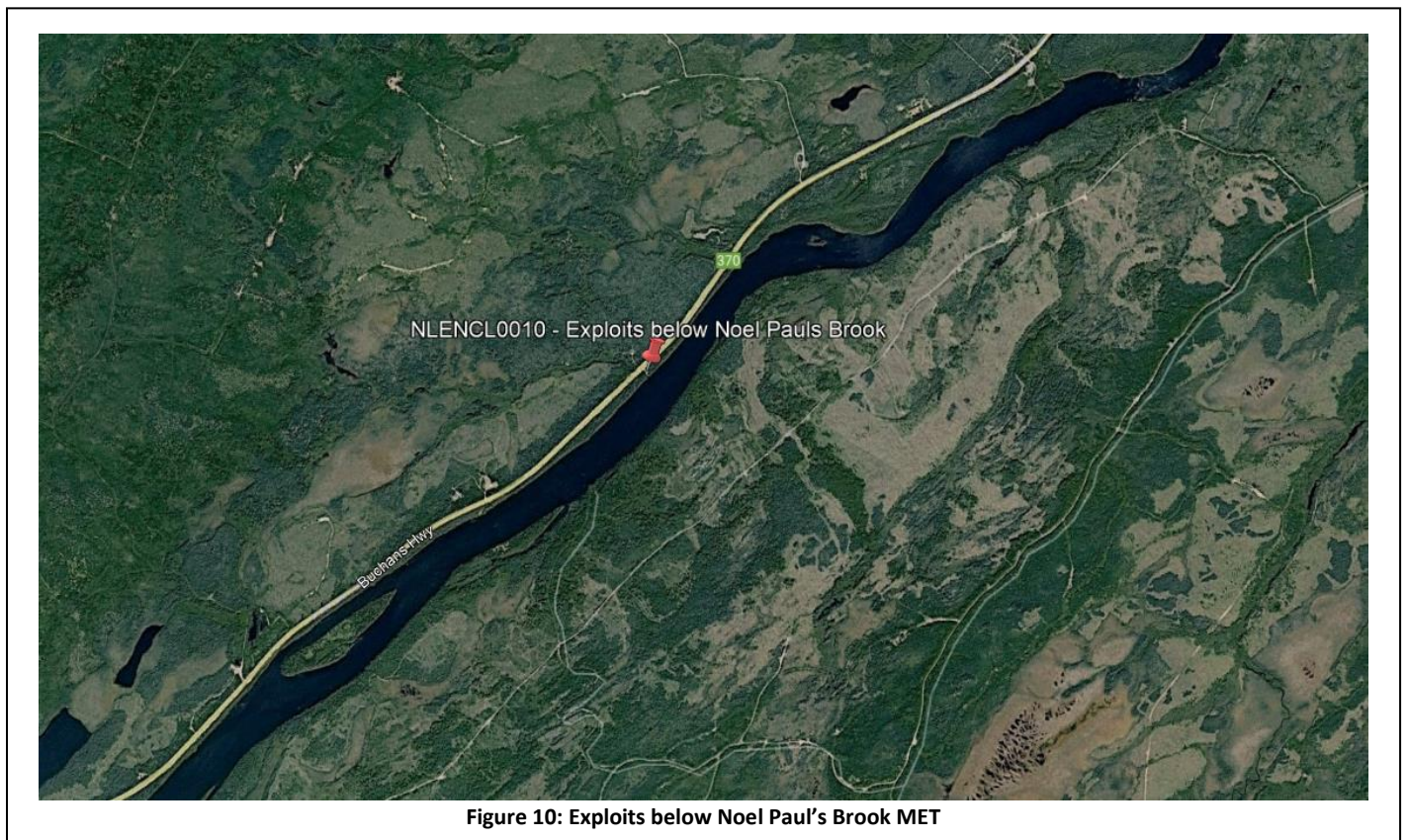


Figure 10: Exploits below Noel Paul's Brook MET

Tasks accomplished:

- Datalogger:
 - Model: CR1000X
 - Serial: 7468
- Snow Depth Sensor:
 - Model: SR50A-EE Sonic Ranger
 - Serial: 11430
- Precipitation:
 - Model: TR-525-M-10-CA Texas Electronics
 - Serial: 77405-818
- Temperature/Relative Humidity:
 - Model: CS215
 - Serial: E21317
- Anemometer:
 - Model: 05103AP-10-L RM Young Alpine Version
- Barometric Pressure:
 - Mode: CS106 Barometric Pressure Sensor
- Solar Radiation:
 - Model: SP Lite2 Pyranometer
- Communication:
 - Model: TX321-G GOES Transmitter
- Antenna:
 - Model: 420-70-DIS 402 MHz Yagi Directional Antenna
 - Serial: 17A092633
- Solar Panel:
 - Model: SLP050-12C1D2 – 50 Watt 12 Volt with Mount & Regulator
 - Serial: 81005012500081
- GPS Antenna:
 - Model: Trimble GPS Antenna P/N 57861-20
 - Serial: 3480213

Follow-up tasks required:

- Regular scheduled maintenance
- Fix Temp-RH mount (missing screw in clamp)
- Purchase and install all weather battery box, large enough to fit two batteries
- Install soil moisture probe as ground was too frozen to install in November
- Install alter shield around rain gauge tipping bucket (RGTB)
- Purchase and install smaller 8 inch diameter funnel for RGTB that would accommodate snowfall adaptor
- Purchase snowfall adaptor
- Purchase and install better RGTB mount
- Create site sketch based on sensor siting measurements
- Install horizontal to vertical pole mount for improved Yagi antenna transmission angle (i.e., 250° azimuth, 20° above horizon)
- Collect sensor siting measurements

Mud Lake Road MET

Station Details:

- Station Identification: NLENCL0011
- Station Installed: October 2020
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Soil Moisture
 - Wind Speed
 - Wind Direction
 - Snow Depth
 - Solar Radiation
 - Sunshine Hours
- Site Selection Rationale: NLENCL0004 required to relocate as the coastline is deteriorating. This is a relocated site with mostly new equipment. Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: Oct. 5th-8th 2020
- Location: N 53° 20' 6.9" W 60° 11' 23.5"
- Elevation: 0 m

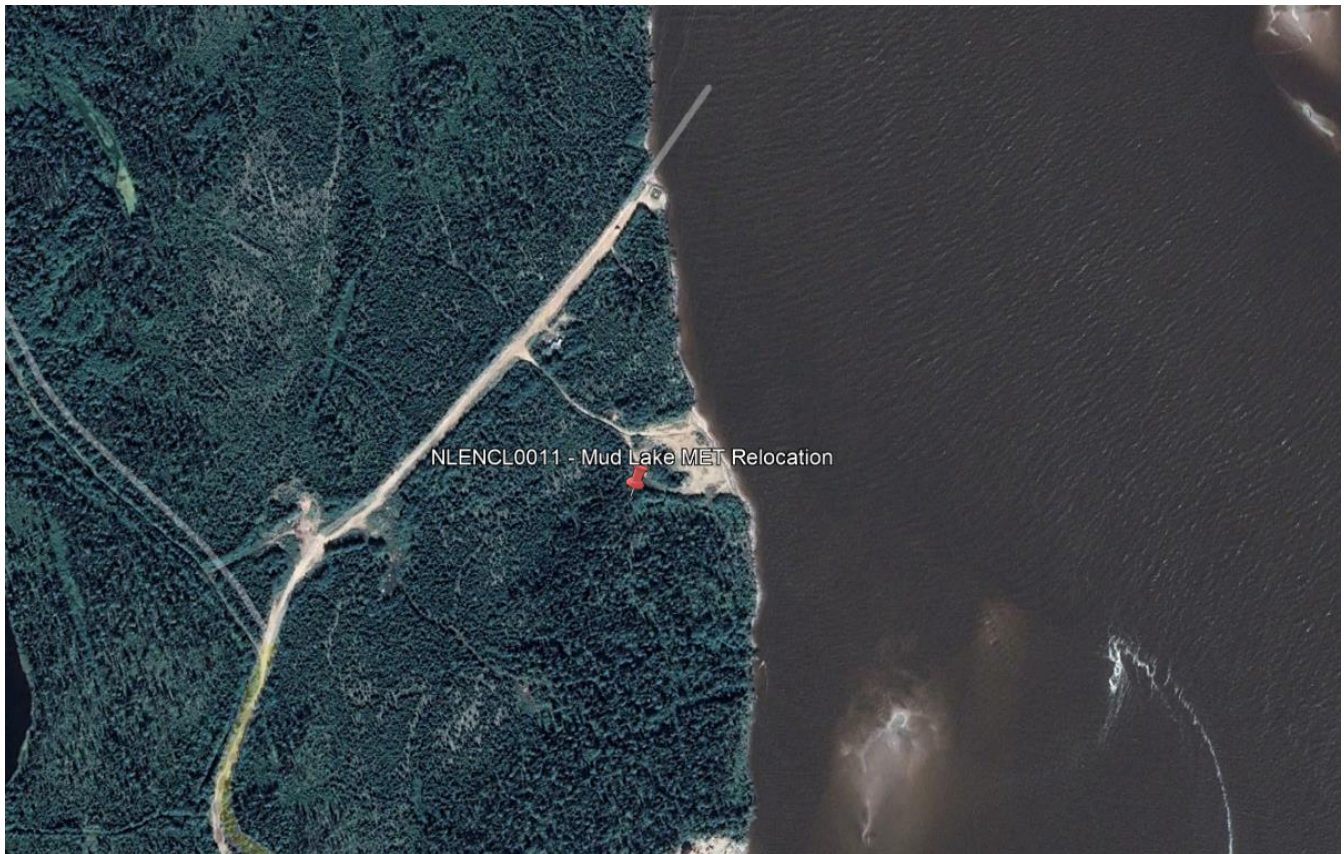


Figure 11: Mud Lake Road MET

Tasks accomplished:

- Datalogger:
 - Model: CR1000X
 - Serial: 19389
- Snow Depth Sensor:
 - Model: SR50A-EE Sonic Ranger
 - Serial: 12504
- Precipitation:
 - Model: TE525WS Texas Electronics
- Temperature/Relative Humidity:
 - Model: HygroVUE10
 - Serial: E1342
- Anemometer:
 - Model: 05108-45-L40
 - Serial: 175874
- Barometric Pressure:
 - Mode: CS106 Barometric Pressure Sensor
 - Serial: J4430010
- Solar Radiation:
 - Model: SP Lite2 Pyranometer
 - Serial: 205096
- Soil Moisture:
 - Model: Stevens Hydra-Probe II
 - Serial: 253660
- Communication:
 - Model: Microhard 4GMini
- Antenna:
 - Model: C2444 9dB Yagi Antenna
- Solar Panel:
 - Model: SLP050-12C1D2 – 50 Watt 12 Volt with Mount & Regulator

Follow-up tasks required:

- Regular scheduled maintenance
- Keep an eye on battery, station is new but extreme cold of Labrador affects capacity
- Collect sensor siting measurements

Vale LH1 MET

Station Details:

- Station Identification: NLENCL0012
- Station Installed: November 2020
- Parameters measured every fifteen minutes and transmitted every hour:
 - Air Temperature
 - Relative Humidity
 - Atmospheric Pressure
 - Dew Point Temperature
 - Precipitation
 - Wind Speed
 - Wind Direction
- Site Selection Rationale: This station was installed in partnership with Vale Long Harbour. They required MET data from on site and we have the infrastructure in place already to host their data.
- Date Visited: Nov. 9th-10th 2020
- Location: N 47° 25' 27" W 53° 45' 57.7"
- Elevation: 163.1 m



Figure 12: Vale LH1 MET

Tasks accomplished:

- Datalogger:
 - Model: CR1000X
 - Serial: 15039
- Precipitation:
 - Model: 52202-L RM Young Heated Rain and Snow Gauge
- Temperature/Relative Humidity:
 - Model: HygroVUE10
- Anemometer:
 - Model: RMY86000 Ultrasonic Anemometer
- Barometric Pressure:
 - Mode: CS106 Barometric Pressure Sensor
 - Serial: S1050162
- Soil Moisture:
 - Model: Stevens Hydra-Probe II
 - Serial: 253660
- Communication:
 - Model: Microhard 4GMini
- Antenna:
 - Model: WIP antenna

Follow-up tasks required:

- Regular scheduled maintenance
- Keep an eye on wind speed measurements
- Collect sensor siting measurements
- Talk to Vale about purchasing wind alter shield for heated precipitation gauge
- Install alter shield
- Create site sketch based on sensor siting measurements

Waterford River at Kilbride

Station Details:

- Station Identification: NF02ZM0009
- Station Installed: July 21st 2015
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: Provides essential information for visual image of changing water levels in this urban stream.
- Date Visited: Oct. 20th 2020
- Location: N 47° 31' 44.44" W 52° 44' 41.04"
- Elevation: 32.9 m



Figure 13: Waterford River at Kilbride Camera Station Location

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR800
 - Replaced desiccant and indicator card
 - Power cycled station
- Camera:
 - Model: CC5MPX
 - Cleaned fish eye lens inside and out

Follow-up tasks required:

- Regular scheduled maintenance

Exploits River at Badger Steps

Station Details:

- Station Identification: NLENCM0001
- Station Installed: November 2009
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: Snow monitoring provides essential information for flood forecasting, hydropower generation and for climate change adaptation in the province. WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the community of Badger in the Exploits River Basin.
- Date Visited: July 7th, 2020 and Dec. 18th 2020
- Location: N 48°56'25.86" W 55°58'42.98"
- Elevation: 100.6 m

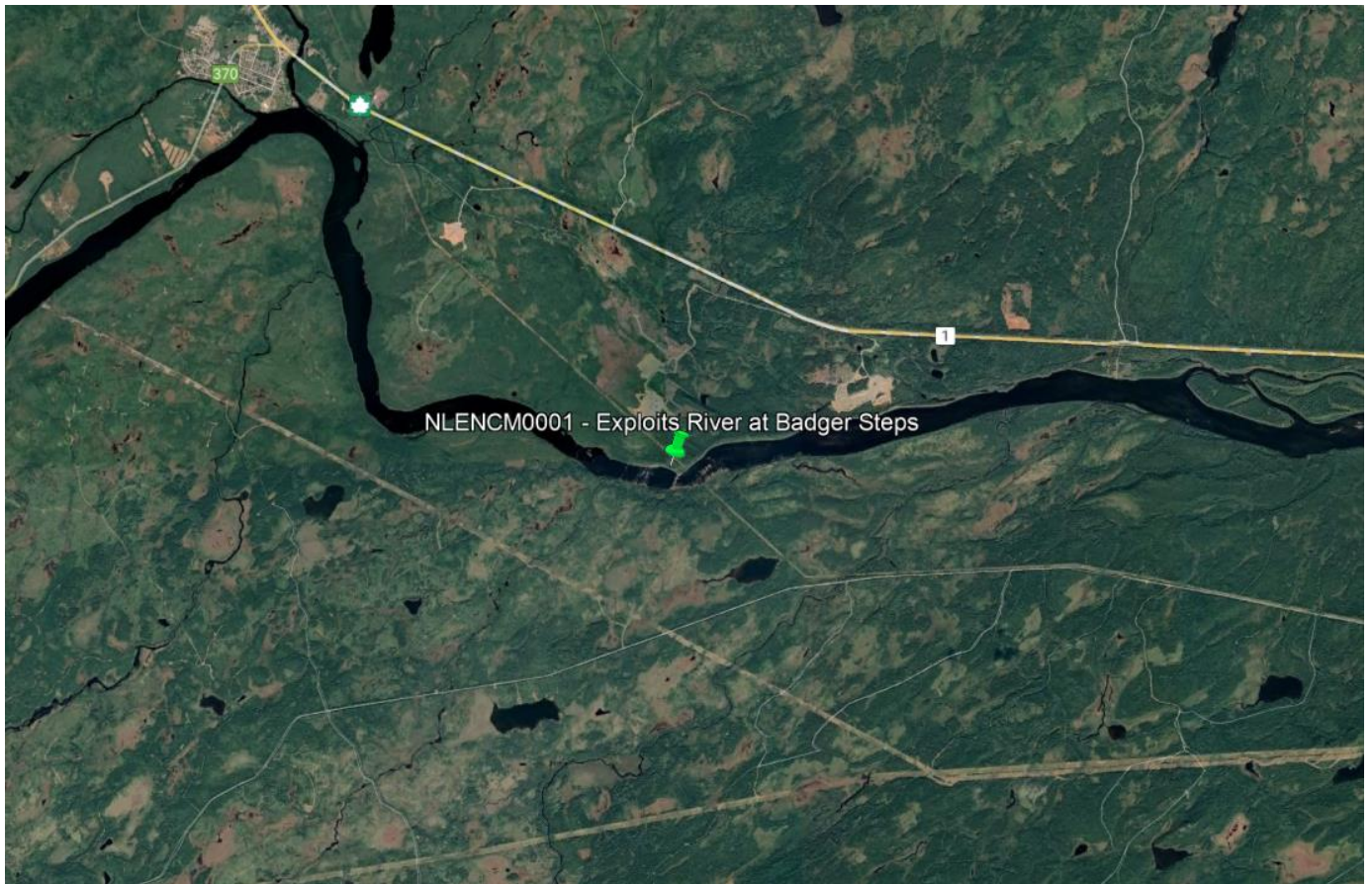


Figure 14: Exploits River at Badger Steps Camera Station Location

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR1000
 - Replaced desiccant and indicator card
- Camera:
 - Model: CC5MPX
 - Mounted new replacement CC5MPX and took CC640 down
- Site:
 - Battery changed

Follow-up tasks required:

- Regular scheduled maintenance
- Monitor battery, died very quickly after being replaced
- Check and fix all loose connections

Steady Brook 470 meters above Confluence to Humber River

Station Details:

- Station Identification: 02YL012
- Station Installed: June 23rd 2015
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: WRMD provides flood forecasting services, in which snow monitoring has been integrated, for the communities of Deer Lake and Steady Brook in the Humber River Basin.
- Date Visited: July 21st, 2020
- Location: N 48° 57' 11.59" W 57° 49' 40.02"
- Elevation: 7.3 m



Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR800
 - Serial: 28914
 - Replaced desiccant
- Camera:
 - Model: CC5MPX
 - Serial: 1862
 - Cleaned lens
- Compound:
 - Tilted solar panel to a more desirable angle

Follow-up tasks required:

- Regular scheduled maintenance

Churchill River at end of Mud Lake Road – Water Level

Station Details:

- Station Identification: 03OE018
- Station Installed: Oct 24, 2018
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: Sept. 21st 2020
- Location: N 53°20'5.24" W 60°11'18.18"
- Elevation: 1.2 m



Figure 16: Churchill River at end of Mud Lake Road Camera Station Location

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR800
 - Serial: 43339
 - Replaced desiccant
- Camera:
 - Model: CCFC
 - Wiped lens

Follow-up tasks required:

- Regular scheduled maintenance

Churchill River below Traverspine River

Station Details:

- Station Identification: 03OE019
- Station Installed: Sept 23, 2018
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: Not visited in 2020
- Location: N 53°17'28.20" W 60°13'16.49"
- Elevation: 1.2 m



Figure 17: Churchill River below Traverspine River Camera Station Location

Tasks accomplished:

- Site not visited

Follow-up tasks required:

- Regular scheduled maintenance

Goose River at Bridge

Station Details:

- Station Identification: NLENHM0001
- Station Installed: Sept 23, 2018
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: Sept. 21st, 2020
- Location: N 53°23'35.07" W 60°25'12.05"
- Elevation: 1.2 m

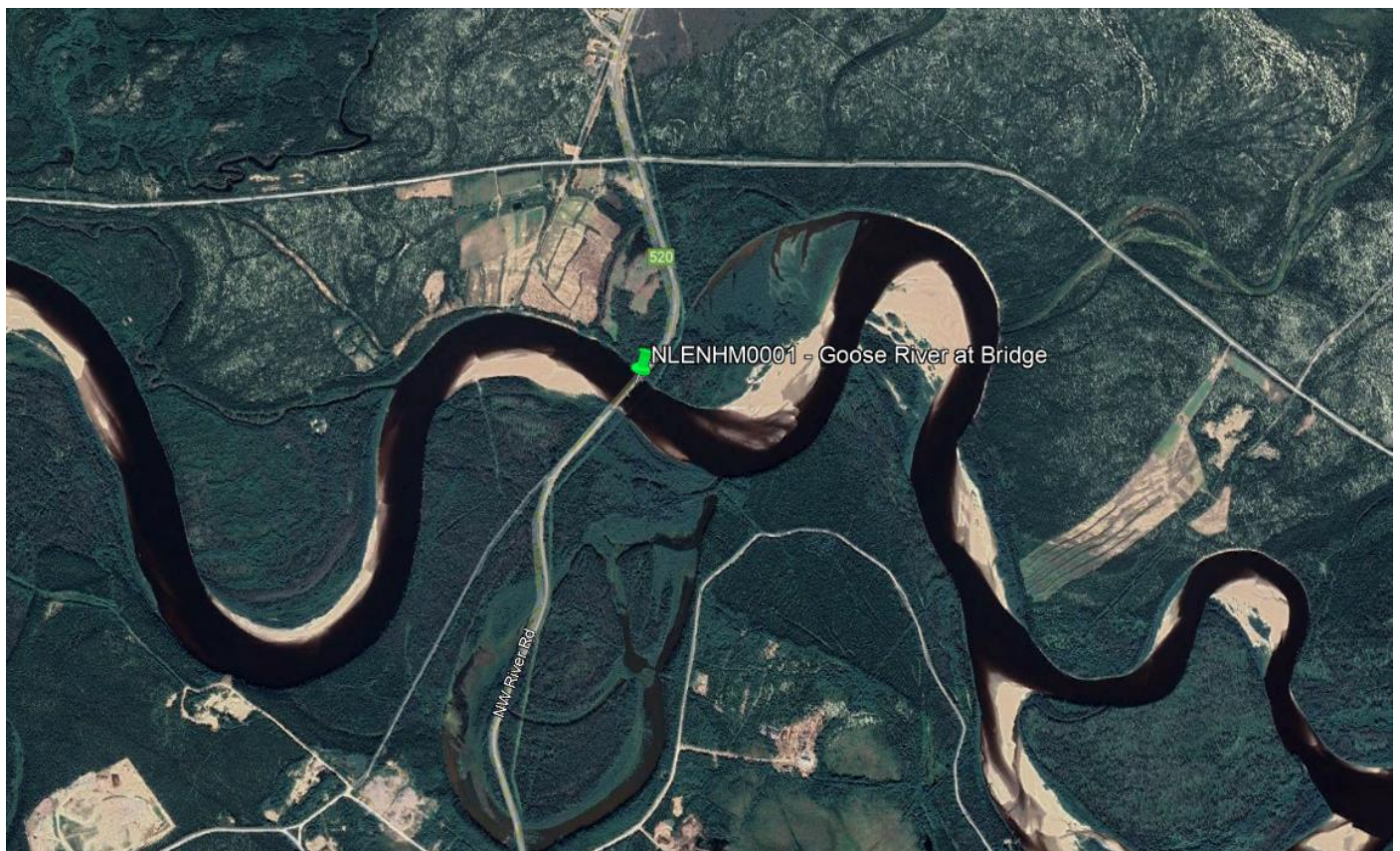


Figure 18: Goose River at Bridge

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR800
 - Serial: 43340
 - Replaced desiccant
- Camera:
 - Model: CCFC
 - Wiped lens

Follow-up tasks required:

- Regular scheduled maintenance
- Purchase new mounting equipment and relocate swing-arm mount to larger I-beam
- Use aircraft cable to secure RLS sensor to swing arm mount

Mud Lake at Mud Lake

Station Details:

- Station Identification: 03OE017
- Station Installed: Sept 23, 2018
- Image taken and transmitted every hour during the day time
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: Nov. 5th, 2020
- Location: N 53°18'14.10" W 60°10'2.37"
- Elevation: 1.2 m

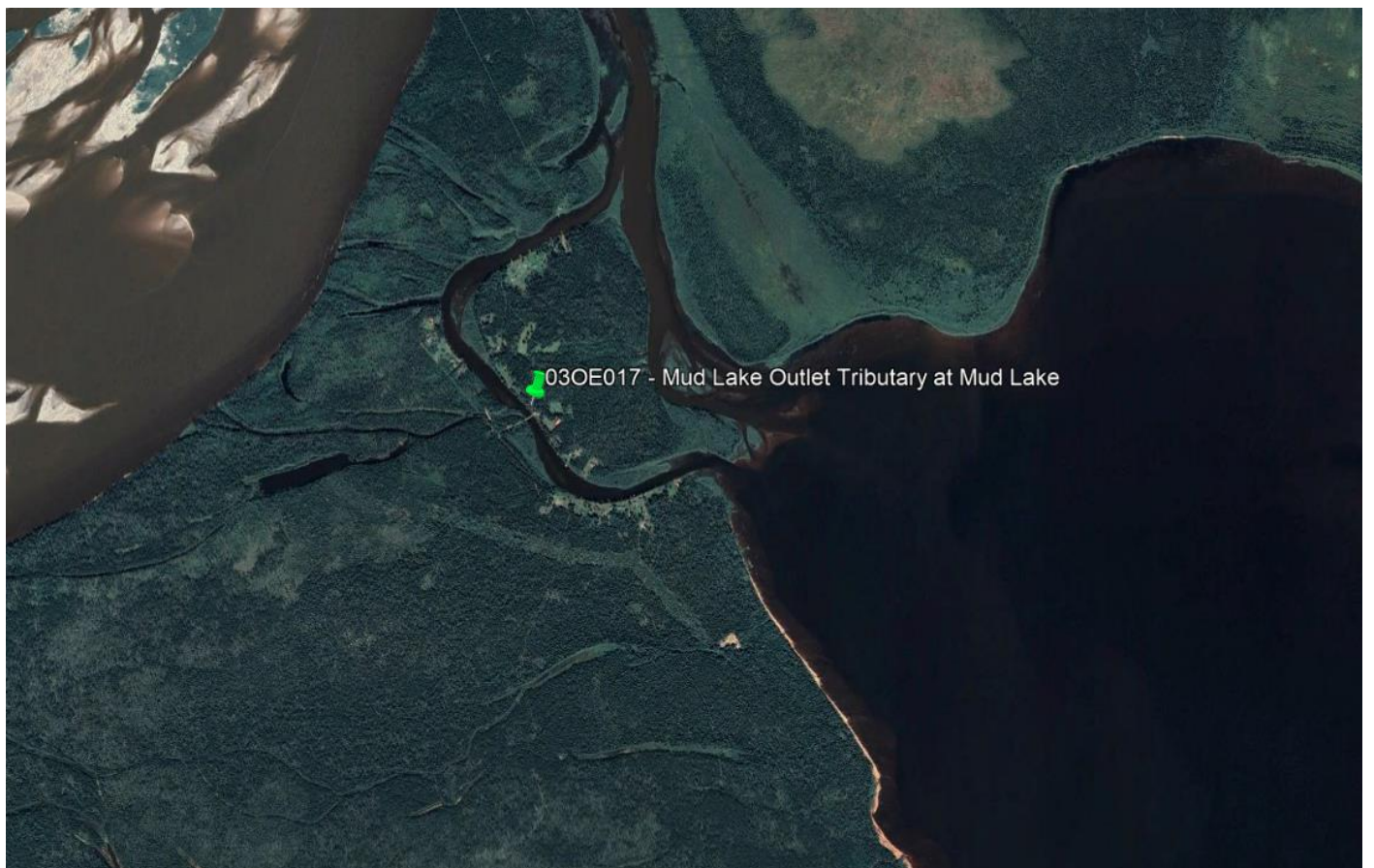


Figure 19: Mud Lake at Mud Lake Camera Station Location

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Camera:
 - Model: NuPoint Fixed Sight Satellite Camera System
 - Serial: 13000468
 - Installed new NuPoint fixed camera system in place of old CCFC
 - Old CCFC connection port very corroded
- Site:
 - Old equipment (datalogger and Yagi) stored in WRMD garage in Happy Valley-Goose Bay
 - CCFC shipped back to St.John's and stored in Lab to be RMA'd

Follow-up tasks required:

- Regular scheduled maintenance
- RMA old CCFC

Churchill Falls above Grizzle Rapids

Station Details:

- Station Identification: 03OE013
- Station Installed: July 3rd 2019
- Image taken and transmitted once a day at 10:30 AM NST
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: June 29th, 2020 by Maria Murphy and Brenda Congram
- Location: N 52°58'12.22" W 61°26'43.48"
- Elevation: 62.5 m



Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Camera:
 - Model: NuPoint Fixed Sight Satellite Camera System
 - Serial: 13000602
 - Reinstalled repaired NuPoint camera system
- Site:
 - Replaced batteries

Follow-up tasks required:

- Regular scheduled maintenance
- Keep an eye on battery level; batteries just changed but still going below 12v

Exploits River at Bishop's Falls Trestle

Station Details:

- Station Identification: NLENHM0003
- Station Installed: Sept 9 - 10, 2019
- Image taken and transmitted every hour during the day time
- Parameters measured every fifteen minutes and transmitted every hour:
 - Distance from Bridge to Water
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: July 6th, 2020
- Location: N 49° 0'29.50" W 55°29'23.80"
- Elevation: 36.0 m

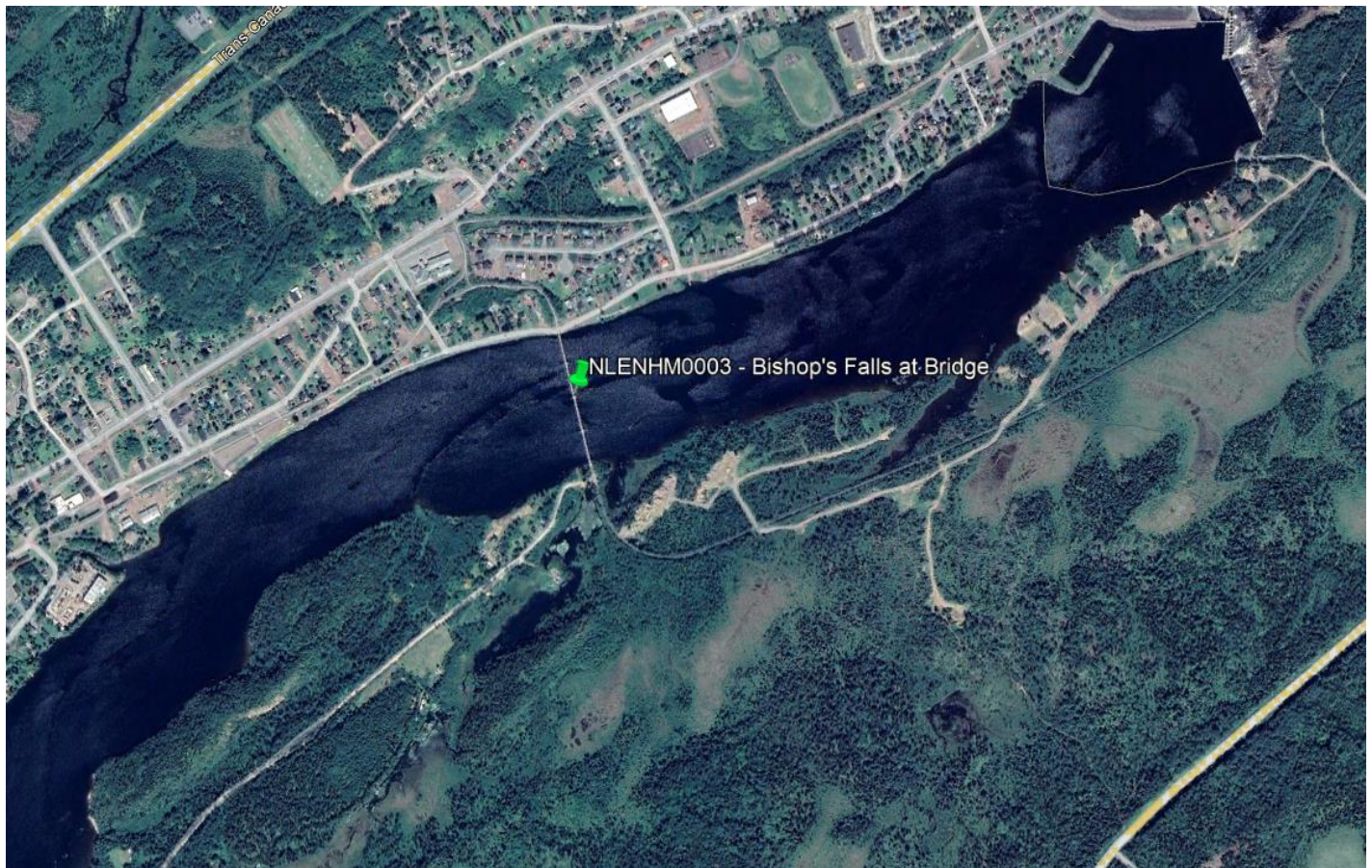


Figure 21: Exploits River at Bishop's Falls Trestle Hydrometric Station Location

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR800
 - Serial: 44026
 - Replaced desiccant
- Camera:
 - Model: CC5MPX
 - Serial: 01293
 - Lens wiped
 - Timezone adjusted

Follow-up tasks required:

- Regular scheduled maintenance
- Keep an eye on color changing images; possibly too high saturation when sun hits ice in winter?

Humber River at Nicholsville Bridge

Station Details:

- Station Identification: NLENHM0004
- Station Installed: Sept 10 - 11, 2019
- Image taken and transmitted every hour during the day time
- Parameters measured every fifteen minutes and transmitted every hour:
 - Distance from Bridge to Water
- Site Selection Rationale: Selected with consultation from Environment Canada for use in flood forecasting models.
- Date Visited: July 23rd, 2020
- Location: N 49°11'18.98" W 57°26'52.32"
- Elevation: 30.8 m

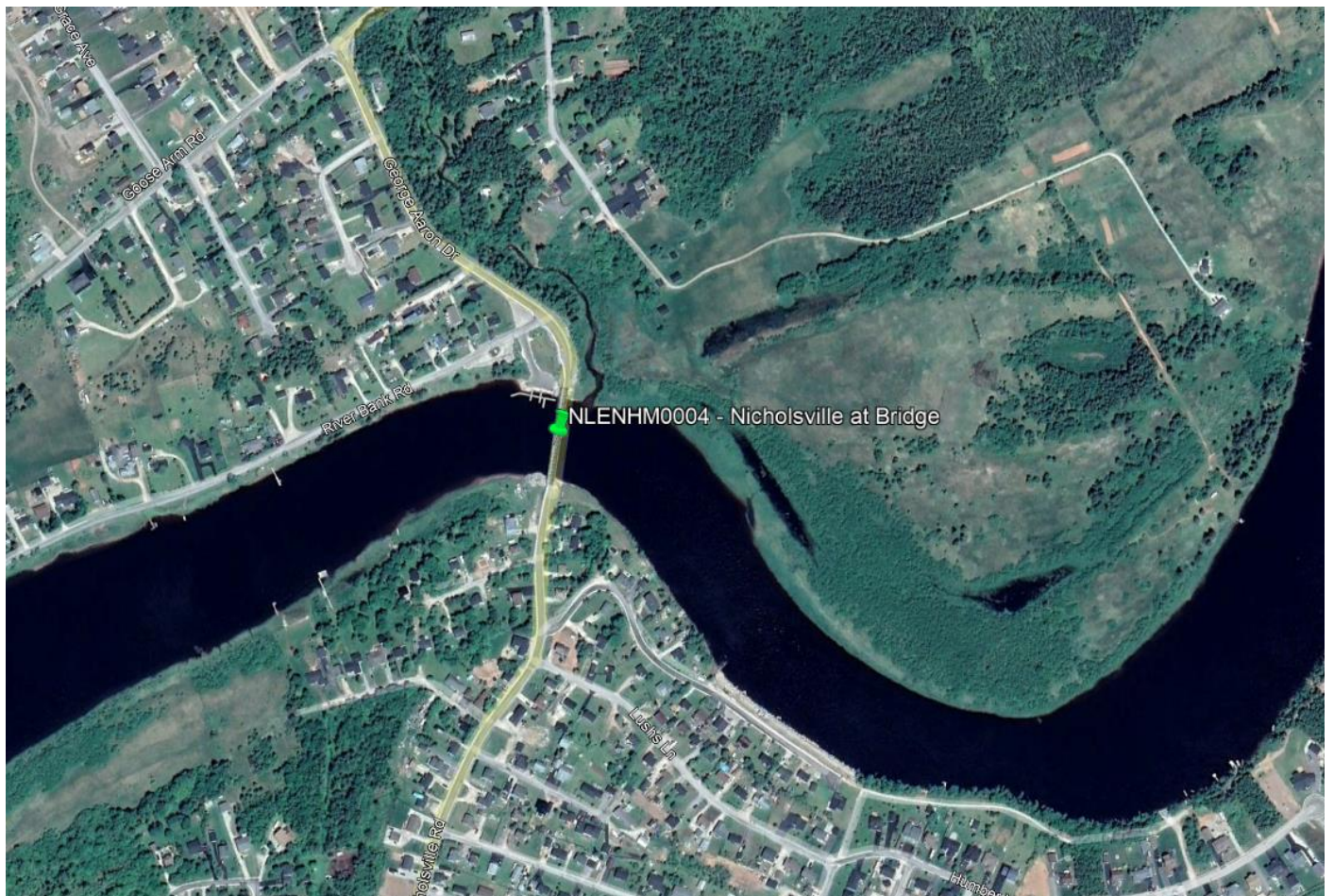


Figure 22: Humber River at Nicholsville Bridge Hydrometric Station Location

Weather Station Annual Maintenance - 2020, Newfoundland and Labrador

Tasks accomplished:

- Datalogger:
 - Model: CR800
 - Serial: 44027
 - Replaced desiccant
- Camera:
 - Model: CCFC
 - Lens wiped

Follow-up tasks required:

- Regular scheduled maintenance
- Adjust time zone

The next scheduled annual maintenance trip will be completed by October 2021.