INTERNATIONAL ST. CROIX RIVER WATERSHED BOARD

ANNUAL REPORT

2020

ST. CROIX RIVER
MAINE AND NEW BRUNSWICK

2020 ANNUAL REPORT

OF THE

INTERNATIONAL ST. CROIX RIVER WATERSHED BOARD

Covering

The Orders of Approval with respect to the control of the discharge of the St. Croix River at Forest City, Vanceboro, and the water levels of East Grand Lake, Spednic Lake, Grand Falls Flowage and Milltown Dam Forebay

&

The Water Quality and Aquatic Ecosystem Health of the St. Croix River Boundary Waters

SUBMITTED TO

THE INTERNATIONAL JOINT COMMISSION

BY

THE INTERNATIONAL ST. CROIX RIVER WATERSHED BOARD

Prepared March 2021

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1.0 GENERAL

1.1 Synopsis for 2020

During the year 2020, reservoir levels at East Grand Lake, Spednic Lake, and Grand Falls Flowage were operated within prescribed levels in the Commission's Orders.

At Vanceboro Dam and Forest City Dams the Commission's Orders for minimum flows were maintained throughout the year. Except for a very brief minimum flow deviation reported at Forest City Dam on December 15 and 16 due to ice at the gates.

In 2020, the annual mean river flow of the St. Croix River, as measured at the Forest City Stream, Vanceboro, and Baring gaging stations, was near or lower than the long term mean value. The flow recorded differed from the long-term annual mean flow values by -8%, 1%, and -20%, respectively. The lower annual mean flow at Baring reflects the drought conditions experienced during summer 2020 in Maine.

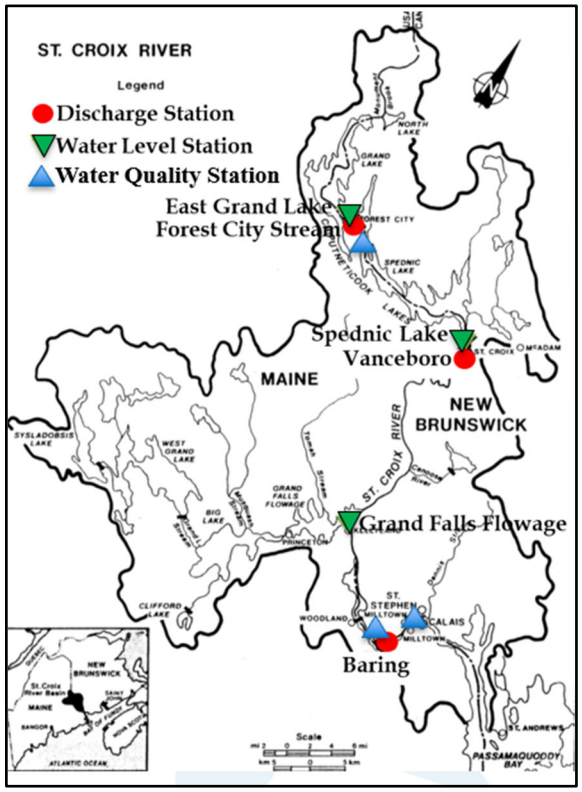


Figure 1: St. Croix River

In 2020, average annual mean water levels measured at East Grand Lake, Grand Falls Flowage, and Spednic Lake were close to the long-term mean values.

In 2020, real time water quality was monitored at two stations in the lower watershed, just above Milltown Dam in the dam headpond and ½ mile upstream of Milltown Dam in a free-flowing section of the river. The dissolved oxygen concentrations at these stations were observed to be above the International Joint Commission's (IJC) objective of 5.0 mg/L for aquatic health.

In 2020, Environment and Climate Change Canada (ECCC) was unable to maintain the water quality monitoring station in the upper watershed at Forest City due to international border restrictions imposed in response to the spread of COVID-19. Therefore, no real time water quality data for that station is included in this report.

The Board also monitors the aquatic health of the river with several water quality samples collected at the Forest City station and the Milltown Dam headpond station. In 2020, sample collection at these stations was limited due to COVID-19 restrictions. Samples were collected in March and November. Total phosphorus (a nutrient that can stimulate algae growth) was four times higher at Milltown than at Forest City, and the November sample slightly exceeded the Ontario Ministry of the Environment (OMOE, 1994) phosphorus guideline of 0.03 mg/L. The Board is continuing to monitor the nutrient trends in the lower watershed.

During the year, the Board held several virtual meetings instead of the normal face to face meetings, due to COVID-19 restrictions. The Board held its annual Board and Partners meeting virtually on Wednesday, June 3rd. On Friday, September 25th, the Board held a follow-up virtual Board and Partners meeting. The Board held its annual public meeting virtually on the evening of Wednesday, December 2nd. Overall, the virtual meetings were a success with good participation, as technology provided the ability to reach a range of stakeholders from various locations in the U.S. and Canada.

In 2020, the Board continued its interest in supporting water resource and ecosystem restoration studies in the St. Croix River watershed. The Board supported several projects through the IJC's International Watershed Initiative (IWI). Projects included fish counts at the Milltown Dam and a study on fish passage opportunities at Woodland and Grand Falls Dams.

1.2 Board Membership

International St. Croix River Watershed Board - Membership	
Canadian Section	**U.S. Section**
Bill Appleby, Canadian Co-Chair Director, Climate Services and Special Projects, Meteorological Service of Canada Environment & Climate Change Canada Dartmouth, Nova Scotia	Colonel John Atilano II U.S. Co-Chair District Engineer U.S. Army Corps of Engineers New England District Concord, Massachusetts
Chief Hugh Akagi Peskotomuhkati Nation at Skutik St. Stephen, New Brunswick	Jackie Leclair Chief Wetlands Protection Section U.S. EPA New England, Region 1 Boston, Massachusetts
Donald Fox, Ph.D. Manager, Water Sciences New Brunswick Department of Environment & Local Government Fredericton, New Brunswick	Susanne Miller, J.D. Regional Director, Eastern Maine Office, Department of Environmental Protection Bangor, Maine
Robert Stephenson, Ph.D. Principal Investigator, Canadian Capture Fisheries Research Network Visiting Research Professor, University of New Brunswick Research Scientist, Fisheries and Oceans Canada St. Andrews, New Brunswick	Sean Ledwin Director, Division of Sea Run Fisheries & Habitat Maine Department of Marine Resources Bangor, Maine
Vacant (appointment process in progress)	Robert Lent, Ph.D. Associate Director Hydrologic Monitoring U.S. Geological Survey New England Water Science Center Augusta, Maine
Board Secretaries	
Kathryn Parlee Regional Analysis & Relations, Atlantic Environment & Climate Change Canada Dartmouth, Nova Scotia	Barbara Blumeris U.S. Army Corps of Engineers New England District Concord, Massachusetts

The International St. Croix River Watershed Board (Board) was established to assist the International Joint Commission. The International Joint Commission (IJC) is a binational United States-Canada organization established under the Boundary Waters Treaty of 1909. The Board has ten members with an equal number of members from the United States and Canada. Board members are appointed by the Commission and they serve the Commission in their personal and professional capacity and not as representatives of their agencies. Board membership in 2020 is provided above. It should be noted that there were three changes to Board membership in 2020. Long time Canadian community/watershed member, Ms. Jessie Davies, stepped down from the Board and Chief Hugh Akagi, Chief of the Peskotomuhkati Nation at Skutik, was nominated and appointed to fill this position and to help bring an Indigenous perspective to the Board. Mr. Ralph Abele from U.S. EPA New England, Region 1, retired and stepped down from the Board and Ms. Jackie Leclair was nominated and appointed to fill this position. Colonel William Conde, U.S. Army, New England District Commander, left the New England District Command and stepped down from the Board as Co-Chair. Colonel Atilano II assumed Command of New England District and was nominated and appointed to fill the U.S. Co-Chair position on the Board.

1.3 Meetings in the Basin

Typically, the Board conducts face to face meetings in the watershed to engage with partners and the public. The Board uses these meetings to share information on its activities, seek input on issues affecting the St. Croix River watershed, and identify needs or opportunities to prevent or resolve potential disputes. However, due to the COVID-19 global pandemic, no in-person meetings were held in 2020. Instead, the Board held several virtual meetings using on-line meeting technology.

Partners Meeting (June): The Board held its annual Board and Partners meeting virtually on Wednesday, June 3rd. Approximately 30 people attended the meeting including representatives from the IJC, Peskotomuhkati/Passamaquoddy, Fisheries and Oceans Canada, U.S. Fish and Wildlife Service, U.S. Geological Survey, LimnoTech Consulting, Dillion Consulting Ltd., NB Power, and the St. Croix International Waterway Commission. Presentations were provided by attendees focusing on current activities and projects related to alewife restoration, fish passage, and the proposal to decommission Milltown dam. Brief updates were also provided on activities and issues that the IJC St. Croix Board has been tracking over the past year such as the future of the Forest City dam, as well as updates on the status of St. Croix Board project proposals to the IJC's International Watershed Initiative.

Partners Meeting (September): On Friday, September 25th, the Board held a follow-up virtual Board and Partners meeting. Over 30 people attended the meeting including representatives from the IJC, Peskotomuhkati/Passamaquoddy, Environment and Climate Change Canada, Fisheries and Oceans Canada, U.S. Geological Survey, Global Affairs Canada, U.S. State Department, and the St. Croix International Waterway Commission. The primary purpose of this meeting was to provide the opportunity for the IJC and key partners to hear presentations from the Board's contracted project with LimnoTech and the Peskotomuhkati's contracted project with Dillion Consulting Ltd. regarding the status and opportunities to improve upstream and downstream fish passage at Woodland and Grand Falls dams. Updates were also provided on the Next Steps Working Group's activities, as well as the Natural Resources Conservation Service (NCRS) Bay of Fundy Aquatic Connectivity project in Maine. Participants also engaged in a preliminary discussion on next steps for supporting further collaboration and activities to restore fish passage and alewife to the St. Croix River. The Board also provided brief updates on its current activities and projects funded under the International Watershed Initiative (IWI). Finally, Nick Stasulis, from the U.S. Geological Survey, provided an overview of water levels in the St. Croix River watershed resulting from the current weather and drought conditions in much of Maine.

Annual Public Meeting (December): The Board held its annual public meeting virtually on the evening of Wednesday, December 2nd. Over 50 people attended the two-hour meeting. Board Co-chairs opened the Board's first ever virtual public meeting and welcomed participants. The welcome was followed by opening words and a song from a local Peskotomuhkati representative and opening comments from IJC Commissioners. Bill Appleby and Lucy Chisholm, from Environment and Climate Change Canada, then provided a presentation on the anticipated impacts of temperature, sea level rise and precipitation on the Gulf of Maine during the next 30 years. Nick Stasulis, from the U.S. Geological Survey, then presented on the 2020 drought in the watershed. Following the presentations, participants were provided the opportunity to ask general questions and provided input. No specific concerns were raised, and the Co-Chairs adjourned the meeting. A recording of the virtual meeting was posted on the Board's website and can be found at: https://vimeo.com/488257603.

1.4 Annual Site Visit of Facilities in the Basin

Due to the on-going COVID-19 global pandemic, and the associated work and travel related restrictions, site visits to the facilities and structures under IJC Orders of Approval in the basin were not conducted in 2020.

It is the responsibility of the dam owners, operators, and appropriate jurisdictional agencies to conduct the necessary dam inspections and maintenance to ensure the safety and security of the dams.

1.5 Policy of the Board Regarding Dam Regulation

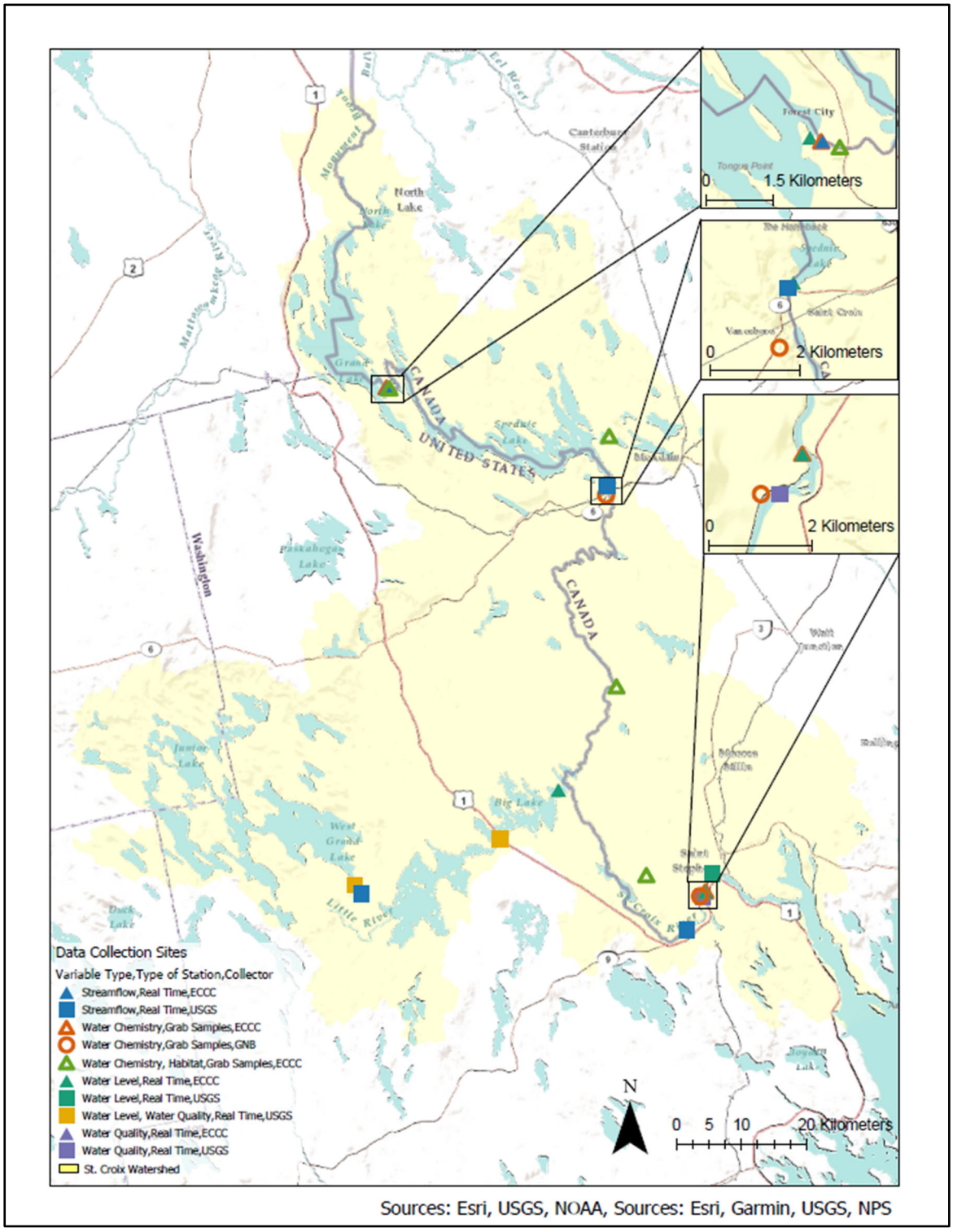
In accordance with its mandate from the IJC, the Board leaves the control of operation of the dams at Forest City, Vanceboro, and Grand Falls (owned and operated by Woodland Pulp LLC) and Milltown (owned and operated by NB Power) to the owners. During the 2020 reporting period, the Board reviewed conditions prevailing in the river by the following means:

- a continuous record of water elevations of East Grand Lake and a continuous record of discharge below Forest City Dam
- a continuous record of water elevations of Spednic Lake and a continuous record of discharge at Vanceboro
- a continuous record of water levels above the dam at Grand Falls
- a continuous record of discharge at Baring
- water level data from a continuous monitoring station in the head pond at Milltown Dam

Figure 2: Staff from USGS Maine Office of the New England Water Science Center, at 01AR011 (Forest City Stream) in September 2020

1.6 St. Croix River Monitoring Station Map

Below is a map detailing the flow, level, and water quality monitoring stations along the St. Croix River boundary water and on the West Branch of the river in Maine.



2.0 MANAGEMENT OF WATER LEVELS AND FLOWS

2.1 Summary

In 2020, the annual mean water level at East Grand Lake was 131.912 meters (432.79 feet), which is higher than the long-term mean value of 131.832 meters (432.51 feet).

The annual mean flow from the lake at Forest City Stream was 6.15 m3/s (217 cfs), 8.1% lower than the long-term mean value of 6.69 m3/s (236 cfs).

In 2020, the annual mean water level at Spednic Lake was 116.170 meters (381.13 feet), lower than the long-term mean value of 116.324 meters (381.64 feet).

The annual mean flow as recorded at Vanceboro was 21.5 m3/s (759 cfs), 1% higher than the long-term mean value of 21.3 m3/s (752 cfs).

In 2020, the annual mean water level at Grand Falls Flowage was 61.648 meters (202.26 feet), which is lower than the long-term mean value of 61.759 meters (202.62 feet).

The annual mean flow at Baring was 61.0 m3/s (2,150 cfs), which is 19.8% lower than the long-term mean value at Baring of 76.1 m3/s (2,690 cfs).

2.2 East Grand Lake Reservoir and Discharges Below Forest City Dam

During the period from January 1 to December 31, East Grand Lake reservoir was operated between a maximum daily mean water level of 132.303 meters (434.06 feet) on April 16th and a minimum daily mean of 131.306 meters (430.79 feet) on October 13th. The maximum water level as prescribed by the Commission's Order is 132.571 meters (434.94 feet); the minimum is 130.436 meters (427.94 feet). The Order was maintained throughout the year. The daily mean water levels are presented in Table I and depicted in Figure I in Appendix 3 and 4.

Table II and Figure II in Appendix 3 and 4 present the daily mean discharges below the Forest City Dam at the outlet of East Grand Lake for 2020. The maximum daily mean flow for the reporting period was 31.7 m3/s (1,120 cfs) on April 16th and the minimum daily mean was 2.13 m3/s (75.2 cfs) on July 1st. The mean discharge for the year was 6.15 m3/s (217 cfs).

The Commission's Order of 2.12 m3/s (75 cfs) as a minimum flow was maintained throughout the year. Except for a very brief minimum flow deviation reported by Woodland Pulp due to ice at the gates on 15 and 16 December 2020.

2.3 Spednic Lake Reservoir and Discharges below Vanceboro Dam

During the year, levels in the Spednic Lake reservoir, ranged from a maximum daily mean water level of 116.963 meters (383.73 feet) on April 19th, to a minimum daily mean water level of 114.989 meters (377.26 feet) on November 23rd. The maximum limit specified in the Commission's Order is 117.610 meters (385.86 feet). The allowable minimum level is 113.233 meters (371.50 feet) for the period January 1 to April 30 and October 1 to December 31 inclusive, and 114.757 meters (376.50 feet) for the period May 1 to September 30 inclusive. These orders were maintained throughout the year. The daily mean elevations for the Spednic Lake reservoir during the year are presented in Table III and depicted in Figure III in Appendix 3 and 4.

The maximum daily mean discharge recorded from the outflow at the reservoir at Vanceboro was 93.7 m3/s (3,308 cfs) on April 16th and the minimum daily mean discharge recorded was 6.96 m3/s (245 cfs), on October 1st. The Commission's Order of a minimum flow of 5.66 m3/s (200 cfs) was maintained throughout the year. Daily mean discharges are presented in Table IV and Figure IV in Appendix 3 and 4.

2.4 Water Levels above Grand Falls Dam

Table V and Figure V in Appendix 3 and 4 include water level elevations of the headpond above the Grand Falls Dam. The recorded maximum daily mean elevation was 61.943 meters (203.23 feet) on April 10th and the minimum recorded elevation was 61.307 meters (201.14 feet) on July 18th. The maximum prescribed elevation of 62.106 meters (203.76 feet), as set by the Commission, was maintained throughout the year.

2.5 Discharges at Baring, Maine

Table VI and Figure VI in Appendix 3 and 4 present the daily mean discharges of the St. Croix River at Baring, Maine. The mean discharge for the report period was 61.0 m3/s (2,150 cfs). The maximum daily mean was 314 m3/s (11,100 cfs) on April 17th. The minimum daily mean was 19.2 m3/s (678 cfs) on September 27th.

Woodland Pulp LLC did not meet the target minimum flow set at 21.2 m^3/s (750 cfs) in 2020. See Appendix 3 Figure VI-I for the duration of flow below the target (from about

September 23rd to October 11th). This is the normal minimum flow requirement as considered by the Maine Department of Environmental Protection. The flow at Baring is reported by the Board for information purposes only.

2.6 Headwater Elevations above Milltown Dam

Table VII and Figure VII in Appendix 3 and 4 present and depict daily water elevations in the forebay of the New Brunswick Power Corporation plant at Milltown, New Brunswick. These elevations refer to mean sea level datum. In 2009, Environment Canada established a continuous water-level and water quality monitoring station. The supplied data for 2020 was extracted from this gauging station located in the headpond.

Figure 3: Photo taken in 2018 looking upstream from Milltown Dam

3.0 WATER QUALITY

3.1 U.S. Geological Survey (USGS) Milltown Monitor

USGS Milltown Monitor

Water quality values for the St. Croix River at Milltown monitor were within the extreme values for the period of daily record during the summer of 2020, based on record since September 1969. Dissolved oxygen values were above the water quality objectives for the river – meeting the requirements.

Table 1
St. Croix River at Milltown, USGS Station # 01021050
Water Quality Monitor, June – September 2020.

Dissolved Oxygen (mg/L) IJC objective = 5.0 mg/L minimum
Maximum for the season: 10.0 mg/L
Minimum for the season: 6.0 mg/L

	June	July	August	September
Maximum	8.6	8.4	8.6	10.0
Minimum	6.5	6.2	6.0	7.1
Mean	7.8	7.4	7.4	8.6

Water Temperature (degrees Celsius)

	June	July	August	September
Maximum	26.9	28.7	28.2	23.3
Minimum	17.4	20.7	18.8	13.5
Mean	21.9	24.3	24.6	18.8

pH (standard units)

	June	July	August	September
Maximum	7.3	7.4	7.3	7.1
Minimum	6.9	7.0	6.8	6.6
Mean	7.1	7.2	7.0	6.9

Specific conductance (µS per centimeter at 25 C)

	June	July	August	September
Maximum	105	112	113	107
Minimum	54	73	79	33
Mean	81	101	100	76

3.2 Environment and Climate Change Canada Monitoring Stations – Forest City and Milltown

Environment and Climate Change Canada (ECCC), in partnership with the New Brunswick Department of Environment and Local Government, maintains two automated real time water quality monitoring stations on the St. Croix River system. The first station is located in the headpond at the Milltown Dam in Milltown (St. Stephen), New Brunswick and the second station is located in Forest City, Maine below the East Grand Lake, Forest City Dam.

The ECCC Milltown Dam Station and the USGS Milltown Station monitor water quality in the "urban" area below Baileyville, Maine but generally above St. Stephen, New Brunswick/Calais, Maine. The Forest City Station monitors water quality in the northern portion of the watershed that is primarily forested land.

The Forest City station normally records hourly measurements of temperature and specific conductance. In 2020, ECCC was unable to maintain the station at Forest City due to international border restrictions imposed in response to the spread of COVID-19. Therefore, no real time data for that station is included in this report. Staff were able to collect grab samples on two occasions (March and November 2020), with the November sample being collected on the Canadian side of the border.

The Milltown station records hourly measurements of temperature, dissolved oxygen, pH, specific conductance and turbidity. Under normal circumstances, in order to maintain and calibrate the measuring devices and to collect a grab sample for water quality analysis, both sites are visited every 5 to 6 weeks during the warmer months of the year, and less frequently during the colder months when fouling of the sensors is less problematic. In 2020, the Milltown site was visited twice, in March and November 2020. Between those dates, field travel within the province by ECCC staff was restricted to help prevent the spread of COVID-19 within the Province of New Brunswick. Therefore, for 2020 the data collected at the Milltown station is incomplete, and may not accurately represent the true conditions at the site for the year.

Real time water quality monitoring provides a continuous set of measurements using specialized instruments. Hourly measurements of key water quality parameters provide a clearer picture of daily, weekly, and seasonal fluctuations in water quality which can be associated with specific events like rainfall, snow melt, industrial discharges and stormwater overflows which might not be captured with regular grab sample monitoring.

3.2.1 Interpretation of Real Time Monitoring Data

ECCC Milltown Station

This station, operated by Environment and Climate Change Canada, is located just above the Milltown Dam at a depth of 1.8 to 3.0 metres depending on head pond elevation. It was operational for all of 2020. Annual charts showing daily means, minimums and maximums from the Milltown station for each parameter as well as monthly summaries of the real time data are presented in Appendix 5, Table 1 and Figure 1.

Temperature

Water temperature at the site increased gradually through the spring and summer until it reached its maximum of 28.55˚C on July 29th. The temperature increased quickly in May and remained relatively high until the 11th of August and sharply declined after that time. August was the month with the highest mean temperature at 24.52˚C, much higher than 2019 (23.96˚C). The lowest temperatures recorded were all in January and February, with monthly the averages of 0.23˚C and 0.59˚C, respectively (Appendix 5). These averages are higher than 2019 average of 0.11˚C. The daily mean water temperature stayed over 20˚C for 93 days, compared to 78 days in 2019. Furthermore, water temperature was below 5˚C for only 137 days in 2020, much lower than the previous 3 years. Annual water temperature at this station in 2020 averaged 11.10˚C.

Dissolved Oxygen

Dissolved oxygen readings followed a similar, but inverse, trend to water temperature, reaching the lowest concentration of 6.16 mg/L on July 30th, and highest of 14.25 mg/L on January 18th. May and October were the months with the greatest change in dissolved oxygen concentration, with mean daily ranges of 3.02 mg/L and 2.63 mg/L, respectively. The annual average concentration of dissolved oxygen was 10.83 mg/L in 2020 compared to 11.28 mg/L in 2019. The measurement from July 30th was below the 6.5 mg/L minimum Canadian Council of Ministers of the Environment (CCME) Guideline for the Protection of Aquatic Life. Despite the very little equipment maintenance in 2020, our field measurements for dissolved oxygen, which are taken with a newly calibrated sonde, were similar to measurements from the deployed instrument. This indicates low sensor drift throughout the time of deployment and allows reasonable confidence in the data presented in this report.

pH

The pH showed greater than normal amounts of drift due to lack of equipment calibration, with a total of 96 days having a pH that was below the lower CCME guideline, in contrast to the 19 days recorded in 2019. A reduction in pH through the spring is typical for this site, however in 2020 the values appear to be lower and over a more extended period. Furthermore, the highest pH values in 2020 were in October and November rather than July and August as in other years. The highest pH measurement (7.37 pH units) was recorded in November and the lowest (5.94 pH units) was recorded in April. Concurrently, specific conductance was low during April and high during November (Appendix 5). The 2020 annual mean pH at this station was 6.70, which was slightly lower than the 6.81 annual mean of 2019.

Specific Conductance

Specific conductance is a measure of how well water can conduct an electrical current and is directly related to the concentration of ions in the water, such as chloride, calcium, magnesium, sodium, nitrate, phosphate, and iron. Specific conductance readings fluctuated moderately between 23.60 and 118.40 µS/cm and averaged 69.13 µS/cm (Appendix 5). The range of values is similar to those of 2014-2019, but the average is much higher than 2019's 51.6 µS/cm. Measurements of specific conductance reached their highest of 118.4 µS/cm on November 16th, and their lowest 23.50 µS/cm on April 17th. Spring freshet most likely contributed to the low specific conductance in April when high water volume tends to lower concentration of ions.

Unlike 2019, fall (October and November) saw a slightly higher average specific conductance than August and September (115.45 µS/cm vs 108.40 µS/cm). Although the dam controls stream discharge at this location, ion concentration can change with rainfall and/or spring melt/freshet conditions and ion concentration is usually higher in summer when rainfall is lowest. The lowest monthly average specific conductance was measured from April to May, and is related to the spring thaw. The two grab samples showed laboratory-measured specific conductance levels that were very similar to those from the deployed sonde, which adds confidence to the data.

Turbidity

Turbidity data for 2020 appeared somewhat reliable, despite the lack of equipment maintenance. Daily mean turbidity stayed below 10 NTU for almost 278 days of measurements although turbid events (spikes) occurred once or twice per month. Turbidity ranged from 0 to 3000 NTU (currently set as our maximum). Similar to previous years, the majority of elevated turbidity measurements occurred in December, with some

also occurring during spring freshet.

Spike events related to fouling were considerably more frequent in 2020 compared with previous years. A common issue with turbidity sensors is that obstructions on the sensor (fouling) can compromise readings for long periods. The real time turbidity readings in Appendix 5, Figure 1 shows the beginning of such events quite clearly, as turbidity increases exponentially. Then, because the obstruction of the sensor continues beyond the actual event, the turbidity readings at the site remain elevated until the sensor is properly cleaned during sonde switch out. Figure 1 in Appendix 5 was created by cropping all the values above 250 NTU to improve the visibility of the spikes and to increase the visibility of the non-spike concentration occurrences.

Forest City Station

This station, operated by Environment and Climate Change Canada, is located immediately downstream of the East Grand Lake, Forest City Dam in Forest City, Maine. The real time water quality station at Forest City was inaccessible to ECCC staff throughout 2020 and so no data is available for this report.

3.3 Daily Mean Water Temperature in Recent Years

Milltown Station Water Temperature 2007-2020

Daily mean water temperatures at Milltown were calculated for the time period between 2007 and 2020 and are presented in Figure 4 below. The number of days with water temperatures above 20˚C were also calculated for each year, based on daily mean. Those numbers are included in Figure 4 at the top of each annual data cycle. The greatest number of days with water temperature above 20˚C were 97 and 98 in 2017 and 2018, respectively. The summer of 2020 was a relatively hot year with 93 days having water temperatures above 20˚C. Visual observation of the data (monthly means from 2007 to 2020) seems to indicate that June is getting colder and September, hotter (mean temperature of summer months). That did not carry through to the year 2020, in which September was a much colder month overall. High temperature occurrences of 25˚C appear to be becoming more common in recent years (2015 to 2018).

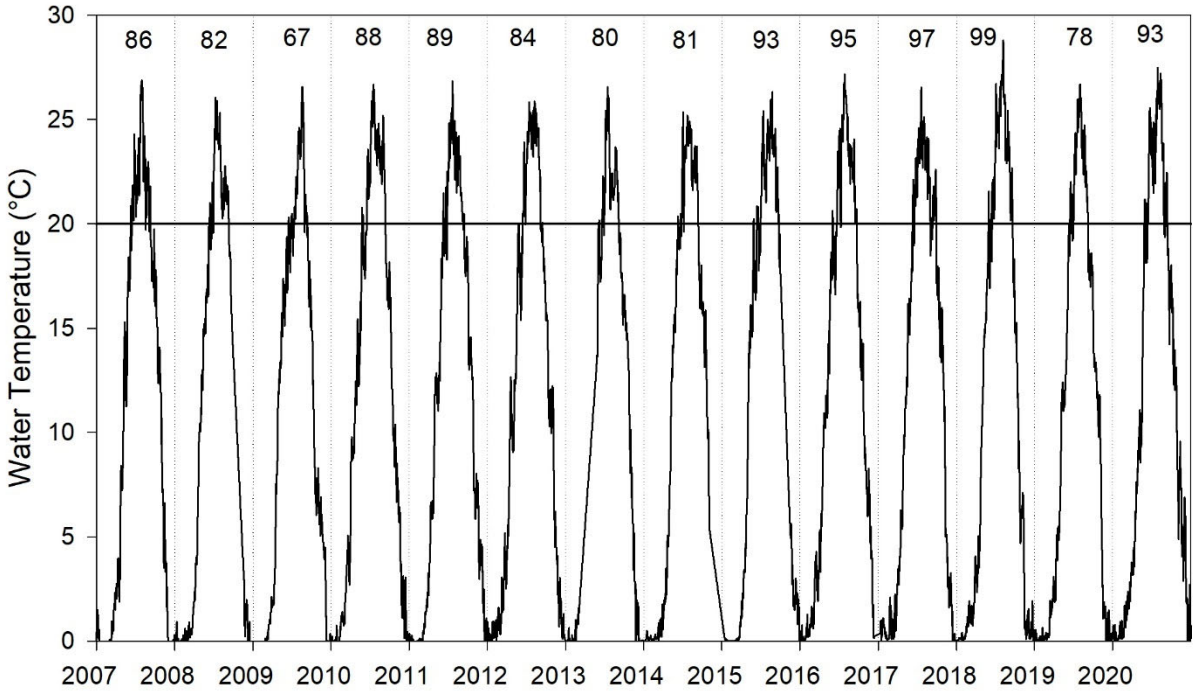


Figure 4: Mean daily water temperatures and number of days with water temperatures > 20˚C at Milltown between 2007 and 2020 (Note: sensor was not operational for spring 2012 and fall 2015).

3.2.2 Interpretation of Grab Samples Results

Two grab samples were collected in 2020 at the Milltown station and the Forest City station. ECCC's Atlantic Laboratory for Environmental Testing located in Moncton, NB was shut down due to COVID-19 from March 2020 until January 2021. Analysis for the March samples at each site were only partially completed before the shut down began, so only non-metals analysis were completed. Metals samples passed their holding times during the extended shut-down and so were discarded. The samples collected in November 2020 were analysed at RPC Laboratory in Fredericton as part of the Federal-Provincial Water Quality Agreement with the Province of New Brunswick. That Agreement facilitates cooperation between Federal and Provincial governments on water monitoring activities in the province.

St. Croix River at Milltown, NB

Results for each sample taken at Milltown are shown in Appendix 5, along with the applicable CCME guideline for the protection of freshwater aquatic life. Where no CCME guideline exists for a parameter, the most pertinent guidelines from other provinces were used as reference. A summary of the parameters analyzed is included below.

- As in previous years, total aluminum exceeded the CCME guideline of 100 micrograms per litre (µg/L) in 2020. Elevated levels of aluminum are fairly common in Atlantic Canada, although links between elevated aluminum levels and local fish health are not clear. This is believed to be because most of the aluminum in Atlantic Canada rivers is complexed with organic compounds and therefore not bio-available to aquatic life.

  Dennis and Clair (2012) produced data which supported that theory and they developed an algorithm for calculating the amount of complexed aluminum based on measured total organic carbon (TOC) in Atlantic rivers. With a TOC value of 8.1 mg/L, the calculated complexed aluminum concentrations made up a large proportion of the measured total aluminum (> 75%).

- The 2020 sample had a cadmium concentration exceeding the calculated CCME guideline (0.04 µg/L). This guideline has been exceeded in the past (e.g. 2016, 2019), although caution should be used as the guideline value is within 10 times the laboratory detection limit for cadmium.

  The CCME guidelines for cadmium, copper, nickel and lead, and the British Columbia Ministry of Environment (BC MOE) guideline for zinc are based on formulae that use water hardness to determine guideline concentration and which also have a minimum base values. Based on the water hardness at the Milltown station (17.7 mg/L), we used the minimum values stated in the CCME and BC MOE guidelines for these metals (Appendix 5).

- Total phosphorus was four times higher at Milltown than at Forest City, and the sample slightly exceeded the Ontario Ministry of the Environment (OMOE, 1994) phosphorus guideline of 0.03 mg/L. Similarly, nitrate was also higher at Milltown than at Forest City, although concentrations were well below the CCME guideline. The differences between the two sites suggest that sources such as municipal and industrial wastewater and inputs from major tributaries are likely contributing to nutrient loads. Measurement of nutrients (nitrogen and phosphorus) at Milltown may also be influenced by marine derived nutrients from migrating alewife. Increased nutrients could result in an increase in algal production in the lower reaches of the river and the estuary.

St. Croix River at Forest City, ME

Results for samples taken at Forest City are shown in Appendix 5, along with applicable guidelines for the protection of freshwater aquatic life. Where no CCME guideline exists for a parameter, the most pertinent guidelines from other provinces were used as reference. In 2020, the November sample at Forest City slightly exceeded the guideline value for aluminum. As in indicated for Milltown, aluminum in that sample would be largely complexed with organic carbon (TOC = 3.9 mg/L), rendering it less bioavailable to aquatic species.

Water Quality Index

The CCME water quality index (WQI) is a useful tool to assess water quality at regularly visited monitoring sites. It measures the frequency and extent to which selected parameters exceed water quality guidelines and reports the results as a single score. This allows for a quick assessment of the status of the water body and can be used as an indicator of overall aquatic health. Further analysis should always be completed on individual parameters in addition to other assessments (e.g. biological) for a full evaluation of aquatic health. More information on the CCME WQI is available at: http://www.ccme.ca/ourwork/water.html?category_id=102.

The WQI ratings for 2020 could not be calculated due to the limited number of samples collected. The WQI requires a minimum of three samples per year, which was not attained for either site in 2020. Graph included below provides ratings for 2007 to 2019.

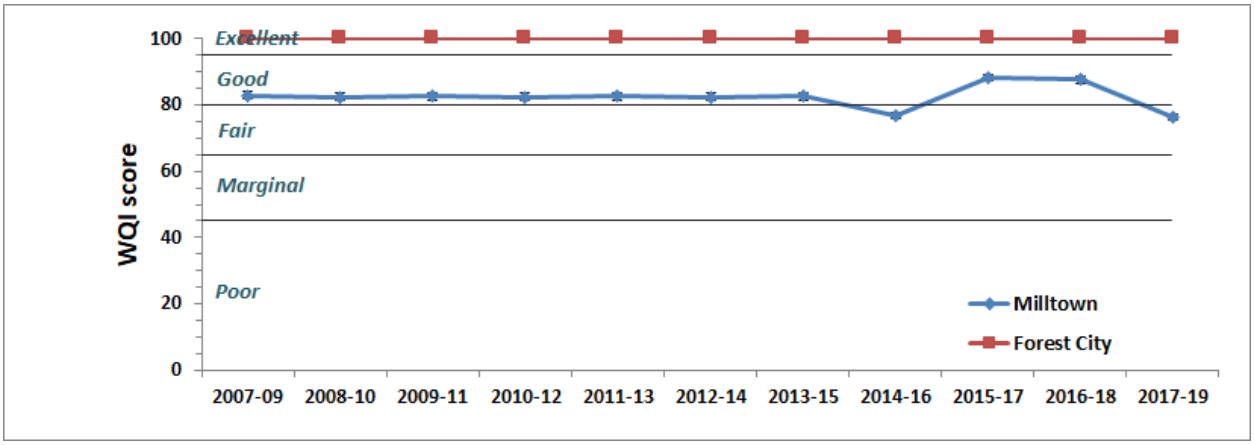


Figure 5: Water Quality Index scores, 2007 to 2019

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4.0 STATUS OF POLLUTION ABATEMENT

4.1 Maine

Baileyville: Permit compliance reporting to the Maine Department of Environmental Protection (Department) for the Baileyville Wastewater Treatment Facility (Facility) indicated there were no Sanitary Sewer Overflow (SSO) events in 2020. The Town of Baileyville has completed several inflow and infiltration (I/I) removal projects as part of a 3-phased approach, which have successfully removed excess flows from the collection system. There were no reports of permit numeric limitation violations in 2020. The Department's most recent on-site compliance inspection was completed on January 22, 2020. This inspection was focused on the laboratory and self-monitoring requirements. Some minor deficiencies were identified, and corrective actions were implemented by Facility staff. A Facility check-in, via the phone, was conducted on March 31, 2020 to ensure there were no anticipated problems related to the pandemic. The Department's next on-site compliance inspection will be conducted prior to September 30, 2021.

Calais: Permit compliance reporting to the Department for the City of Calais Wastewater Treatment Facility (Facility) noted one Sanitary Sewer Overflow (SSO) event in 2020. The SSO event was due to vandalism. Someone placed a branch and some pallet straps in a manhole causing a blockage and manhole overflow. The Facility is part of the Department's Combined Sewer Overflow (CSO) Program and has a Department approved CSO Master Plan which was updated in November 2020. The updated CSO Master Plan lists the many I/I projects that have been completed as well as a tentative schedule for completing the list of projects out to the year 2025. The Department's most recent inspection was a COVID-19 phone call on March 31, 2020. This inspection was a questionnaire for staff scheduling and backup operator options, should facility staff contract COVID-19 and need to be quarantined. The next inspection will be conducted prior to July 2021.

Woodland Pulp: In 2020, the Woodland Pulp Mill (Mill) in Baileyville reported one exceedance related to wastewater discharge permit numeric limitations. There was a temperature exceedance of 106^{o}F on a limit of 105^{o}F at outfall 002 on April 13, 2020. Outfall 002 is condensate, cooling water and storm water. The air compressors, which are water cooled, had partially plugged water filters. Because the filters were partially plugged the flow of water in the line was reduced and the water had more time to heat up which caused the water to increase in temperature greater than normal. Cleaning the filters and switching to a different, cooler, water source resolved the problem.

There were no reported unauthorized discharges of wastewater to the river or tributary streams reported in 2020.

The Department issued a Notice of Violation to the Mill on January 22, 2020 for a spill of foam to the ground and nearby woods that occurred on November 19, 2019. Department staff conducted a COVID-19 readiness review on March 26, 2020 by telephone, to determine the Mill's plans to maintain wastewater operations and compliance as well as COVID-19 testing of staff. On October 8, 2020 Department staff verified the condition of containment built around an effluent line vent and that aerators were operating in the treatment lagoons. No formal inspections were conducted due to the COVID-19 pandemic.

4.2 New Brunswick

McAdam: The McAdam wastewater treatment facility continues to meet the effluent requirements of the Province of New Brunswick, except for two suspended solids exceedances in November and December. The McAdam wastewater treatment facility is an oxidation type system that uses an activated sludge process. During the fall period, the McAdam wastewater treatment facility had issues with the aerators in the lagoon. However, this issue has been rectified and the most recent results from February 2021 are in compliance with the effluent discharge limits. There were four wastewater overflow events that occurred during rain and rain/snow melt events in 2020.

St. Stephen: The wastewater lagoon system along Dennis Stream continues to meet the effluent requirements of the Province of New Brunswick. Two wastewater bypass events were reported in 2020, due to power outages that took place in June and August. According to the latest Approval to Operate issued by the Department, any overflows caused by heavy rain and/ or rapid snowmelt are also required to be reported immediately as emergency events. In 2020, there were 13 wastewater overflow events reported during rain and rain/snow melt events.

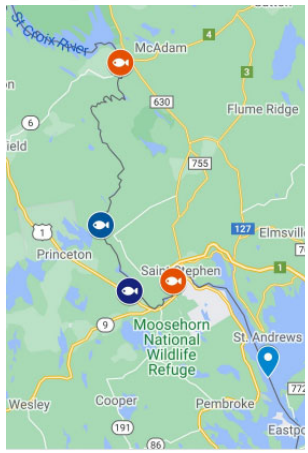
Champlain Industrial Park: The extended aeration facility treats the domestic wastewater of its employees as well as the industrial inputs from the industrial park.
The effluent currently meets the limits set in the Approval to Operate, except for six suspended solids exceedances. The facility continues to work on a multi-cell approach to address the suspended solids problems and plans to upgrade the wastewater treatment system in 2021. There were no wastewater bypass events reported in 2020.

Evergreen Acres: The facultative lagoon treats the domestic wastewater of the 58 mobile homes in the park. The facility discharges treated effluent to the marshy headwaters of Meadow Brook. In 2014, a new owner purchased this property and made upgrades to both the potable and domestic systems. In 2018, another new owner purchased this property, and received an Approval to Operate containing an effluent monitoring program. Department staff will follow up on the overdue annual report to ensure that they have completed the required effluent testing.

5.0 FISHERIES

5.1 Anadromous Fisheries

Anadromous fish, fish that migrate from the sea up rivers to spawn, include species such as salmon and river herring. Although salmon have not been observed in the area for several years, the herring populations have been steadily increasing. To reach their spawning habitat, anadromous fish entering the St. Croix River pass through up to four (4) dam systems, equipped with fish passageways. The first dam in the fish upstream passage is the Milltown Hydro Power Station (Milltown Dam), then the Woodland Pulp mill (Woodland Dam), followed by Grand Falls Dam, and ending at Vanceboro Dam.



(Google, 2021)

In response to the local stakeholder interest in the river herring population in the St. Croix watershed, a fish count process was initiated in 1981 and DFO installed a research trap at the NB Power Milltown Hydro Power Station fishway.

From 1981 to 2006, the counting facility was operated seasonally for up to seven months each year in order to document all inbound fish but notably Atlantic salmon (*Salmo salar*), river herring [alewives or Gaspereau (*Alosa pseudoharengus*), and blueback herring (*Alosa aestivalis*)]. Beginning in 2007 and continuing to the present, the counting facility was operational from May - July and primarily focused on documenting the annual river herring run.

Fish passage in the St. Croix River was limited during the period of 1995 – 2013 when the upstream fishways at the Woodland and Grand Falls dams were blocked, preventing passage of the spawning river herring. In 2001, the Department of Fisheries & Oceans Canada began to restock the river by transporting a portion of the spawning run from Milltown to Woodland Flowage, above the Woodland Dam. Subsequently, barriers in these fishways were removed in 2008 and 2013, respectfully.

Weekly Trap Reports were issued and made available to the public by request, through social media and an email distribution list of approximately 140 individuals and organizations. Based on the requests of various end users, the report was updated to include additional information, such as the daily count, weather, and water levels. In total, 13 reports were prepared and distributed in 2020.

On April 15, 2020, the research trap was opened and the fishway activated by NB Power. At the time of activation, spring river flows were 4440 cubic feet per second (cfs). Due to the configuration of the Milltown dam and fishway, river flows greater than 5000 cfs significantly limit attraction and effective operation of the fishway. River flows did not exceed 4440 cfs during the 2020 fish count.

The operation of the research trap and access to the facilities were severely impacted by the safety protocols initiated in response to the COVID-19 pandemic. Access to the facility was initially denied and DFO did not authorize the use of the fish trap for the 2020 season. With the assistance of NB Power and DFO, access for one staff member was granted in time to prepare for the fish count. As additional staffing was not an option, video surveillance was determined to be the most effective solution. On April 27, 2020 NB Power installed a security camera over the fishway "whiteboard" – the area of the fish ladder where passing fish are counted. The camera was wired to a laptop in the SCIWC building on site, where video could be saved and viewed. Video was recorded daily between 6 am-10 pm, and the recordings were saved on a 2 TB external hard drive for viewing. The size of the video files was substantial enough that less than a week of videos could be stored. By way of click counting, the fish could be counted from the video, therefore reducing the number of hours and staffing required at the dam. From the installation date to the end of the season, July 30th, the camera operated effectively with only two (2) days of lost data (May 20th – 21st) when the camera failed to record.

On May 13th, after Covid-19 restrictions were relaxed in the province of New Brunswick, further access to the fishway and fish trap was granted and the entrance of the fishway was checked for the first time. No fish were seen at the base of the fishway, nor were there any signs of cormorants fishing down river. The entrance of the fishway was checked daily thereafter. The first fish was recorded on May 18th. However, on May 17th, an otter below the dam was observed eating a shad that could have been the 'first fish'.

Figure 6: Otter at Milltown Dam, 2020

Turbine 7, closest to the entrance of the fishway, was shut off during peak run times (8 am – 8 pm) each day, to ease fish passage by reducing turbulence near the fishway entrance. Additionally, the GIS system (Gas Infusion System) operated throughout the season and lights were installed over the fishway, increasing visibility of the camera footage taken after dusk.

In 2020, water levels in the river were lower than usual and this is thought to have affected the migration of river herring in the St. Croix/Skutik. Because of this low water, on June 16th, NB Power staff adjusted the boards at the fishway exit to modify flow in the fish ladder and see if this change would entice the fish. The water line used for attraction at the entrance was also reduced. On June 29th, the headpond levels were adjusted due to the low levels in the river. The attraction was turned back on to regular levels.

A total of 611,907 alewife and blueback herring were recorded at the Milltown trap in 2020, a 25.8% increase from the 486,500 alewife and blueback herring counted in 2019. The ten-year average for alewife and blueback herring is 175,863 (2011 – 2020). See Table 2.

The list of species counted is included in Table 3.

A total of 58 fish scale samples were collected and submitted to Maine Department of Marine Resources (results are delayed due to COVID-19). Results for past years are included in Table 4. Except for the one shad found dead, scales were taken from live samples.

It is anticipated that the river herring run will exceed one million fish in 2021 and COVID-19 related restrictions will continue.

Table 2: Ten-year Average Fish Count at Milltown Dam

Year	Total Count	Annual	Year	Total Count	Annual	Year	Total Count	Annual	Year	Total Count	Annual
1981		169,620	1991		586,910	2001		5,202	2011		25,142
1982		233,102	1992		203,750	2002		900	2012		36,168
1983		151,952	1993		297,720	2003		7,901	2013		16,677
1984		152,900	1994		350,154	2004		1,299	2014		27,312
1985		368,900	1995		274,079	2005		11,632	2015		93,503
1986		1,984,720	1996		645,978	2006		11,829	2016		33,016
1987		2,624,700	1997		225,521	2007		1,294	2017		157,750
1988		2,590,750	1998		177,317	2008		12,261	2018		270,659
1989		1,164,860	1999		25,327	2009		10,450	2019		486,500
1990		1,531,250	2000		8,569	2010		59,145	2020		611,907
Decade Total		10,972,754			2,795,325			121,913			1,758,634
Average		1,097,275			279,533			12,191			175,863

Table 3: Summary Fish Count Totals by Species 2017 to 2020

Common Name	Scientific Name	Apr 26 – Jul 21, 2017	May 8 – Jul 16, 2018	May 1 – Jul 21, 2019	May 18 – Jul 30, 2020
River herring: alewife & blueback	Alosa pseudoharengus & A. aestivalis	157,750	270,659	480,500	611,907
American Eel	Anguilla rostrata	5		4	10
American shad	Alosa sapidissima	56	255	29	29
Brook trout	Salvelinus fontinalis	2	3	5	0
Common shiner	Luxilus cornutus	2	1		0
Fallfish	Semotilus corporalis		2	1	0
Golden shiner	Notemigonus crysoleucas	3			0
Lamprey	Petromyzon marinus	8	0		0
Pumpkinseed sunfish	Lepomis gibbosus			1	0
Rainbow smelt	Osmerus mordax	1			0
Smallmouth bass	Micropterus dolomieu	45	23	6	1
Sunfish	Lepomis auratus	1			0
White sucker	Catostomus commersonii	94	87	43	1
Unknown Fish					6
Total		157,967	271,030	480,589	611,954
			71.5% ↑	77.3% ↑	27.3% ↑

Table 4: Scale Sample Summary 2010 to 2019

Year	Escapmt at Milltown	Sample size (for age)	Age distribution from scale data						Sample repeat spawners		Sample Mean Wt. (g)	Sample Mean FL (mm)
			Age 3		Age 4		Age 5					
			#	%	#	%	#	%	#	%		
2010	58776	151	2.0	1.3	69.0	46.0	76.0	50.0	42.0	27.8	204.0	247.0
2011	25142	51	1.0	2.0	32.0	62.7	11.0	21.6	16.0	31.4	207.0	250.0
2012	36168	61	1.0	1.6	31.0	50.8	20.0	32.8	21.0	34.4	224.0	254.0
2013	16677	26	2.0	7.7	14.0	53.8	8.0	30.8	10.0	37.0	201.0	249.0
2014	27312	69	12.0	17.4	40.0	58.0	12.0	17.4	16.0	23.0	191.0	242.0
2015	93503	87	2.0	5.0	74.0	85.0	6.0	7.0	11.0	13.0	200.0	247.0
2016	33016	52	2.0	4.0	22.0	42.0	26.0	50.0	18.0	35.0	215.0	251.0
2017	157750	45	4.0	8.9	23.0	51.1	8.0	17.8	14.0	31.1	na	253.0
2018	270659	41	11.0	26.8	26.0	63.4	4.0	9.8	3.0	7.3	na	241.0
2019	486500	45	4.0	8.9	34.0	75.6	6.0	13.3	7.0	15.6	223.6	247.8

5.2 Shellfish Harvesting

New Brunswick: Shellfish harvesting occurs principally in Oak Bay, either for direct marketing within areas designated as conditionally approved, or for depuration in areas designated as restricted. Environment and Climate Change Canada (ECCC) sampled Oak Bay and the lower St. Croix River marine water quality stations on three occasions from September 1 to October 29, 2020. Additional water quality sampling was performed as part of the bay's Conditional Management Plan (CMP), which allows shellfish harvesting during dry / low rainfall conditions.

In 2020, bacterial densities within the conditionally managed portions of Oak Bay ranged from <2 to 33 MPN FC per 100 mL. Densities within the Restricted areas ranged from <2 to 130 MPN FC per 100 mL. Sampling occurred under rainfall conditions ranging from dry to 29 mm within 72 hours of sampling. The survey results indicate that water throughout the conditionally approved portions of Oak Bay had returned to acceptable levels two days following rainfall accumulations of 29 mm rainfall on August 30, 2020. This water quality recovery time is consistent with that observed in 2019, three days following a 39 mm rainfall event in mid-July. Water quality remains satisfactory within the approved portions of the lower St. Croix River estuary.

A comparison of 2020 bacterial results with those for 2014 to 2019 (n = 30) does not signal any departure from the norm. Notwithstanding background bacterial density fluctuations at individual sampling stations in response to environmental conditions, water

quality within the survey area is relatively stable overall. The survey data also indicate the continued need for a large portion of the bay waters to be managed conditionally based on rainfall.

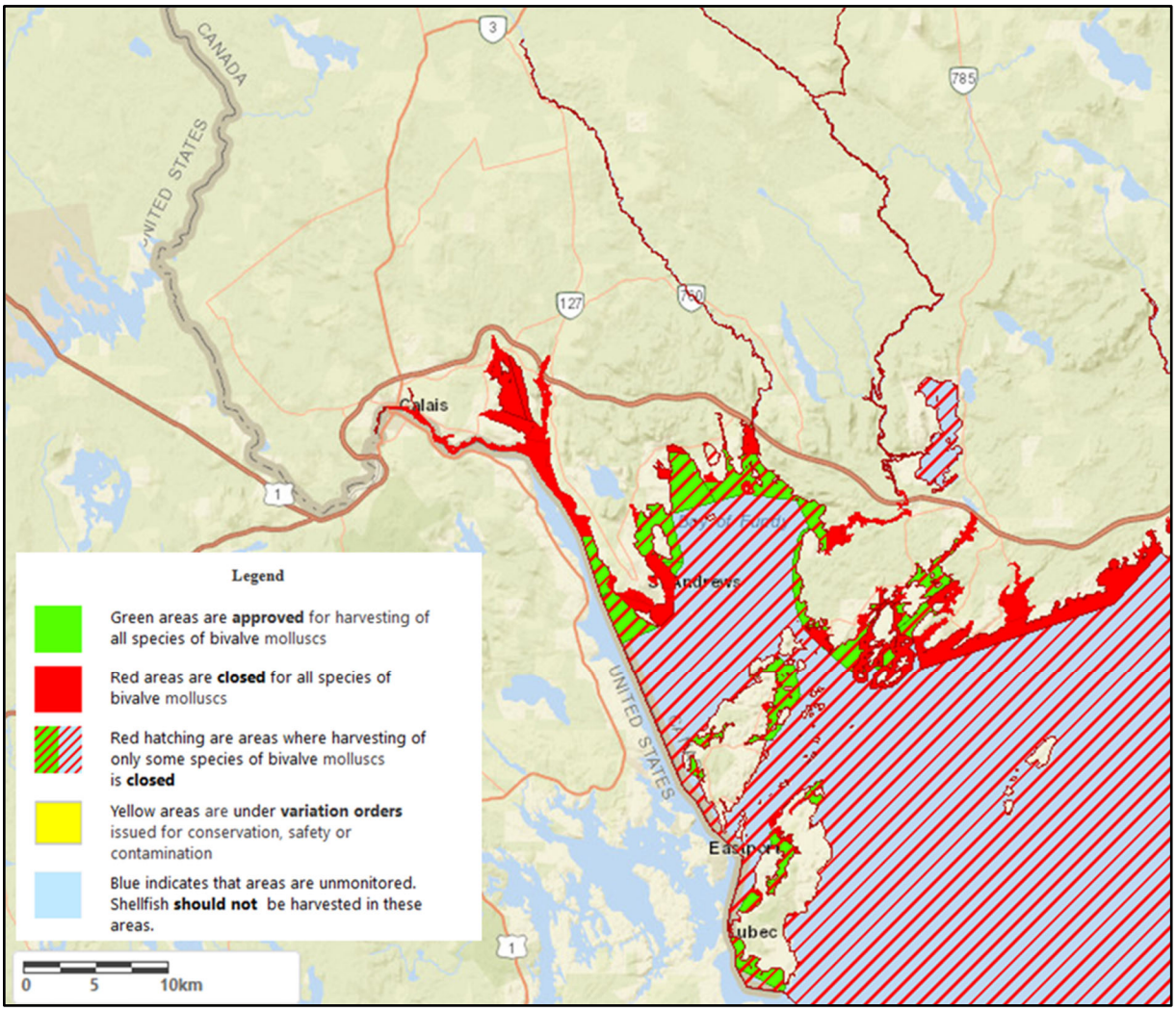


Figure 7: Shellfish Harvest Area Closures - St. Croix River Areas, NB (April 2021)

Source: https://gisp.dfo-mpo.gc.ca/Html5Viewer/Index.html?viewer=CSSP_Public_En_Site&locale=en (Note: The Canadian Shellfish Sanitation Program (CSSP) is a federal food safety program jointly administered by the Canadian Food Inspection Agency (CFIA), Environment and Climate Change Canada (ECCC) and Fisheries and Oceans Canada (DFO). DFO communicates shellfish harvest area closures through the real-time map of shellfish harvest area closures below).

Maine: The Calais, Robbinston, and Perry, Maine shoreline has limited habitat for commercial shellfish. The shellfish areas along the shoreline are currently classified as "Prohibited" to shell fishing by Maine Division of Marine Resources because of pollution.

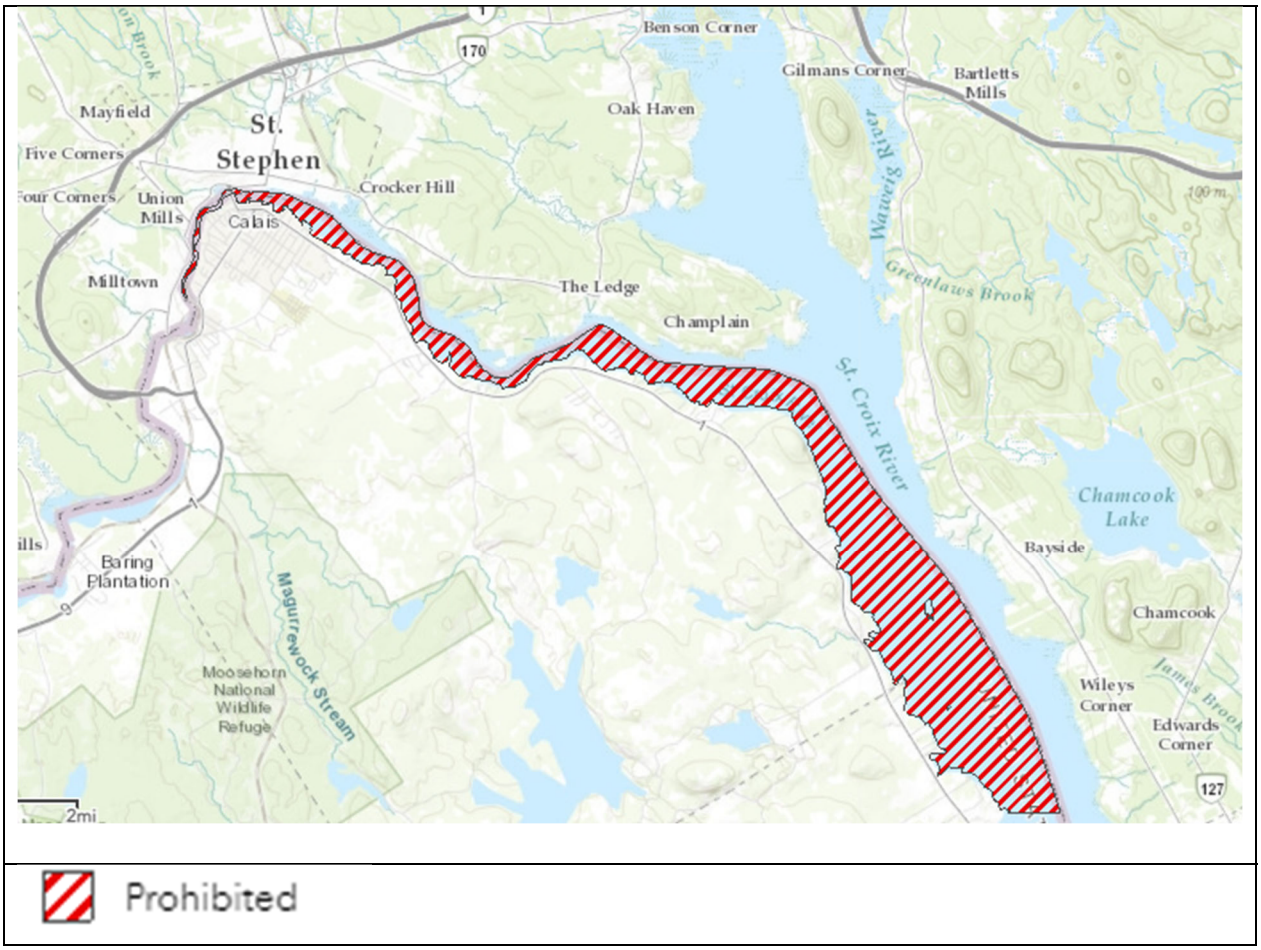


Figure 8: Shellfish Harvest Area Closures - St. Croix River Areas, Maine (April 2021)

Source:https://www.maine.gov/dmr/shellfish-sanitation-management/maps/index.html

6.0 INTERNATIONAL WATERSHED INITIATIVE PROGRAM

The following are projects in the St. Croix watershed that are supported in part by the IJC's International Watershed Initiative (IWI) program.

6.1 St. Croix International Waterway Commission Alewife Count at Milltown Dam

In 2020, the IWI program, through an agreement with the St. Croix International Waterway Commission (SCIWC), continued to provide support for the alewife count at Milltown Dam in partnership with the efforts of other government and non-governmental organizations. The collected data is discussed in Section 5.0 of this report, and detailed counts over time are presented in Appendix 6.

6.2 St. Croix International Waterway Commission Map & Document Library

In 2020, the St. Croix International Waterway Commission (SCIWC) received funding from the IWI to catalogue their in-house library of historical maps, studies and documents collected since their inception in 1986. This includes 1000+ studies, books, and reports, as well as 723 maps that are primarily dated from the 1940s – 1990s and from various counties in New Brunswick.

In early 2020, local historians, a professional archivist, and a local service commission were given access to the maps for their comment. Based on their initial assessment, it was recommended that the maps, although having little monetary value, have the potential to provide some important historical environmental context, especially as it relates to forestry.

To assess the value of the library and map collection, the items needed to be catalogued, with the end goal of making these documents available to the public. An arrangement was made with the Southwest New Brunswick Service Commission (www.snbsc.ca) to use their equipment to scan the maps.

To date, the 723 maps have been scanned and catalogued, and 234 documents have been catalogued using the Integrated Library System (ILS) Librarika. For each document, publication details, scanned cover, and description of the document are completed. The link to Librarika https://SCIWC.librarika.com is posted on the www.stcroix.org website for public viewing.

6.3 St. Croix International Waterway Commission Youth Engagement Program

With the support of the IWI and the Board, the St. Croix International Waterway Commission (SCIWC) developed an outdoor education curriculum, similar to the Washington County Community College's Outdoor Adventure Center program, 'In My Back Yard: Connecting Children to Local Outdoor Resources in the St. Croix River Valley'. The goal for the program was to work collaboratively with the St. Stephen Elementary and Milltown Elementary schools and teachers, Peskotomuhkati elders, municipality and local organizations and businesses to facilitate the delivery of the proposed curriculum for Grade 5 students in the St. Stephen community. The curriculum includes multiple full-day outdoor sessions that provide experiences focused on stewardship of the St. Croix River watershed, water quality data collection, local outdoor history, and outdoor recreation ethics.

Preliminary curriculum was drafted and the SCIWC conducted a trial run, testing four one-day camps at Spednic Lake Provincial Park in August 2020. Each camp had 3-7 registered participants aged 8-12. The themes of the camps were Thriving is the New Surviving, Zombie Apocalypse Survival, Wings & Things, and Nature's Canvas.

Together with the support of the St. Stephen area middle school principals and teachers, a program sessions, schedules and logistics for the youth engagement program were completed and accepted by the school board.

Sessions were due to be delivered beginning in December 2020, but due to COVID-19 restrictions, have been delayed until spring 2021. The sessions will also be made more broadly available to educators or other groups who interested in implementing an Outdoor Education Program.

6.4 University of New Brunswick Watershed Stressor Index

To better understand influences on water quality within the St. Croix River, the Canadian Rivers Institute (CRI) at the University of New Brunswick was contracted to conduct an analysis of key stressors for the watershed and identify areas of the watershed that might be under greater pressure from these stressors. The analysis uses an aggregated stress index, called the Watershed Stressor Index (WSI), which was initially developed by the Nature Conservancy of Canada. This type of index uses geospatial data for a range of stressors including point source pollution, land use, river crossings, and barriers to fish passage in order to produce scores for the individual stressors and individual watershed units. Results are then looked at cumulatively in order to produce an overall stress score

for the individual watershed units. These scores can be used to identify areas within the watershed at higher risk to anthropogenic stressors and to prioritize units within the watershed for further monitoring or restoration/conservation activities.

The CRI is currently finalizing the list of key stressors, compiling relevant data from trusted data sources, conducting initial calculations, and running the WSI analysis for the watershed. Preliminary results of the WSI analysis are anticipated in April. Once the WSI analysis is completed, the CRI will also produce a story map outlining the process and results that will be shared on the Board's website.

6.5 LimnoTech Fish Passage Study

The study entitled "Exploring Upstream and Downstream Fish Passage Improvements on the Lower St. Croix River" was performed by LimnoTech under contract to the IJC at the Board's request.

The study goal was to identify opportunities and constraints for options that maintain or improve fish passage in both upstream and downstream directions within the St Croix River at the Grand Falls and Woodland facilities, while accounting for natural and anthropogenic modifications within the river system. It produced a stepwise evaluation of evidence-based, species-specific options for fish passageway at the Woodland and Grand Falls facilities, which can be used in planning for ongoing support of sea-run anadromous species and their populations within the St. Croix River system. The study greatly benefited by local and regional experiences and a workgroup composed of selected regional experts and stakeholders with a shared interest in enhancing and recovering the sea-run populations of the St. Croix River.

The study presents a range of fishway alternatives both upstream and downstream passage at Woodland Dam and at Grand Falls Dam and powerhouse. The report provides ballpark cost estimates for construction and identifies data gaps and studies needed to fill the data gaps. The Board will release the final report in 2021 for informational purposes.

7.0 OTHER ITEMS TO REPORT

7.1 Environment and Climate Change Canada Water Quality Trend Analysis Study

At the request of the Board, Environment and Climate Change Canada (ECCC) conducted a trend analysis on water quality grab samples collected in the upper watershed, below the Forest City Dam, and in the lower watershed, above Milltown Dam. The objective of this study was to use long-term water quality data from the ECCC Forest City and Milltown Stations to determine whether there have been trends in water quality parameters. Analysis was conducted for most parameters over a 12-year period from 2007 to 2018, and for select metal parameters over a seven-year period from 2011 to 2018. Metal data prior to 2011 was not included in the analysis due to a change in testing methodology. The final report was provided to the Board and IJC in 2020, and a copy of the report was posted to the St. Croix Board website. The results of this report were also used to inform development on the IWI Watershed Stressor Index project that is currently underway.

7.2 Environment and Climate Change Canada Biomonitoring in the St. Croix Watershed

The Canadian Aquatic Biomonitoring Network (CABIN) program[1] is a national aquatic biological monitoring program led by Environment and Climate Change Canada (ECCC). CABIN assesses freshwater quality by looking at aquatic benthic macroinvertebrates using standardized methods. CABIN compliments ECCC's various water quality monitoring programs to enable an integrated approach to watershed monitoring and assessment.

CABIN primarily uses the Reference Condition Approach (RCA) for study design and site assessment. It utilizes measures of benthic macroinvertebrates, including immature forms of aquatic insects, snails, crustaceans, worms, and mites. They are a commonly used indicator as they are widespread, abundant, and have long enough life cycles to reflect the pollution 'history' of a river (Rosenberg & Resh, 1993). The CABIN protocol incorporates other important elements of stream assessment such as water quality, substrate characteristics, and channel dimensions, thus making it an integrative method of ecological, chemical, and physical parameters for assessing streams habitat.
To date, there have been six CABIN sites sampled by ECCC in the St. Croix watershed between 2010 and 2019. Four of the sites were originally selected with the purpose of

[1] https://www.canada.ca/fr/environnement-changement-climatique/services/reseau-canadien-biosurveillance-aquatique/science.html

being incorporated into the Atlantic RCA model, but can also help to provide some insight into the status of the St. Croix River. After some discussions in 2018 about including biomonitoring data in the IJC report, ECCC added two new sites in the sampling plan with the intention of gathering baseline biomonitoring data for the St. Croix in locations that will complement the long-term water quality grab samples that have also been collected by ECCC. More data collection is required to gain a full understanding of the condition of the St. Croix River and its tributaries.

7.3 St. Croix International Waterway Commission Quality Monitoring in the St. Croix Watershed

In 2020, the St. Croix International Waterway Commission (SCIWC) received funding from the New Brunswick Environmental Trust Fund (ETF) to continue water quality monitoring in the St. Croix Watershed.

Water quality samples were collected from 51 sites throughout the watershed. Each sample was analyzed by RPC Science & Engineering (www.rpc.ca) based on identified key matrix for surface water chemistry and metals, total suspended solids, and E.coli. A Field Observation Sheet was completed for each sample site that identified information such as weather conditions; water levels and clarity, presence in the water of algae, oil, film, foam, or garbage; presence of fish and aquatic insects; bank erosion and vegetation; and human utilization of the land for purposes such as ATV crossings, fishing, swimming, or construction. Additionally, at each site temperature, dissolved oxygen, conductivity, and pH measurements were taken using a YSI loaned to the Commission through the Atlantic Water Network Equipment Loaning Program managed by ACAP Saint John (www.acapsj.org). The samples, Field Observation Sheet and Sample Submission Form (Chain of Custody Record) were sent by courier to RPC for analysis.

The SCIWC continued to work with the Atlantic Water Network and uploaded the sample results DataStream Water Quality Monitoring Online Tool (https://atlanticdatastream.ca/).

7.4 St. Croix International Waterway Commission St. Croix Watershed Benthic Invertebrate Sampling Project

In 2020, the St. Croix International Waterway Commission (SCIWC) received funding from the New Brunswick Environmental Trust Fund (ETF) for a new project to collect benthic invertebrate samples in the St. Croix River watershed.

The location of the sampling along the St. Croix River was determined after consultations with Emma Garden, CABIN Training Coordinator, Water Science and Technology Directorate of Environment and Climate Change Canada (ECCC). A total of 6 sites were selected to assess the impact of the Billy Weston Brook runs directly through the Town of St Stephen into Dennis Stream, on the outer limits of St Stephen. These sites were selected for their depth, width, location, and comparable habitat/substrate features.

Each sample was collected in accordance with the CABIN (Canadian Aquatic Biomonitoring Network) protocols and utilizing the Field Manual Wadable Streams 2012. In addition to partnering with ECCC, the SCIWC also collaborated with Kim Reeder at ACAP Saint John, and with the Huntsman Marine Science Centre (HMSC). ACAP Saint John loaned SCIWC the necessary equipment to complete the sample collection. Ms. Reeder is CABIN certified and supervised the collection process. The samples were sent to HMSC for identification. ECCC created the project in the CABIN data base and will be used in conjunction with their ongoing project.

7.5 Next Steps Working Group

The Next Steps Working group includes representatives from the Passamaquoddy Tribes in the U.S., the Peskotomuhkati Nation at Skutik, U.S. Federal agencies (Environmental Protection Agency, Fish and Wildlife Services, Bureau of Indian Affairs, National Atmospheric and Oceanic Administration - National Marine Fisheries, Department of Agriculture), Fisheries and Oceans Canada, Maine Department of Marine Resources, the International St. Croix River Watershed Board, Global Affairs Canada, and the U.S. State Department. The working group has monthly calls and annual meetings to discuss restoration of the St. Croix River. Current topics of discussion include: the upcoming signing ceremony for the Skutik River Statement of Cooperation; improving fish passage; monitoring and research activities; and prioritization and coordination of activities including fish stocking, barrier surveys, and fish counting.

7.6 Fisheries and Oceans Canada (DFO) Coastal Restoration Fund in the St. Croix

DFO’s Coastal Restoration Fund is part of Canada’s national Oceans Protection Plan, which was launched May 2017. The fund provides $75 million over five years to support projects that help to restore coastal aquatic habitats. The fund addresses threats to marine habitats and species located on Canada's coasts and supports efforts that: contribute to strategic planning as well as identifying and responding to restoration priorities; rehabilitate aquatic habitats; contribute to long-term sustainability; and encourage and build local community capacity.

In 2018, DFO announced that the Passamaquoddy Recognition Group (Peskotomuhkati First Nation) will receive $1.65 million over five years to help restore fish passage and improve habitat quality on the Skutik, Waweig, Magaguadavic and Letang rivers in New Brunswick, and to support restoration of key migratory fish species, including Alewife, Atlantic and Shortnose Sturgeon, Striped Bass, Atlantic Salmon, and American Eel, to their native spawning ground.

In 2019, a portion of the funding provided to the Peskotomuhkati, Skutik was used to contract Dillon Consulting Limited for work on the St. Croix River. The Dillion project undertook an assessment of fish passageway conditions at Woodland and Grand Falls dam and assessed alternatives including a side-baffle design fishway to improve passage at these sites. Representatives from Dillion Consulting Limited provided a presentation on the project and preliminary findings at the Board's Board and Partners meeting in September. It is anticipated the final report will be available in 2021.

7.7 U.S. Federal Energy Regulatory Commission (FERC) Licensing

Note: The FERC licensing information provided in the Board's Annual Report is for general information purposes only.

Forest City Dam: Forest City Dam (Forest City Project) is owned and operated by Woodland Pulp LLC based out of Baileyville, Maine. The operation of the dam is subject to licensing by the U.S. Federal Energy Regulatory Commission (FERC). In November 2015, FERC issued a new 30-year license to Woodland Pulp LLC for continued operation and maintenance of the project. The license included a number of new conditions. In December 2015, Woodland filed a request for rehearing of license conditions. The rehearing was denied. In December 2016, Woodland filed an application with FERC to surrender the FERC license at Forest City Dam citing that the new licensing requirements rendered the project uneconomical. The surrender application proposed removing the gates on the U.S. side of the dam.

Woodland Pulp also submitted a request to FERC in July 2017 to determine whether the project was jurisdictional if the project was owned by the State of Maine. In December 2017, FERC denied the petition. Woodland Pulp LLC subsequently filed a request for a rehearing on the decision, and in February 2018 FERC granted a request for rehearing.

On August 28, 2019, FERC held a technical meeting to gather new technical information concerning the following three items: (1) whether there are alternative modes of project

operation that could demonstrably lower the project's impact on downstream generation; (2) whether there are methods for implementing license requirements in an economically efficient manner; and (3) whether there are decommissioning plans that would meet the needs of stakeholders. At the meeting, the Commissioner of the Maine Department of Inland Fish and Wildlife indicated that the State of Maine was no longer interested in taking over the dam, but is committed to working towards a solution to find an owner of the dam.

In October 2019, the Governor of Maine and the Premier of New Brunswick sent a letter to FERC proposing that an independent third party take over ownership of the dam (provided that an independent non-hydropower entity would not be subject to FERC licensing), and that Maine would lead efforts, in cooperation with New Brunswick to develop an acceptable operational plan for the Dam.

In May 2020, the State of Maine filed additional information with FERC to further support its goal of working with the Province to find an alternative to license surrender. New Brunswick also submitted a supplemental supportive letter.

Vanceboro Dam/Spednic Lake: Vanceboro Dam is owned and operated by Woodland Pulp LLC and used for hydropower storage. Energy is generated downstream at Grand Falls and Woodland Dams. On March 22, 2016, FERC issued a new 30-year license to Woodland Pulp LLC for continued operation of the Vanceboro Dam for hydropower storage. In 2020 Woodland Pulp LLC worked on fish and wildlife license requirements including investigating eel passage at the dam and monitoring Loon nesting on the reservoir.

7.8 Proposed Milltown Generating Station Decommissioning

Note: The Milltown decommissioning information is provided in the Board's Annual Report for general information purposes only.

The Milltown Generating Station and dam is owned by New Brunswick Power (NB Power). It was originally built in the late 1800s, with a number of modifications made in the early to mid-1900s. Currently, only four of the seven turbines are operational at the facility, and existing upstream and downstream fish passage systems are inefficient.

In 2018, NB Power communicated potential interest in upgrading the Milltown facility with new technologies and a new fish passage system. However, following a thorough engineering and cost evaluation of the existing station and the infrastructure required to

support these new technologies, it was determined that the refurbishment was not an economically viable option. Further, based on ongoing costs to maintain the facility and investments needed to meet new upstream and downstream fish passage systems requirements by Fisheries and Oceans Canada, it was determined that extending the life of the station was not financially feasible and that the Milltown Generating Station should therefore be decommissioned and the section of the river, known historically as Salmon Falls, be restored.

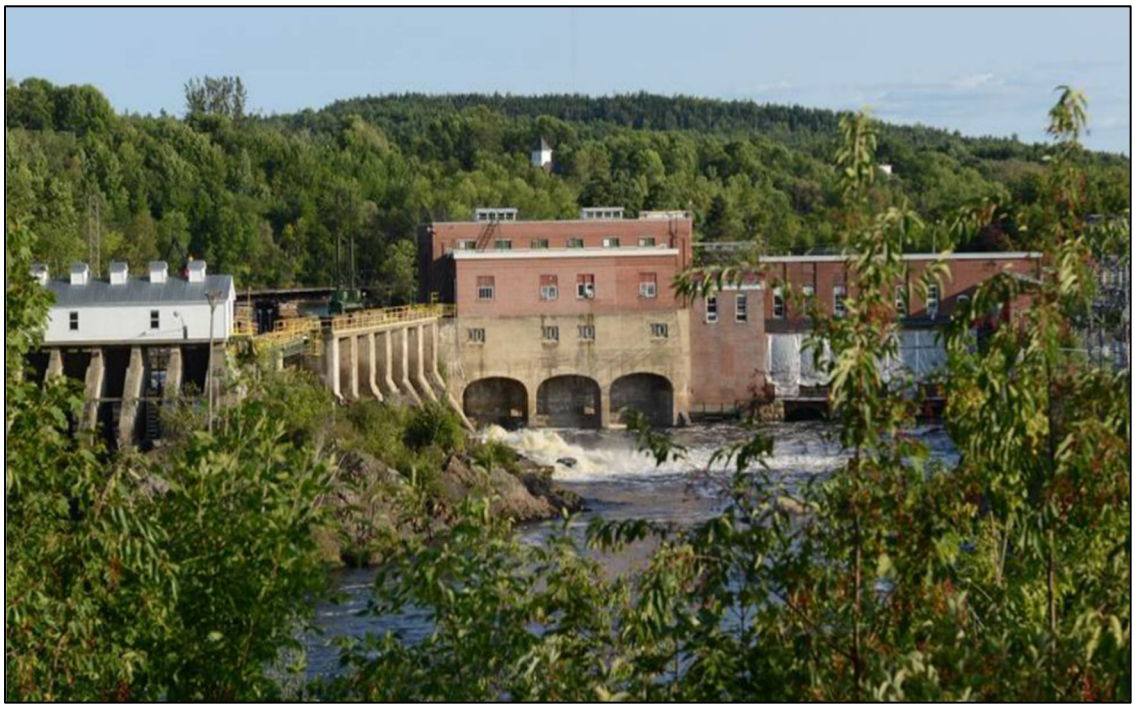


Figure 9: Milltown Generation Station
(Photo Source: NB Power, Presentation to Board December 4, 2019)

In December 2020, NB Power registered the Decommissioning Project for the Milltown Generation Station with the New Brunswick Department of Environment and Local Government's Environmental Impact Assessment. NB Power also indicated that it would submit the project proposal to appropriate U.S. Federal and state agencies over the winter of 2021 to seek necessary approvals and permits for the U.S. side of the border.

The proposed NB Power timelines, pending project approvals and regulatory permitting, indicate the decommissioning process would begin in spring-summer 2022 (10 to 16-month duration) with completion anticipated in spring-summer 2023. The station would continue to generate electricity until March 2022 and then in July 2022, following the end of the spring fish run, the system would be dewatered and the decommissioning process would commence.

7.9 Drought 2020

In 2020, the St. Croix Watershed experienced a “flash drought”. This is a short-term intense dry period that can follow a period of normal to above-normal precipitation.

Figure 10 illustrates the 2020 flows at the Baring gage. Flows were generally in the normal to above normal range in the spring but dropped to below normal from June to November due to low precipitation in the watershed.

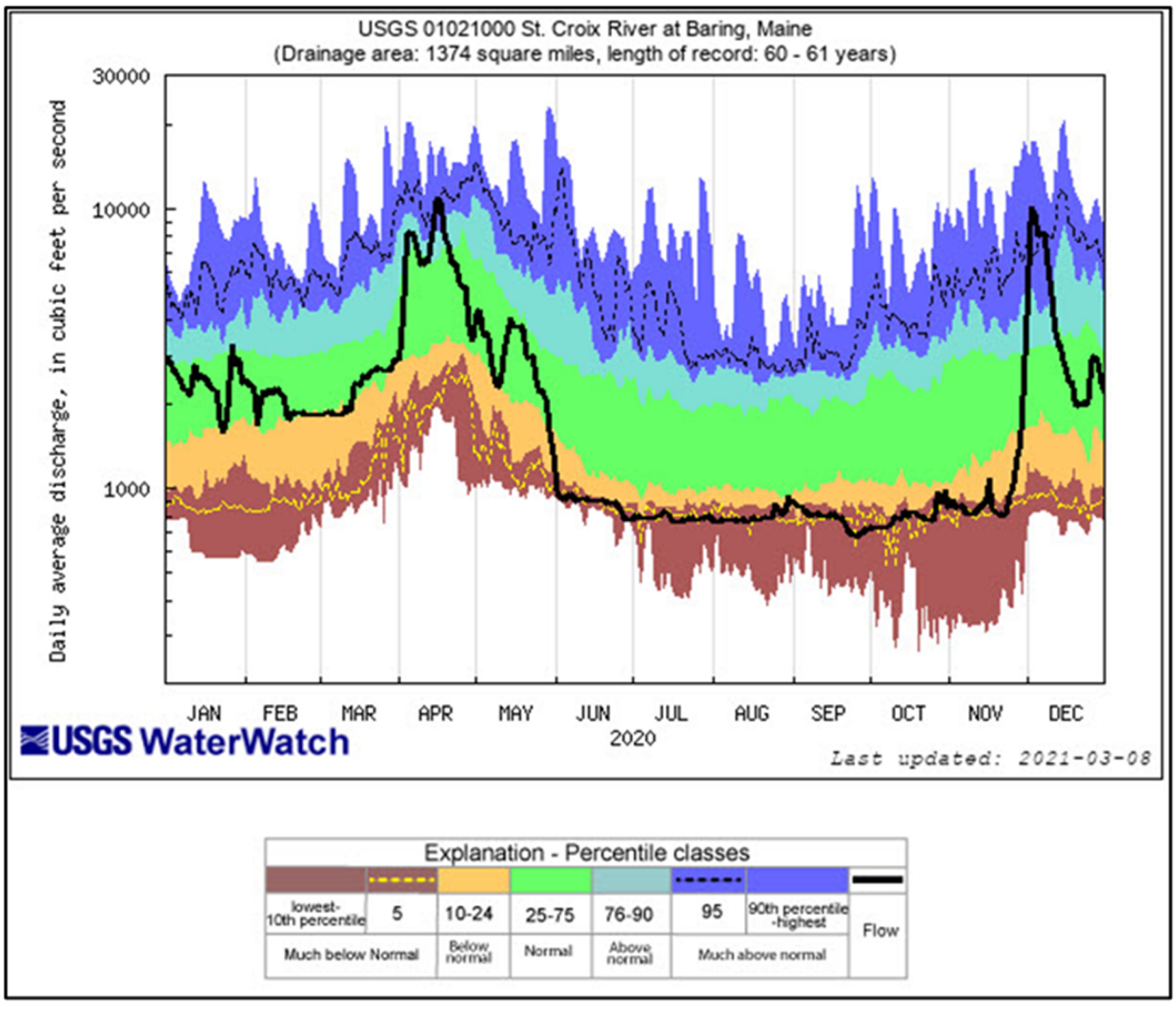


Figure 10: USGS WATER WATCH 2020

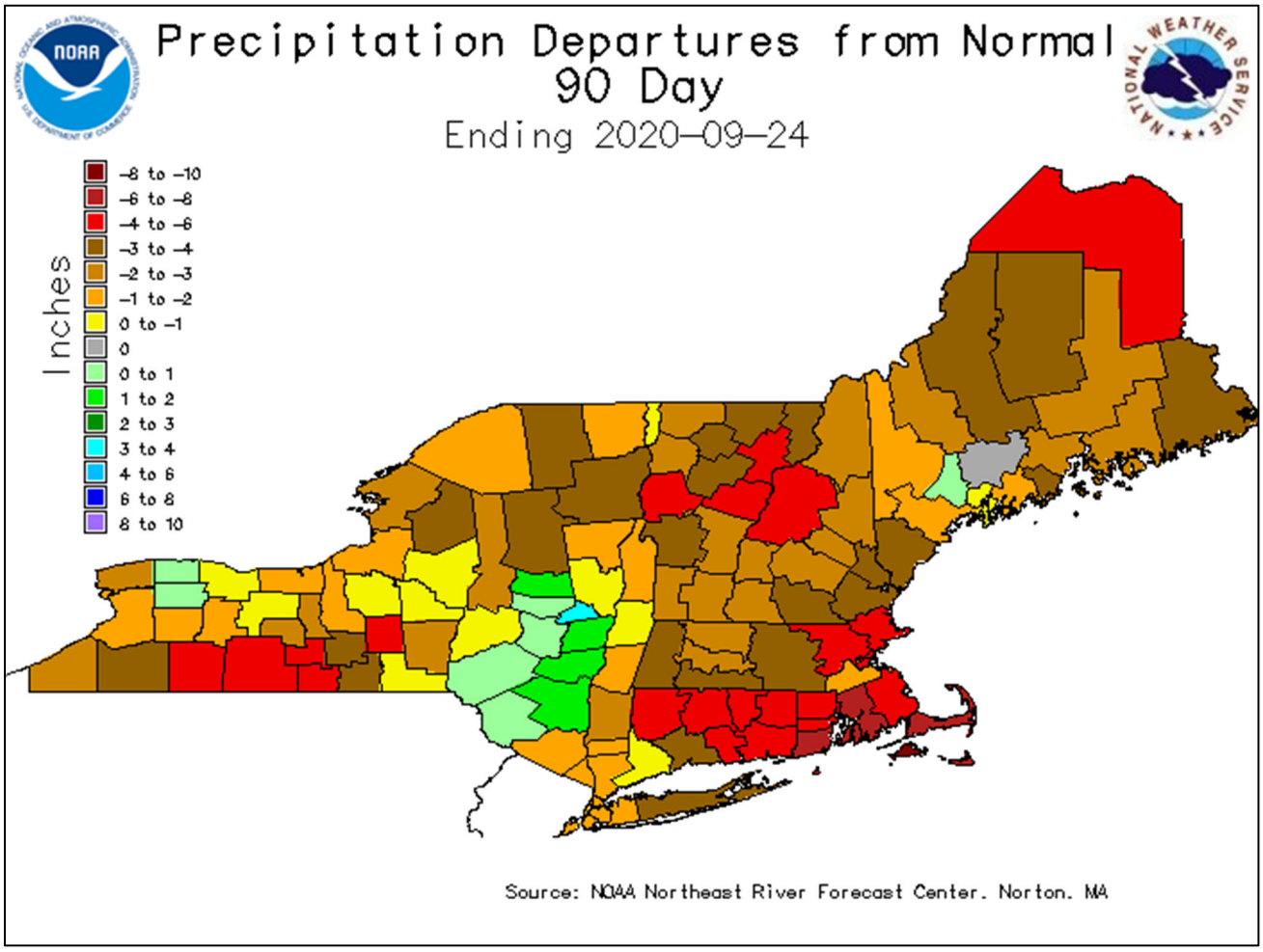


Figure 11: Precipitation in New England

7.10 Fish Kills at Canoose Flowage (New Brunswick)

Note: The Canoose Flowage fish kill incident is provided in the Board's Annual Report for general information purposes only.

Figure 12: Canoose Dam, New Brunswick

On October 3rd, Canada's National Environmental Emergencies Centre (NEEC) was notified of a reported fish kill at Canoose Flowage. The New Brunswick Department of Environment conducted an initial site inspection. During the inspection, it was noted that water levels in Canoose Flowage had dropped 2-3 metres below normal levels and there was little to no water at the dam itself. Upstream of the dam, hundreds of dead fish where found in a small pool of water. Preliminary assessment was that the incident was likely caused due to dry weather conditions associated with the drought experienced in the region during 2020. Some concern about the dam's state of repair were also noted, and Fisheries Officers from Fisheries and Oceans Canada (DFO) visited the site to assess the situation. They also concluded that the incident was likely caused by extreme dry weather conditions.

Canoose Flowage and the dam in question are located entirely in New Brunswick (about 5 kilometres from the Canada-U.S. boundary). The waters are part of the St. Croix River watershed but have no link with existing IJC Orders of Approval. The Board is tracking the issue. Domestic Federal and Provincial authorities, including Officers from Fisheries and Oceans Canada (DFO), are investigating and addressing the situation as appropriate.

7.11 U.S. Geological Survey (USGS) Tide Gage Station

The USGS in cooperation with the IJC established a tide gage station at the international bridge in Calais, Maine in October 2015. Water level data collected at the tide gage will be used to document trends over time and to capture real time storm surges at the mouth of the river. The average daily tide range at the site has been recorded at approximately 24 feet. Date from 2020 is presented in Figure 13.

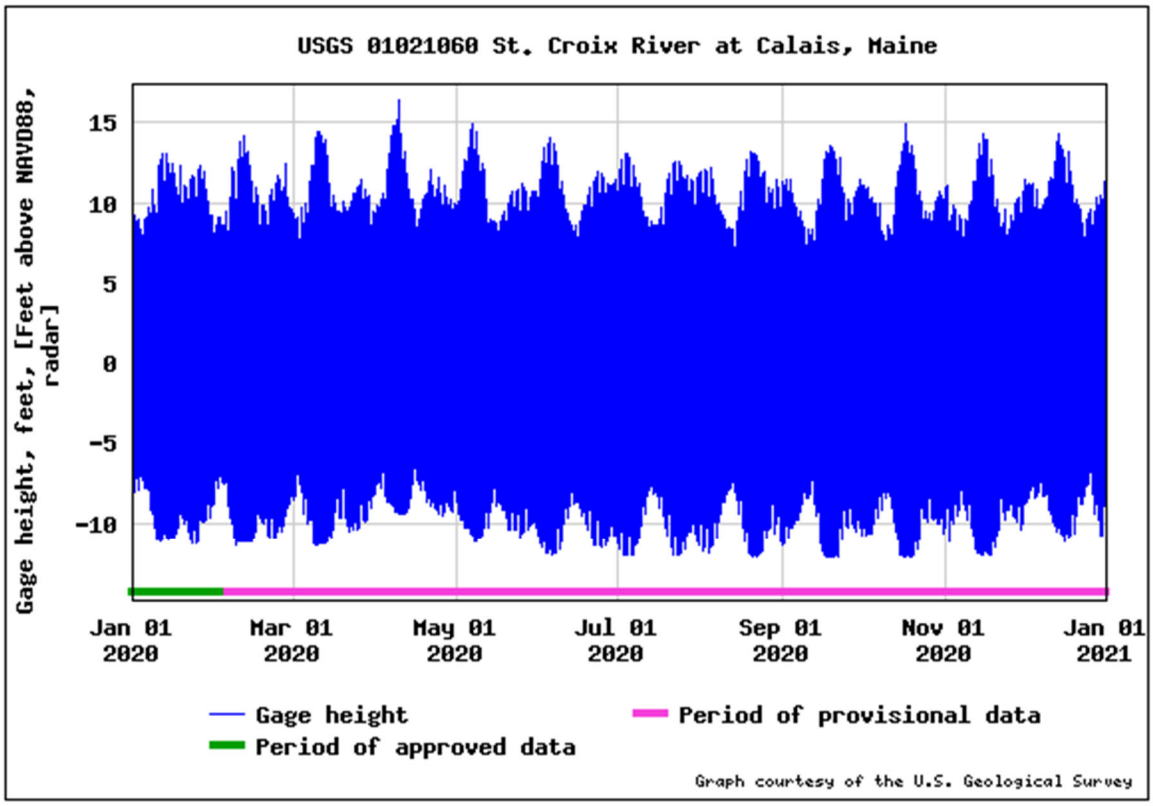


Figure 13: USGS Gage, St. Croix River at Calais, Maine

Note: Gage height data are measured down from the bridge deck and not using historical methods from the water pressure above a defined point in the river. Therefore, water level data will read higher when ice is present on the water surface.

The real time data for the site is available at:
http://waterdata.usgs.gov/me/nwis/uv/?site_no=01021060&PARAmeter_cd=00065,00060

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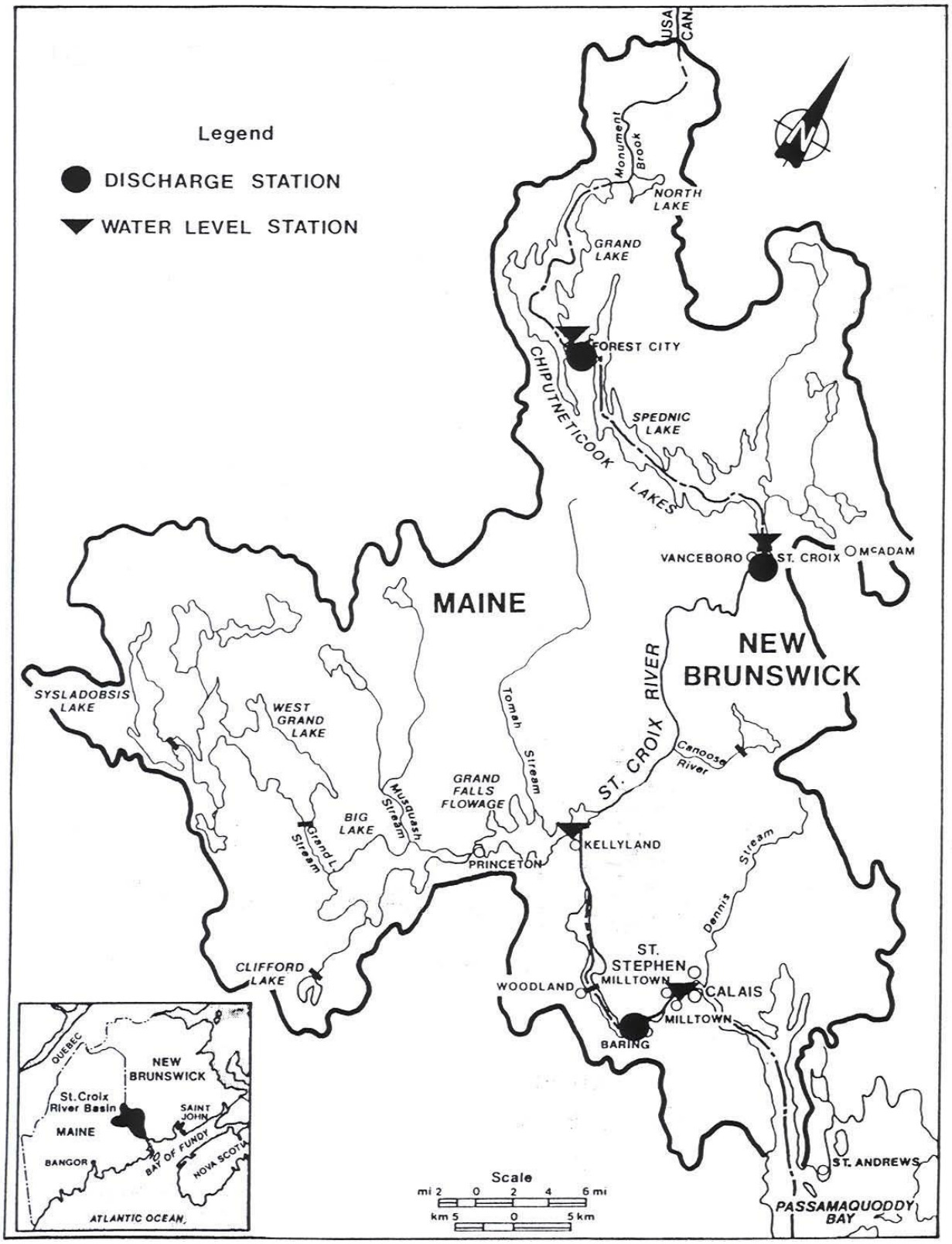
APPENDIX 1
SUMMARY ORDERS OF APPROVAL & BASIN MAP

SUMMARY OF ORDERS OF APPROVAL

INTERNATIONAL JOINT COMMISSION

9 November 1915	For approval of a dam and power canal and the obstruction, diversion and use of the waters of the St. Croix River at Grand Falls in the State of Maine and the Province of New Brunswick: Maximum elevation 202.0 feet m.s.l.
3 October 1923	Erection and repairs of fishways in the St. Croix River at St. Croix Gas and Light and Canadian Cottons Mill Dam. The St. Croix Gas and Light Dam was destroyed by fire in 1924. The Canadian Cotton Mills Dam was reconstructed in 1934 and is known as Milltown Dam.
6 October 1931	For the obstructions of the waters of the St. Croix River at Grand Falls in the State of Maine and the Province of New Brunswick. Increase in elevation to 203.5 feet m.s.l.
2 October 1934	For the reconstruction of a dam across the St. Croix River from Milltown in the Province of New Brunswick to Milltown in the State of Maine.
15 October 1965	For the construction of a storage dam in the St. Croix River at Vanceboro, Maine and St. Croix, New Brunswick: Discharge from Spednic Lake: 200 cfs (5.66 m3\s) minimum Elevation of Spednic Lake: 385.86 feet (117.611 metres) maximum Between 1 October and 30 April: 371.50 feet (113.233 metres) minimum Between 1 May and 30 September: 376.50 feet (114.759 metres) minimum Discharge from East Grand Lake: 75 cfs (2.12 m3\s) minimum Elevation of East Grand Lake: 434.94 feet (132.571 metres) maximum 427.94 feet (130.438 metres) minimum
16 November 1982	For the reconstruction of the diversion dike in the St. Croix River near Baileyville, Maine.


Legend
DISCHARGE STATION
WATER LEVEL STATION
USA
CAN.
Monument Brook
NORTH LAKE
GRAND LAKE
FOREST CITY
CHIPUTNETICOOK LAKES
SPEDNIC LAKE
VANCEBORO
ST. CROIX
McADAM
MAINE
NEW BRUNSWICK
ST. CROIX RIVER
SYSLADOBSIS LAKE
WEST GRAND LAKE
Tomah Stream
Canoose River
GRAND FALLS FLOWAGE
Musquash Stream
BIG LAKE
Grand L. Stream
PRINCETON
KELLYLAND
Dennis Stream
CLIFFORD LAKE
ST. STEPHEN
MILLTOWN
WOODLAND
CALAIS
MILLTOWN
BARING
ST. ANDREWS
PASSAMAQUODDY BAY
Scale
mi 2 0 2 4 6 mi
km 5 0 5 km
QUEBEC
NEW BRUNSWICK
St. Croix River Basin
SAINT JOHN
MAINE
BANGOR
BAY OF FUNDY
NOVA SCOTIA
ATLANTIC OCEAN

.

APPENDIX 2

MILLTOWN, GRAND FALLS, VANCEBORO AND FOREST CITY DAMS

2020 Report

GENERAL DESCRIPTION OF MILLTOWN,
GRAND FALLS, VANCEBORO & FOREST CITY DAMS

Milltown Dam & Fish Passage Facilities

The Milltown facility is located in Milltown, New Brunswick across the river from Calais, Maine and approximately one mile upstream from the international bridge between Calais and St. Stephen, New Brunswick. It consists of a powerhouse with 6 hydroelectric generating units (installed capacity is 3.6 MW), an upstream fish passage facility that goes from the lower pool around the side of the powerhouse to the upper pool. The spillway is located adjacent to the powerhouse and has 6 openings with large wooden stop logs that can be removed or installed via a railed vertical lifting mechanism. Other sections of the spillway have been equipped with wooden flashboards that are meant to fail and increase the spillway's capacity during high flows. At the far end of the spillway, running perpendicular from the spillway to the river bank, is a gatehouse with 5 vertical lift gates used to control the forebay elevation. A wooden-chute downstream fish passage facility is located in the area between the spillway and the gatehouse.

Grand Falls Dam & Fish Passage Facilities

Grand Falls Flowage Dam is approximately 8 miles upstream of the town of Baileyville, Maine and can store approximately 88,000 acre-feet of water. This dam has 9 steel Tainter gates on the right (facing downstream) of the spillway, and a concrete emergency spillway approximately 800 to 850 feet in length running from the concrete gatehouse and ending at the left shoreline. The gatehouse is located between the gates and the emergency spillway. A floating walkway allows access to the entire upstream length of the spillway. Lake levels are recorded by a gauging station on the right bank of the dam.

The downstream side of the emergency spillway/dam has a concrete face sloping at an angle of approximately 45 degrees, and supported by concrete buttresses along its length. The space between these buttresses has been enclosed with a pressure-treated timber log system. This log system was installed to minimize the temperature differential in the downstream face area during freezing conditions to reduce possible degradation of the concrete face.

Water is impounded behind Grand Falls Dam and delivered to the hydroelectric plant and fish passage facilities via a channel on the right side of the impoundment, approximately 1000 feet upstream of the dam.

Water flows to the turbines via three steel penstocks. A Denil fishway is located on the side of the hydroelectric plant. It is a concrete structure with a series of bays equipped with guide slots that allow for the installation of wooden V notched weirs to modify flows to levels acceptable for fish migration.

Vanceboro Dam & Fish Passage Facilities

Vanceboro Dam consists of an earth embankment with a concrete gate structure and with rock filled gabions on the upstream face. The concrete structure is 69 feet (21 m) long, and contains a fishway and two Tainter gates, each 22'-6" (6.9 m) wide by 14'-6" (4.4 m) high. These gates are operated by electrical cable lifts. The gate structure is located on the International Boundary line between the United States and Canada. Gate sill elevation is at 371.5 feet (113.23 m) NGVD. Normal full pond elevation is at 385.86 feet (117.61 m), with an impounded surface of 20,870 acres (84.5 km2). There are approximately 221,200 acre-feet (0.27 km3) of useable storage at normal full pond. The fishway is a vertical slot fish ladder and is to the left of the Tainter gates and consists of 10 bays or pools. There are 5 vertical lift wooden gates to regulate flow through the ladder. There is a steel trash rack on the upstream face of the fish passage.

Forest City Dam & Fish Passage Facilities

Forest City Dam is a small timber crib rock filled structure with three wooden sluice gates operated with a wooden ratchet lever system that lifts the gates using a steel cable or steel chain. These gates have openings of 8'-4" (2.54 m) and a sill elevation of 427.94 feet (130.44 m) NGVD. Full pond elevation is at elevation 434.94 feet (132.57 m) NGVD, and impounds 105,300 acre-feet (0.130 km3) of water. The fishway is located on the right side (facing upstream) of the dam and consists of timber baffle system with an upstream timber trash rack.

FACILITY SITE VISITS IN 2020

Due to the on-going COVID-19 global pandemic, and the associated work and travel related restrictions, site visits to the facilities and structures under IJC Orders of Approval in the basin were not conducted in 2020.

It is the responsibility of the dam owners, operators, and appropriate jurisdictional agencies to conduct the necessary dam inspections and maintenance to ensure the safety and security of the dams.

Forest City Dam: Woodland Pulp LLC operates and maintains the dam. The US Federal Energy Regulatory Commission (FERC) conducts periodic dam safety inspections at the site.

Figure 1: Forest City Dam, View of Dam from downstream, June 2019, no site visit in 2020

Vanceboro Dam: Woodland Pulp LLC operates and maintains the dam. FERC conducts periodic dam safety inspections at the site.

Figure 2: Vanceboro Dam, View of Dam from downstream, June 2019, no site visit in 2020

Grand Falls Dam: Woodland Pulp LLC operates and maintains the dam. The Maine Emergency Management Agency, Dam Safety Program, and Woodland Pulp LLC conduct periodic dam safety inspections at the site.

Figure 3: Grand Falls Dam, View of Spillway at Dam, June 2019, no site visit in 2020

<u>Milltown Dam</u>: New Brunswick Power operates and maintains the dam. New Brunswick Power conducts an annual inspection at the dam and an independent engineering inspection is conducted every 4 years. The recent Quadrennial Inspection by Hatch Engineering was in 2016.

Figure 4: Milltown Dam, View of Dam Powerhouse and Fishway Entrance from Downstream, June 2019, no site visit in 2020

APPENDIX 3

WATER LEVELS AND FLOWS

GRAND LAKE AT FOREST CITY
DAILY MEAN WATER LEVEL IN METERS FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	132.168	132.157	132.062	132.013	132.147	132.182	132.066	131.982	131.768	131.447	131.371	131.512	1
2	132.166	132.153	132.055	132.041	132.163	132.174	132.063	131.969	131.757	131.439	131.400	131.604	2
3	132.163	132.149	132.055	132.090	132.155	132.163	132.061	131.958	131.758	131.434	131.408	131.637	3
4	132.161	132.145	132.058	132.133	132.163	132.161	132.053	131.950	131.754	131.421	131.397	131.663	4
5	132.161	132.141	132.056	132.168	132.170	132.157	132.046	131.946	131.744	131.408	131.394	131.698	5
6	132.157	132.138	132.054	132.201	132.165	132.160	132.049	131.940	131.732	131.391	131.395	131.775	6
7	132.155	132.148	132.050	132.224	132.165	132.175	132.039	131.928	131.717	131.378	131.395	131.798	7
8	132.152	132.157	132.042	132.238	132.163	132.170	132.036	131.919	131.709	131.380	131.391	131.812	8
9	132.149	132.152	132.037	132.246	132.185	132.163	132.042	131.909	131.703	131.355	131.390	131.821	9
10	132.144	132.153	132.031	132.264	132.192	132.149	132.035	131.901	131.696	131.331	131.388	131.828	10
11	132.142	132.151	132.026	132.248	132.187	132.140	132.029	131.892	131.692	131.333	131.385	131.831	11
12	132.165	132.146	132.019	132.227	132.215	132.149	132.031	131.890	131.675	131.316	131.387	131.835	12
13	132.168	132.142	132.019	132.220	132.231	132.149	132.038	131.884	131.658	131.306	131.382	131.845	13
14	132.168	132.138	132.027	132.274	132.235	132.143	132.036	131.874	131.656	131.378	131.383	131.851	14
15	132.169	132.130	132.025	132.295	132.230	132.136	132.027	131.863	131.640	131.377	131.374	131.860	15
16	132.169	132.125	132.021	132.303	132.247	132.130	132.013	131.851	131.623	131.371	131.372	131.855	16
17	132.169	132.120	132.018	132.302	132.250	132.125	132.004	131.844	131.614	131.397	131.379	131.844	17
18	132.164	132.115	132.017	132.292	132.249	132.120	132.009	131.844	131.604	131.414	131.377	131.838	18
19	132.168	132.117	132.012	132.277	132.245	132.116	132.002	131.854	131.588	131.413	131.364	131.827	19
20	132.166	132.111	132.009	132.266	132.237	132.109	131.998	131.842	131.573	131.415	131.359	131.821	20
21	132.162	132.105	132.008	132.253	132.230	132.100	131.993	131.833	131.556	131.415	131.362	131.819	21
22	132.158	132.098	132.007	132.250	132.223	132.096	131.983	131.832	131.545	131.416	131.354	131.815	22
23	132.154	132.092	132.004	132.238	132.216	132.092	131.975	131.824	131.534	131.410	131.362	131.811	23
24	132.151	132.086	132.013	132.225	132.202	132.082	131.986	131.818	131.517	131.410	131.409	131.801	24
25	132.147	132.080	132.009	132.210	132.191	132.089	131.977	131.824	131.508	131.408	131.395	131.801	25
26	132.161	132.076	132.005	132.196	132.188	132.082	131.973	131.829	131.494	131.398	131.408	131.833	26
27	132.165	132.076	132.003	132.182	132.186	132.081	131.988	131.809	131.475	131.406	131.431	131.855	27
28	132.166	132.078	132.000	132.170	132.182	132.074	131.999	131.796	131.464	131.398	131.440	131.863	28
29	132.165	132.281	132.000	132.159	132.181	132.075	131.996	131.786	131.459	131.397	131.448	131.884	29
30	132.162	132.071	132.009	132.147	132.185	132.072	131.991	131.795	131.448	131.394	131.436	131.881	30
31	132.159		132.010		132.191		131.990	131.780		131.384		131.891	31
TOTAL	4096.974	3831.760	4092.761	3966.352	4098.169	3963.814	4092.528	4087.966	3948.661	4073.140	3941.736	4085.809	TOTAL
MEAN	132.160	132.130	132.025	132.212	132.199	132.127	132.017	131.870	131.622	131.392	131.391	131.800	MEAN
MAX	132.169	132.281	132.062	132.303	132.250	132.182	132.066	131.982	131.768	131.447	131.448	131.891	MAX
MIN	132.142	132.076	132.000	132.013	132.147	132.072	131.973	131.780	131.448	131.306	131.354	131.512	MIN

SUMMARY FOR THE YEAR 2020
Mean water level, 131.912 m
Maximum daily water level, 132.303 m On 2020-04-16
Minimum daily water level, 131.306 m On 2020-10-13

NOTE: WATER LEVELS ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC

TABLE I

FOREST CITY STREAM BELOW FOREST CITY DAM
DAILY MEAN DISCHARGE CUBIC METERS PER SECOND FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	3.46	4.50	8.34	13.2	36.4	2.84	2.98	2.97	6.96	9.00	2.70	2.84	1
2	3.47	4.51	8.35	13.2	36.1	2.82	2.98	2.96	6.91	8.89	2.76	2.87	2
3	3.47	4.54	8.34	13.3	35.9	2.80	2.98	2.96	6.89	8.85	2.91	2.90	3
4	3.49	4.57	8.34	13.5	34.7	2.78	2.99	3.00	6.86	8.67	2.98	2.90	4
5	3.54	4.63	9.20	14.3	33.8	2.77	2.98	3.03	6.80	8.55	3.01	2.91	5
6	3.54	4.67	10.4	15.8	33.5	2.78	2.98	3.03	6.76	8.34	3.08	2.93	6
7	3.54	4.72	10.4	16.3	33.2	2.75	2.96	3.03	6.69	8.20	3.15	2.93	7
8	3.56	4.74	10.5	16.3	29.9	2.73	2.96	3.04	6.63	8.01	3.18	2.92	8
9	3.55	4.78	11.1	16.3	24.1	2.70	2.96	3.09	6.56	7.92	3.20	2.94	9
10	3.55	4.80	11.8	16.2	20.7	2.69	2.96	3.09	6.53	7.87	3.28	2.95	10
11	3.55	4.84	11.8	16.2	19.5	2.67	2.97	3.94	6.48	7.86	3.29	2.97	11
12	3.60	5.65	11.8	16.2	17.2	2.66	2.96	5.17	6.45	7.96	3.28	2.84	12
13	3.78	6.94	11.8	16.6	15.0	2.63	2.96	5.16	6.43	7.80	3.33	2.68	13
14	3.87	6.97	11.9	17.1	11.7	2.52	2.94	5.15	6.42	7.66	3.34	2.70	14
15	3.95	7.58	11.9	17.2	8.87	2.38	2.93	4.39	6.36	7.48	3.28	2.70E	15
16	4.01	8.21	11.9	17.9	8.86	2.38	2.94	3.59	6.31	7.56	3.35	2.68	16
17	4.06	8.21	11.8	18.5	8.84	2.39	2.97	3.58	6.30	7.33	3.37	2.69	17
18	4.11	8.23	11.8	18.6	8.74	2.38	2.97	3.61	7.29	5.82	3.37	2.68	18
19	4.15	8.24	11.7	19.6	8.69	2.38	2.97	3.60	9.46	4.34E	3.38	2.69	19
20	4.18	8.25	11.7	20.2	8.68	2.37	2.97	3.59	10.40	4.26	3.39	2.70	20
21	4.20	8.25	11.7	20.3	8.65	2.38	2.96	3.58	9.13	4.29	3.39	2.73	21
22	4.23	8.25	11.7	20.4	7.67	2.65	2.95	3.58	7.48	4.19	3.38	2.81	22
23	4.31	8.29	11.6	20.5	5.22	2.92	2.95	3.56	7.38	4.09	3.38	2.83	23
24	4.33	8.29	11.6	20.7	4.21	2.93	2.95	4.15	7.29	3.21	3.39	2.88	24
25	4.34	8.32	11.6	20.8	4.18	2.95	2.95	4.92	7.19	2.58	3.41	2.91	25
26	4.38	8.32	11.5	27.1	4.14	2.95	2.96	4.91	7.19	2.55	3.41	2.96	26
27	4.42	8.30	12.4	33.3	4.11	2.95	2.98	4.89	8.24	2.54	3.44	2.99	27
28	4.43	8.32	13.2	36.1	4.08	2.96	2.99	4.90	9.43	2.63	3.09	3.04	28
29	4.44	8.05	13.1	36.2	4.05	2.97	2.98	4.89	9.29	2.63	2.83	2.97	29
30	4.46		13.2	36.5	4.02	2.97	2.97	4.89	9.14	2.66	2.84	2.97	30
31	4.46		13.2		3.54		2.97	6.00		2.68		2.98	31
TOTAL	152	166	242	617	214	73.8	85.3	98	191	168	81.4	150.6	TOTAL
MEAN	4.90	5.92	7.8	20.6	6.9	2.46	2.75	3.18	6.35	5.43	2.71	4.86	MEAN
MAX	4.97	7.43	8.0	31.7	9.9	2.62	3.40	3.36	9.3	8.89	2.86	8.19	MAX
MIN	4.83	4.89	7.65	7.71	2.66	2.14	2.13	2.98	2.96	2.44	2.60	3.07	MIN
DAM3	13100	14300	20900	53300	18400	6400	7400	8500	16500	14600	7000	13000	DAM3

SUMMARY FOR THE YEAR 2020
Total discharge 193400 DAM
Mean discharge, 6.15 m^3/s
Maximum daily discharge, 31.7 m^3/s On 2020-04-16
Minimum daily discharge, 2.13 m^3/s On 2020-07-01

NOTE: DISCHARGE DATA ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC
E ESTIMATE

TABLE II

SPEDNIC LAKE AT ST. CROIX
DAILY MEAN WATER LEVEL IN METERS FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	116.917	116.597	116.224	116.016	116.727	116.739	116.437	116.130	115.612	115.392	115.194	115.156	1
2	116.901	116.585	116.202	116.055	116.760	116.724	116.430	116.106	115.589	115.393	115.237	115.379	2
3	116.889	116.569	116.189	116.147	116.730	116.696	116.422	116.092	115.587	115.401	115.221	115.508	3
4	116.878	116.556	116.180	116.248	116.734	116.691	116.414	116.070	115.578	115.388	115.198	115.582	4
5	116.874	116.543	116.173	116.336	116.743	116.674	116.405	116.048	115.563	115.381	115.185	115.652	5
6	116.859	116.528	116.161	116.422	116.732	116.668	116.407	116.044	115.545	115.368	115.178	115.789	6
7	116.846	116.533	116.153	116.504	116.728	116.674	116.395	116.018	115.520	115.364	115.171	115.879	7
8	116.834	116.532	116.130	116.577	116.729	116.670	116.389	115.999	115.515	115.409	115.155	115.938	8
9	116.822	116.516	116.117	116.636	116.756	116.652	116.392	115.982	115.507	115.367	115.147	115.992	9
10	116.803	116.508	116.100	116.708	116.759	116.629	116.382	115.960	115.502	115.326	115.133	116.032	10
11	116.789	116.499	116.090	116.721	116.734	116.609	116.373	115.943	115.507	115.344	115.121	116.065	11
12	116.806	116.487	116.072	116.721	116.760	116.617	116.372	115.932	115.488	115.315	115.120	116.095	12
13	116.801	116.476	116.059	116.725	116.790	116.617	116.376	115.918	115.465	115.301	115.100	116.127	13
14	116.793	116.466	116.073	116.824	116.799	116.596	116.363	115.899	115.475	115.358	115.100	116.159	14
15	116.783	116.447	116.071	116.890	116.792	116.589	116.353	115.875	115.451	115.349	115.076	116.210	15
16	116.775	116.431	116.061	116.928	116.819	116.578	116.338	115.858	115.424	115.341	115.065	116.195	16
17	116.771	116.419	116.049	116.954	116.841	116.567	116.320	115.840	115.422	115.371	115.074	116.200	17
18	116.750	116.402	116.047	116.962	116.851	116.557	116.312	115.826	115.409	115.372	115.070	116.217	18
19	116.742	116.396	116.034	116.963	116.849	116.549	116.294	115.821	115.404	115.367	115.034	116.220	19
20	116.730	116.378	116.028	116.962	116.843	116.530	116.284	115.804	115.393	115.360	115.017	116.222	20
21	116.714	116.360	116.033	116.938	116.841	116.513	116.273	115.780	115.377	115.350	115.016	116.230	21
22	116.697	116.342	116.029	116.950	116.835	116.508	116.250	115.770	115.373	115.347	114.996	116.227	22
23	116.682	116.324	116.019	116.938	116.819	116.495	116.234	115.753	115.388	115.324	114.989	116.223	23
24	116.668	116.307	116.029	116.900	116.807	116.479	116.235	115.737	115.365	115.318	115.063	116.216	24
25	116.652	116.292	116.020	116.879	116.793	116.489	116.217	115.735	115.357	115.319	115.012	116.216	25
26	116.652	116.276	116.015	116.850	116.783	116.473	116.201	115.745	115.350	115.285	115.021	116.246	26
27	116.651	116.265	116.011	116.815	116.775	116.469	116.194	115.707	115.353	115.292	115.058	116.273	27
28	116.648	116.257	116.004	116.795	116.765	116.456	116.188	115.681	115.358	115.266	115.071	116.281	28
29	116.638	116.241	115.999	116.768	116.756	116.447	116.179	115.654	115.370	115.255	115.081	116.301	29
30	116.625		116.007	116.739	116.753	116.440	116.161	115.674	115.377	115.243	115.072	116.297	30
31	116.610		116.012		116.762		116.150	115.642		115.225		116.309	31
MEAN	116.761	116.432	116.077	116.696	116.780	116.580	116.314	115.872	115.454	115.338	115.099	116.046	MEAN
MAX	116.917	116.597	116.224	116.963	116.851	116.739	116.437	116.130	115.612	115.409	115.237	116.309	MAX
MIN	116.610	116.241	115.999	116.016	116.727	116.440	116.150	115.642	115.350	115.225	114.989	115.156	MIN

SUMMARY FOR THE YEAR 2020
Mean water level, 116.170 m
Maximum daily water level, 116.963 m On 2020-04-19
Minimum daily water level, 114.989 m On 2020-11-23

NOTE: WATER LEVELS ARE IN METERS AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. WATER LEVELS ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC

TABLE III

ST. CROIX RIVER AT VANCEBORO
DAILY MEAN DISCHARGE IN METERS PER SECOND FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	30.9	24.7	28.3	26.2	55.6	17.6	7.10	16.6	14.5	7.01	14.9	14.2	1
2	30.8	24.6	29.3	24.7	49.8	15.6	7.08	16.6	14.4	6.96	14.8	12.6	2
3	28.0	24.5	29.2	24.7	43.6	15.5	7.08	16.5	14.3	9.82	14.7	11.0	3
4	26.0	24.5	29.0	23.5	43.7	15.4	7.08	16.3	14.2	11.5	14.9	10.8	4
5	26.0	24.4	28.9	20.9	43.5	14.8	7.08	16.2	14.1	12.3	14.8	9.4	5
6	26.0	24.4	28.9	20.0	38.7	15.0	7.07	16.1	14.1	12.9	14.7	9.61	6
7	25.9	24.3	28.9	20.3	35.4	13.9	7.08	16.0	14.1	12.9	14.6	9.80	7
8	25.8	24.3	28.8	20.7	32.2	13.1	7.06	16.0	14.0	12.8	14.6	10.2	8
9	25.8	24.3	28.8	21.0	29.2	13.2	7.07	15.9	13.9	12.7	14.6	9.07	9
10	25.7	24.2	28.6	21.3	29.2	13.1	7.08	15.8	12.9	14.0	14.5	7.56	10
11	25.6	24.1	28.5	26.6	29.4	13.1	7.04	15.8	12.3	15.1	14.5	7.65	11
12	25.5	24.1	28.4	46.2	29.3	13.0	7.04	15.7	12.3	15.1	14.4	7.72	12
13	25.7	24.0	28.3	63.0	29.2	11.8	7.02	15.6	12.4	15.2	14.4	7.79	13
14	25.6	24.0	28.3	70.0	29.4	11.0	7.02	15.6	12.3	15.1	14.4	7.81	14
15	25.6	23.9	28.2	77	29.5	11.0	7.03	15.5	12.2	15.0	14.3	7.9	15
16	25.5	23.9	28.3	89	29.5	11.0	7.01	15.5	12.2	15.3	14.3	8.0	16
17	25.5	23.7	28.3	94	29.5	10.9	6.99	15.4	12.2	15.2	14.2	8.1	17
18	25.5	24.5	28.2	86	29.6	10.9	11.1	15.3	12.1	15.2	14.1	8.1	18
19	25.5	25.6	28.2	82.2	29.7	10.9	16.6	15.2	12.1	15.4	14.2	8.1	19
20	25.3	25.5	28.1	82.4	33.0	10.9	16.5	15.2	12.0	15.4	14.1	10.5	20
21	25.3	25.5	28.1	79.4	35.6	10.9	16.5	15.2	12.0	15.3	14.0	13.6	21
22	25.2	25.3	28.0	77.1	35.6	10.8	16.4	15.1	12.0	15.3	13.9	13.6	22
23	25.1	25.2	28.1	73.4	35.6	10.8	16.4	15.0	11.9	15.2	13.9	16.8	23
24	25.0	25.1	28.0	70.2	31.9	10.13	16.3	14.9	11.0	15.2	13.8	19.5	24
25	24.9	25.0	28.0	69.9	28.6	8.9	16.6	14.9	10.4	15.2	13.8	19.5	25
26	24.9	24.9	28.0	69.5	28.5	8.4	16.8	14.8	10.4	15.2	14.1	19.4	26
27	24.9	25.9	27.9	69.2	28.4	8.1	16.8	14.8	8.89	15.2	13.9	19.4	27
28	24.9	27.3	27.9	68.7	26.4	7.5	16.7	14.8	7.40	15.1	13.9	19.6	28
29	24.9	55.5	27.9	68.3	20.8	7.14	16.7	14.7	6.98	15.1	14.1	19.7	29
30	24.9		27.8	60.9	18.8	7.12	16.7	14.5	7.00	15.0	14.1	19.7	30
31	24.8		27.8		19.1		16.6	14.5		14.9		19.8	31
TOTAL	801	747	879	1645	1008	352	347	480	360	432	429	387	TOTAL
MEAN	25.8	25.8	28.4	54.8	32.5	11.7	11.2	15.5	12.0	13.9	14.3	12.5	MEAN
MAX	30.9	55.5	29.3	94	55.6	17.6	16.8	16.6	14.5	15.4	14.9	19.8	MAX
MIN	24.8	23.7	27.8	20.0	18.8	7.12	6.99	14.5	7.0	7.0	13.8	7.56	MIN

SUMMARY FOR THE YEAR 2020
Total discharge 679700 DAM
Mean discharge, 21.5 m^3/s
Maximum daily discharge, 93.7 m^3/s On 2020-04-16
Minimum daily discharge, 6.96 m^3/s On 2020-10-01

NOTE: DATA ARE SUPPLIED BY THE UNITED STATES GEOLOGICAL SURVEY AND ARE PROVISIONAL

TABLE IV

GRAND FALLS FLOWAGE AT GRAND FALLS
DAILY MEAN WATER LEVEL IN METERS FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	61.813	61.809	61.664	61.851	61.712	61.729	61.498	61.459	61.595	61.475	61.524	61.810	1
2	61.807	61.806	61.659	61.865	61.669	61.727	61.494	61.467	61.597	61.461	61.574	61.904	2
3	61.796	61.800	61.654	61.893	61.677	61.724	61.478	61.479	61.607	61.460	61.578	61.913	3
4	61.782	61.792	61.647	61.943	61.711	61.731	61.473	61.482	61.625	61.450	61.582	61.807	4
5	61.773	61.790	61.635	61.942	61.712	61.727	61.459	61.492	61.625	61.446	61.593	61.703	5
6	61.761	61.809	61.636	61.906	61.706	61.719	61.451	61.497	61.621	61.450	61.603	61.721	6
7	61.750	61.816	61.630	61.848	61.712	61.710	61.442	61.495	61.612	61.451	61.610	61.790	7
8	61.742	61.812	61.641	61.799	61.727	61.713	61.435	61.499	61.606	61.468	61.601	61.805	8
9	61.734	61.792	61.644	61.744	61.764	61.706	61.426	61.507	61.602	61.451	61.612	61.799	9
10	61.721	61.774	61.645	61.699	61.812	61.692	61.416	61.510	61.597	61.435	61.612	61.798	10
11	61.720	61.776	61.649	61.642	61.812	61.695	61.396	61.514	61.587	61.431	61.611	61.765	11
12	61.749	61.771	61.655	61.622	61.830	61.696	61.389	61.523	61.585	61.421	61.609	61.771	12
13	61.735	61.756	61.668	61.625	61.858	61.691	61.378	61.531	61.585	61.417	61.598	61.847	13
14	61.758	61.741	61.709	61.728	61.837	61.665	61.347	61.529	61.585	61.463	61.604	61.842	14
15	61.771	61.724	61.733	61.862	61.820	61.654	61.324	61.519	61.567	61.472	61.594	61.854	15
16	61.773	61.709	61.755	61.889	61.826	61.647	61.317	61.525	61.566	61.479	61.600	61.803	16
17	61.763	61.702	61.771	61.841	61.834	61.641	61.307	61.534	61.553	61.492	61.610	61.772	17
18	61.744	61.703	61.777	61.799	61.826	61.628	61.315	61.548	61.525	61.515	61.606	61.754	18
19	61.742	61.710	61.772	61.785	61.813	61.616	61.328	61.558	61.517	61.527	61.606	61.730	19
20	61.741	61.702	61.774	61.752	61.818	61.599	61.342	61.555	61.511	61.540	61.601	61.712	20
21	61.735	61.687	61.790	61.721	61.839	61.576	61.348	61.557	61.507	61.541	61.604	61.710	21
22	61.736	61.673	61.800	61.735	61.833	61.566	61.342	61.558	61.495	61.550	61.596	61.707	22
23	61.761	61.666	61.804	61.710	61.790	61.555	61.351	61.565	61.501	61.551	61.610	61.700	23
24	61.772	61.661	61.816	61.676	61.777	61.542	61.370	61.568	61.510	61.557	61.652	61.686	24
25	61.777	61.657	61.814	61.672	61.787	61.532	61.385	61.586	61.503	61.547	61.649	61.679	25
26	61.782	61.652	61.808	61.648	61.784	61.538	61.398	61.606	61.501	61.545	61.674	61.684	26
27	61.760	61.649	61.809	61.600	61.771	61.547	61.409	61.611	61.496	61.553	61.723	61.699	27
28	61.787	61.673	61.811	61.611	61.754	61.527	61.429	61.597	61.487	61.539	61.768	61.688	28
29	61.796	61.666	61.817	61.697	61.751	61.510	61.441	61.586	61.479	61.529	61.797	61.709	29
30	61.793		61.836	61.723	61.750	61.499	61.450	61.607	61.484	61.507	61.777	61.710	30
31	61.808		61.840		61.739		61.456	61.599		61.518		61.731	31
MEAN	61.816	61.786	61.773	61.832	61.839	61.816	61.795	61.585	61.491	61.586	61.734	61.806	MEAN
MAX	62.017	61.909	61.887	61.936	61.925	61.933	61.964	61.616	61.557	61.763	61.823	61.932	MAX
MIN	61.656	61.637	61.605	61.695	61.789	61.772	61.628	61.545	61.421	61.462	61.672	61.658	MIN

SUMMARY FOR THE YEAR 2020
Mean water level, 61.648 m
Maximum daily water level, 61.943 m On 2020-04-10
Minimum daily water level, 61.307 m On 2020-07-18

NOTE: WATER LEVELS ARE IN METERS AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. WATER LEVELS ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC

TABLE V

ST. CROIX RIVER AT BARING MAINE
DAILY MEAN DISCHARGE IN METERS PER SECOND FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	88.3	68.0	53.1	82.0	96.5	42.8	22.1	22.7	26.5	20.1	27.9	52.1	1
2	82.7	68.8	52.7	83.0	101	36.1	22.2	22.1	25.1	20.6	24.6	72.0	2
3	85.0	67.6	52.4	82.0	117	29.0	22.3	21.9	25.3	20.5	24.2	140	3
4	79.0	66.3	52.4	117	123	26.6	22.9	21.8	24.7	20.7	25.8	226	4
5	75.9	65.1	52.6	165	108	26.1	22.4	21.9	24.6	20.9	24.8	290	5
6	73.8	57.3	53.3	229	101	26.1	22.3	21.9	24.7	20.8	24.2	266	6
7	70.1	48.2	53.5	235	103	26.1	22.4	22.1	23.7	20.9	24.8	227	7
8	69.7	60.0	52.7	235	93.3	27.2	22.6	22.0	23.4	20.7	24.2	236	8
9	64.8	63.5	53.0	220	80.3	26.5	22.5	22.0	23.0	20.8	23.4	236	9
10	77.0B	60.6B	52.3	196	68.8	26.4	22.4	22.0	22.7	20.7	23.3	221	10
11	62.0B	64.2	52.3	182	65.5	25.3	22.5	22.0	22.9	20.9	23.3	188	11
12	62.1	62.9	52.3	180	68.7	26.4	22.5	21.8	23.1	22.0	23.3	146	12
13	77.1	63.0	55.6	185	80.0	26.3	22.7	21.9	22.8	22.6	23.4	129	13
14	78.4	64.8	53.6	183	89.4	26.4	22.7	22.0	22.7	22.0	24.1	105	14
15	69.2	63.9	54.5B	205	106	26.1	23.5	21.9	22.7	22.2	24.6	93.4	15
16	71.1	61.7	64.8B	248	116	25.8	23.2	21.7	22.7	23.4	25.3	91.3	16
17	72.2	60.3	68.2	298	109	25.8	22.3	21.6	22.4	22.7	25.7	78.1B	17
18	69.9	52.6B	66.8	314	109	26.0	21.9	22.3	23.0	22.4	30.5	76.1B	18
19	66.3	50.4B	67.9B	291	109	25.9	21.9	22.3	22.9	23.6	24.2	68.5B	19
20	64.8	52.5B	71.5B	242	108	26.0	21.9	22.3	22.3	23.6	23.6	68.4B	20
21	63.9	52.8B	71.0B	220	104	25.9	21.9	22.2	22.3	23.0	23.1	60.4B	21
22	63.2	53.1B	71.7B	207	87.7	25.3	21.9	22.3	22.1	22.7	23.1	55.9	22
23	52.2	53.4B	74.7B	186	82.9	25.2	22.0	22.3	21.5	22.5	22.9	57.7	23
24	44.8	53.2B	75.6	181	83.7	25.5	22.0	22.4	20.1	22.2	22.8	57.6	24
25	48.0	52.6B	76.0	178	83.5	25.4	22.3	22.3	19.9	22.1	23.7	57.3	25
26	49.9	52.5	77.0	158	70.4	25.1	22.2	22.4	19.4	22.1	26.5	57.1	26
27	78.0	52.3	76.0	151	62.9	24.8	22.1	25.1	19.2	22.0	28.2	62.5	27
28	93.1	52.8	76.0	148	63.1	23.1	22.2	23.5	19.2	21.9	30.8	80.2	28
29	77.8	53	75.8	147	62.9	22.4	22.3	22.9	19.4	27.7	35.3	84.9	29
30	83.4	53.0	76.1	113	57.4	22.0	22.3	23.1	19.7	26.9	41.0	82.5	30
31	78.4		76.6		47.7		22.2	24.1		24.9		76.7	31
TOTAL	2175	1698	1962	5661	2759	797	693	693	674	690	772	3744	TOTAL
MEAN	70.2	59	63	189	89.0	26.6	22.3	22.3	22.5	22.3	25.7	121	MEAN
MAX	93	69	77	314	123	42.8	23.5	25.1	26.5	27.7	41.0	290	MAX
MIN	44.8	48.2	52.3	82.2	47.7	22.0	21.9	21.6	19.2	20.1	22.8	52.1	MIN

SUMMARY FOR THE YEAR 2020
Total discharge 1928300 DAM
Mean discharge, 61.0 m^3/s
Maximum daily discharge, 314 m^3/s On 2020-04-17
Minimum daily discharge, 19.2 m^3/s On 2020-09-27

NOTE: DATA ARE SUPPLIED BY THE UNITED STATES GEOLOGICAL SURVEY AND ARE PROVISIONAL
B - BACKWATER

TABLE VI

ST. CROIX RIVER AT MILLTOWN DAM
DAILY MEAN WATER LEVEL IN METERS FOR 2020

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	13.678	13.700	13.707	13.740	13.721	13.690	13.681	13.712	13.775	13.756	13.752	13.755	1
2	13.687	13.689	13.711	13.739	13.714	13.685	13.676	13.716	13.772	13.757	13.743	13.759	2
3	13.686	13.694	13.702	13.754	13.715	13.672	13.680	13.715	13.764	13.762	13.753	13.763	3
4	13.686	13.698	13.693	13.765	13.710	13.678	13.683	13.724	13.760	13.766	13.759	13.760	4
5	13.682	13.700	13.709	13.760	13.713	13.677	13.689	13.722	13.765	13.763	13.754	13.759	5
6	13.695	13.695	13.717	13.758	13.716	13.677	13.698	13.724	13.770	13.760	13.747	13.766	6
7	13.694	13.680	13.717	13.753	13.710	13.686	13.697	13.731	13.769	13.748	13.746	13.762	7
8	13.689	13.704	13.719	13.751	13.707	13.687	13.694	13.731	13.768	13.750	13.747	13.763	8
9	13.704	13.723	13.719	13.746	13.702	13.685	13.698	13.728	13.768	13.762	13.744	13.762	9
10	13.717	13.709	13.716	13.737	13.717	13.683	13.691	13.727	13.763	13.758	13.741	13.759	10
11	13.697	13.705	13.718	13.752	13.720	13.684	13.686	13.725	13.766	13.760	13.739	13.758	11
12	13.699	13.704	13.722	13.760	13.721	13.681	13.686	13.727	13.773	13.766	13.739	13.758	12
13	13.711	13.702	13.718	13.757	13.732	13.677	13.687	13.732	13.768	13.762	13.740	13.758	13
14	13.704	13.715	13.721	13.759	13.734	13.688	13.694	13.733	13.764	13.755	13.739	13.756	14
15	13.700	13.724	13.735	13.751	13.732	13.691	13.707	13.737	13.771	13.759	13.741	13.756	15
16	13.697	13.714	13.748	13.737	13.731	13.690	13.709	13.738	13.770	13.759	13.739	13.759	16
17	13.716	13.711	13.745	13.737	13.733	13.685	13.707	13.737	13.765	13.756	13.740	13.764	17
18	13.715	13.713	13.747	13.731	13.731	13.683	13.705	13.738	13.768	13.764	13.743	13.761	18
19	13.693	13.702	13.750	13.725	13.731	13.680	13.700	13.741	13.773	13.762	13.745	13.756	19
20	13.700	13.714	13.735	13.721	13.727	13.676	13.697	13.744	13.777	13.759	13.742	13.751	20
21	13.711	13.715	13.742	13.716	13.719	13.682	13.699	13.746	13.778	13.759	13.742	13.753	21
22	13.708	13.708	13.756	13.714	13.709	13.682	13.703	13.749	13.768	13.757	13.744	13.753	22
23	13.701	13.709	13.755	13.723	13.715	13.676	13.704	13.750	13.765	13.756	13.738	13.753	23
24	13.704	13.705	13.744	13.721	13.717	13.677	13.708	13.750	13.765	13.750	13.739	13.752	24
25	13.703	13.704	13.746	13.722	13.714	13.686	13.702	13.743	13.767	13.755	13.742	13.750	25
26	13.694	13.706	13.740	13.724	13.710	13.683	13.698	13.747	13.766	13.756	13.739	13.751	26
27	13.698	13.698	13.736	13.723	13.705	13.681	13.701	13.754	13.762	13.755	13.738	13.752	27
28	13.699	13.699	13.743	13.722	13.699	13.682	13.698	13.757	13.760	13.755	13.738	13.750	28
29	13.706	13.702	13.747	13.727	13.688	13.682	13.701	13.754	13.757	13.752	13.743	13.750	29
30	13.718		13.746	13.728	13.678	13.682	13.704	13.754	13.750	13.754	13.751	13.750	30
31	13.708		13.743		13.685		13.708	13.769		13.757		13.748	31
TOTAL	424.700	397.442	425.647	412.153	425.156	410.468	424.591	425.855	413.007	426.490	412.307	426.447	TOTAL
MEAN	13.700	13.705	13.731	13.738	13.715	13.682	13.696	13.737	13.767	13.758	13.744	13.756	MEAN
MAX	13.718	13.724	13.756	13.765	13.734	13.691	13.709	13.769	13.778	13.766	13.759	13.766	MAX
MIN	13.678	13.680	13.693	13.714	13.678	13.672	13.676	13.712	13.750	13.748	13.738	13.748	MIN

SUMMARY FOR THE YEAR 2020
Mean water level, 13.727 m
Maximum daily water level, 13.778 m On 2020-09-21
Minimum daily water level, 13.672 m On 2020-06-03

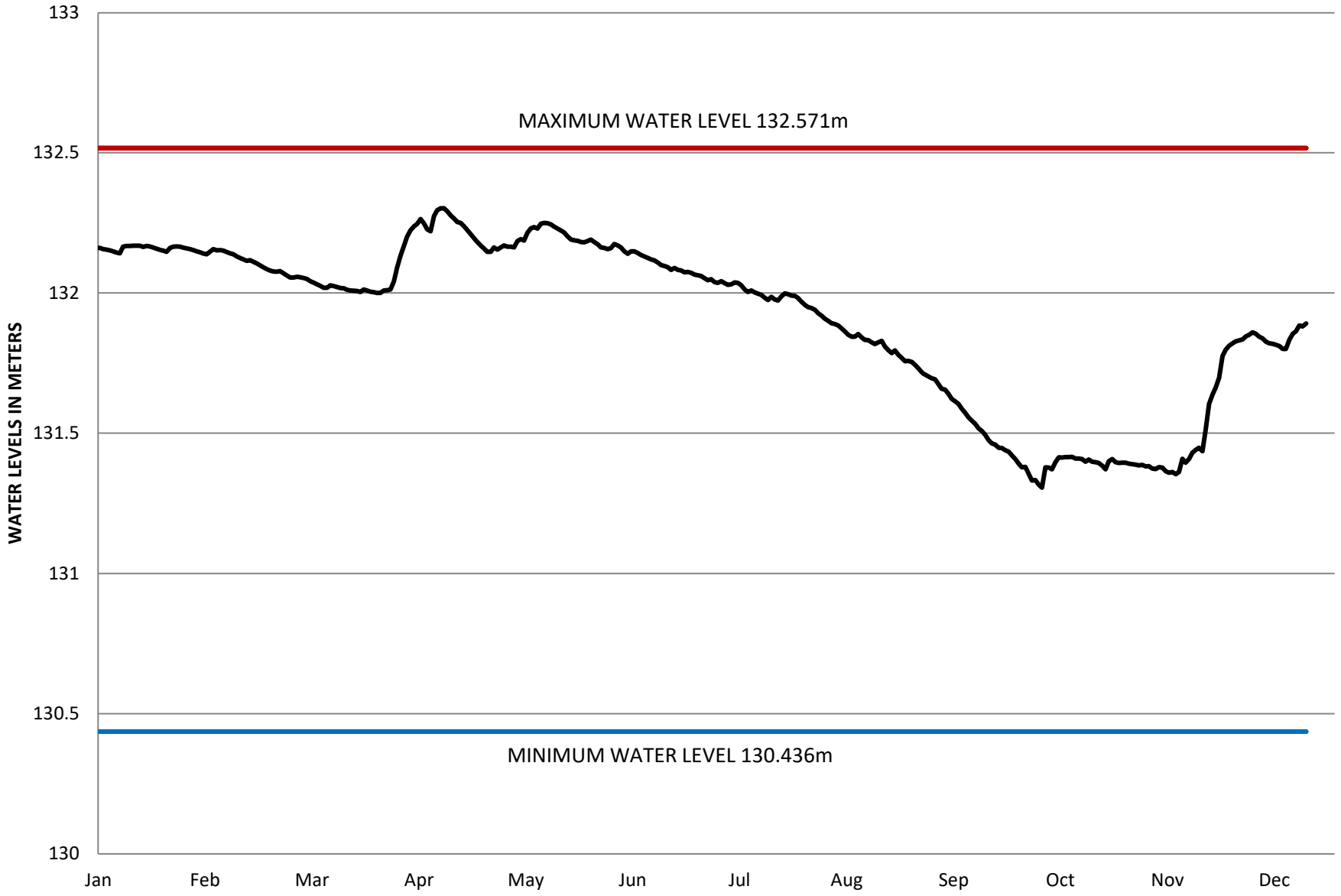
NOTES: WATER LEVELS ARE IN METERS AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. THE WATER LEVEL DATA ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH NEW BRUNSWICK POWER.

APPENDIX 4

HYDROGRAPHS

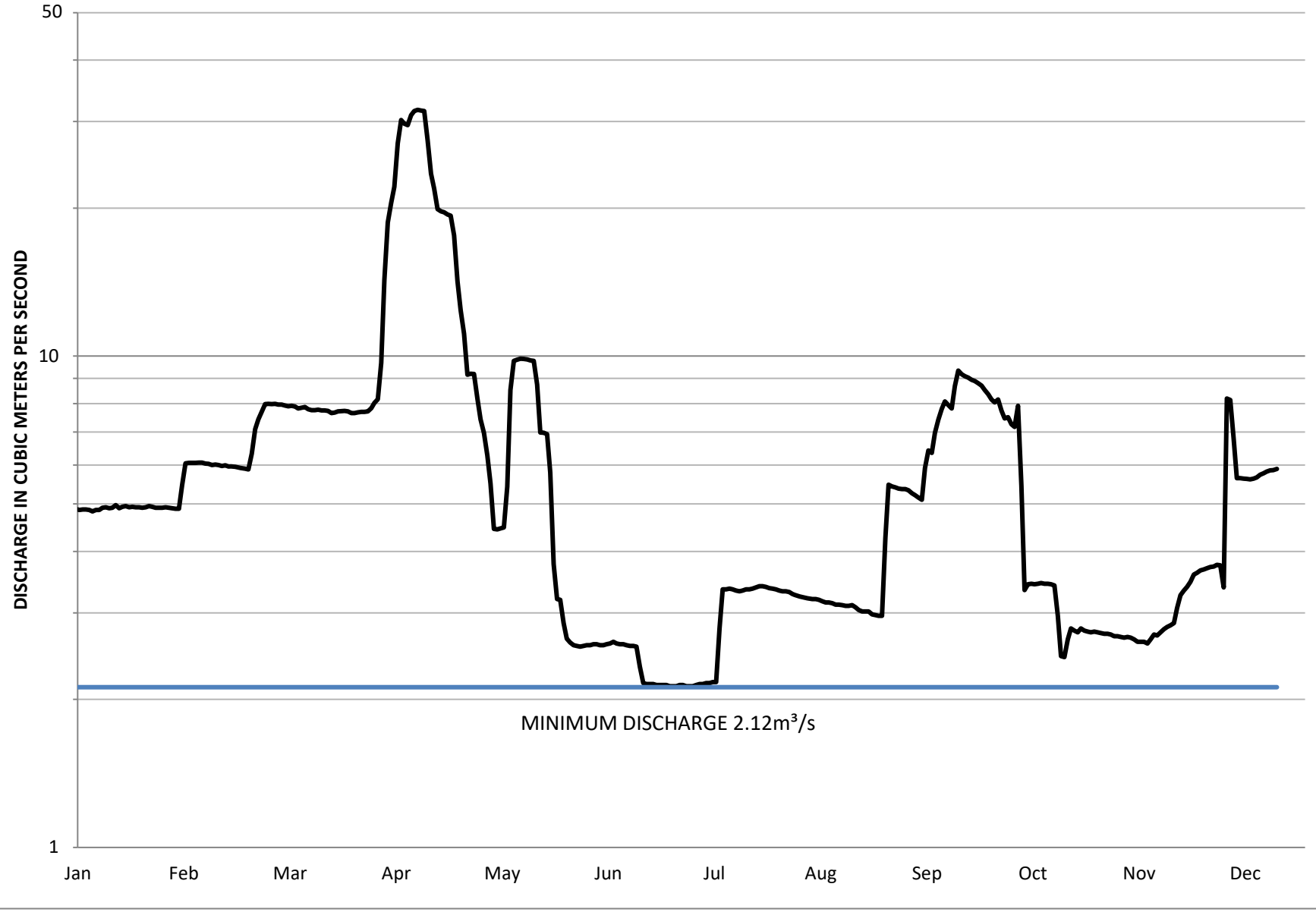
YEAR: 2020 STATION ID: 01AR009 - GRAND LAKE AT FOREST CITY

FIGURE I



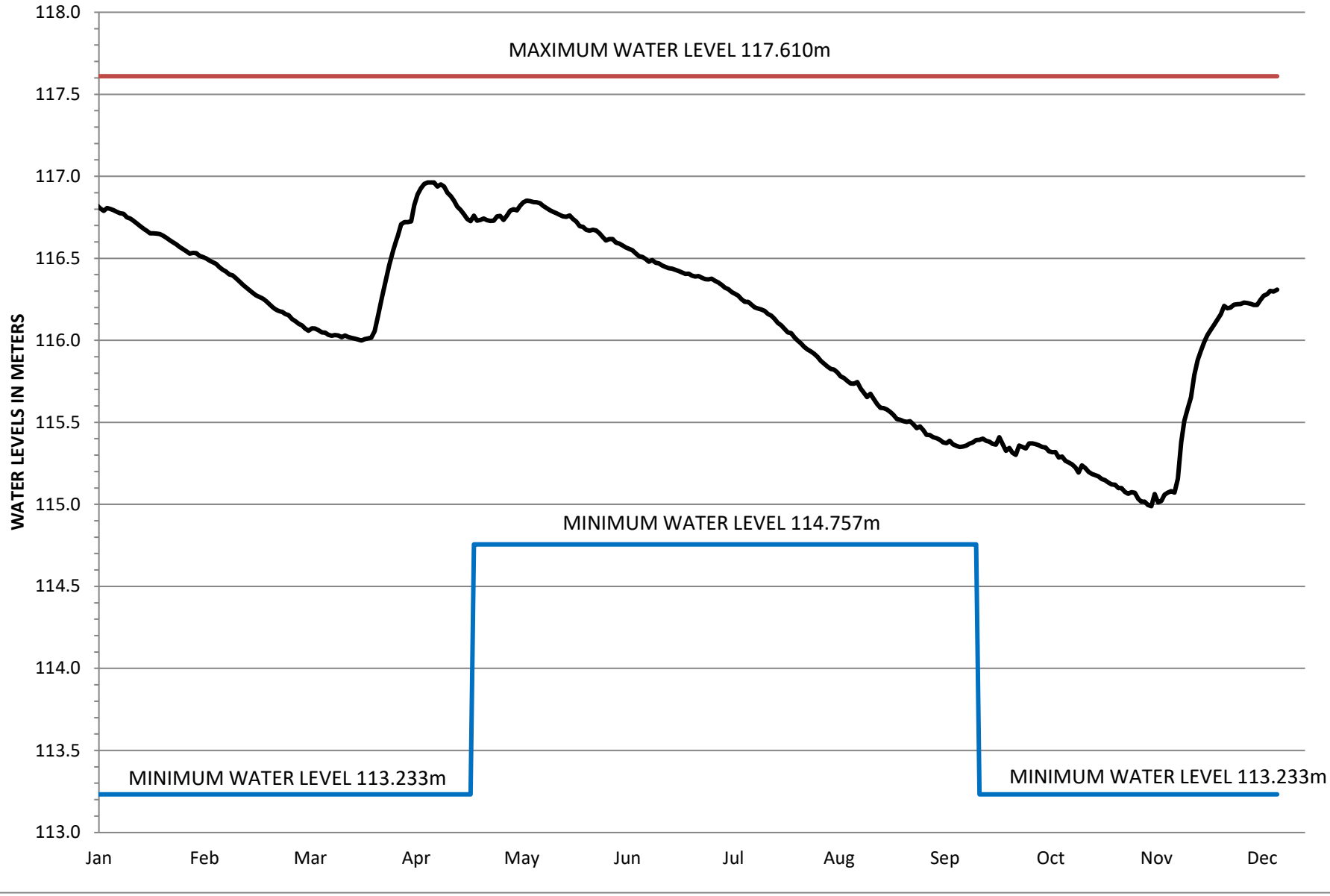
YEAR: 2020 STATION ID: 01AR011 - FOREST CITY STREAM BELOW FOREST CITY DAM

FIGURE II



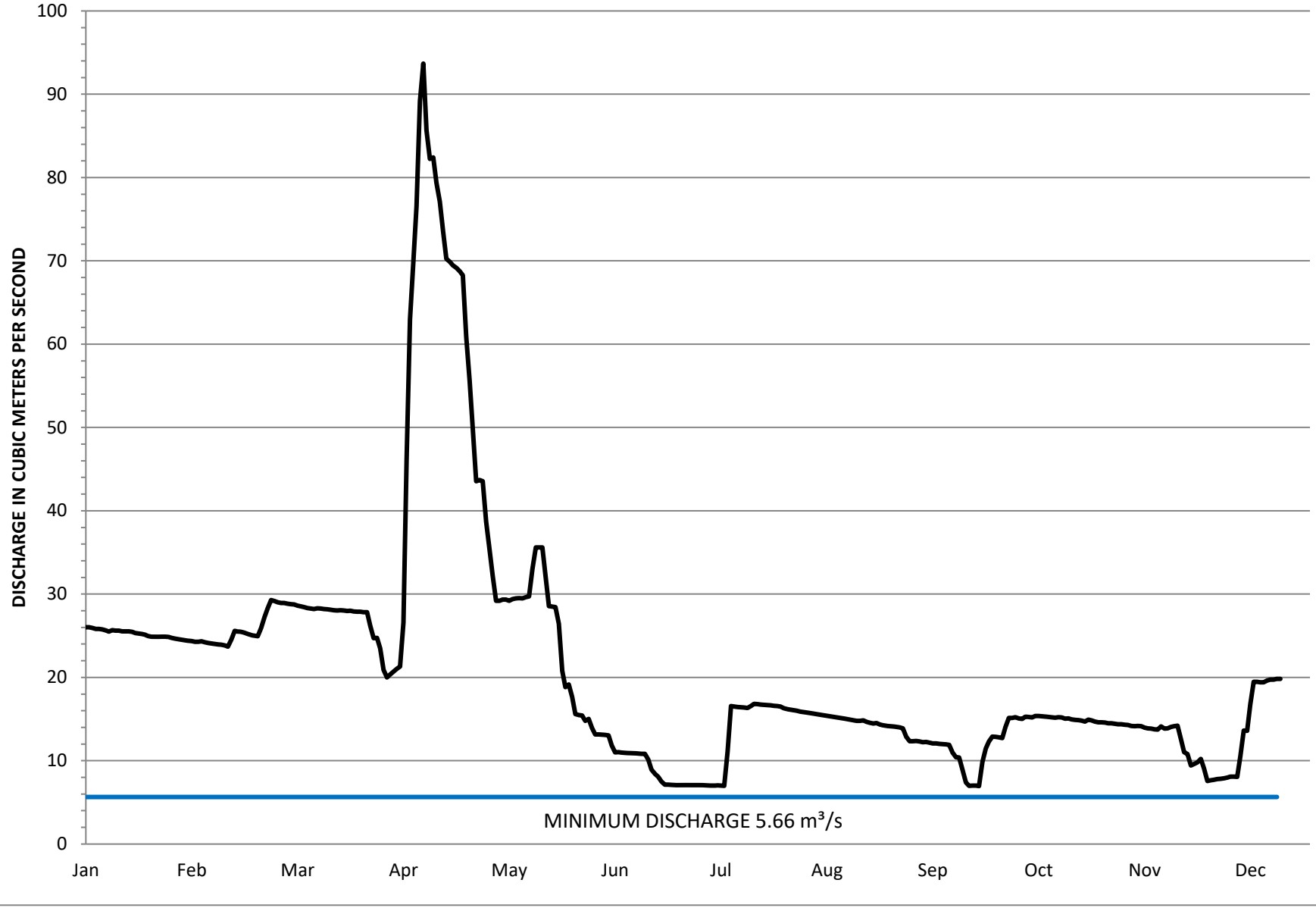
YEAR: 2020 STATION ID: 01AR010 - SPEDNIC LAKE AT ST. CROIX

FIGURE III



YEAR: 2020 STATION ID: 01AR004 - ST. CROIX RIVER AT VANCEBORO

FIGURE IV

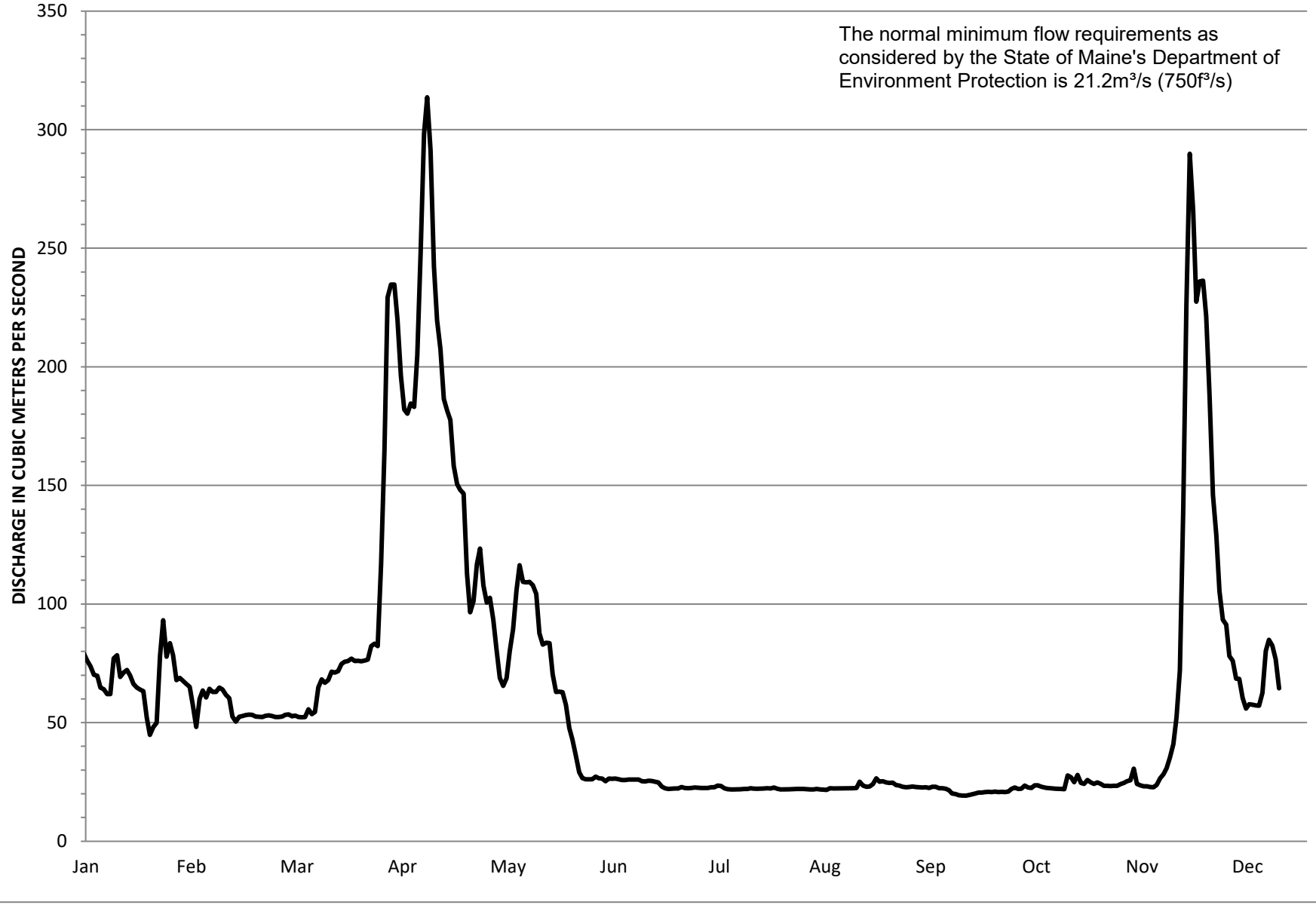


YEAR: 2020 STATION ID: 01AR013 - GRAND FALLS FLOWAGE AT GRAND FALLS

FIGURE V

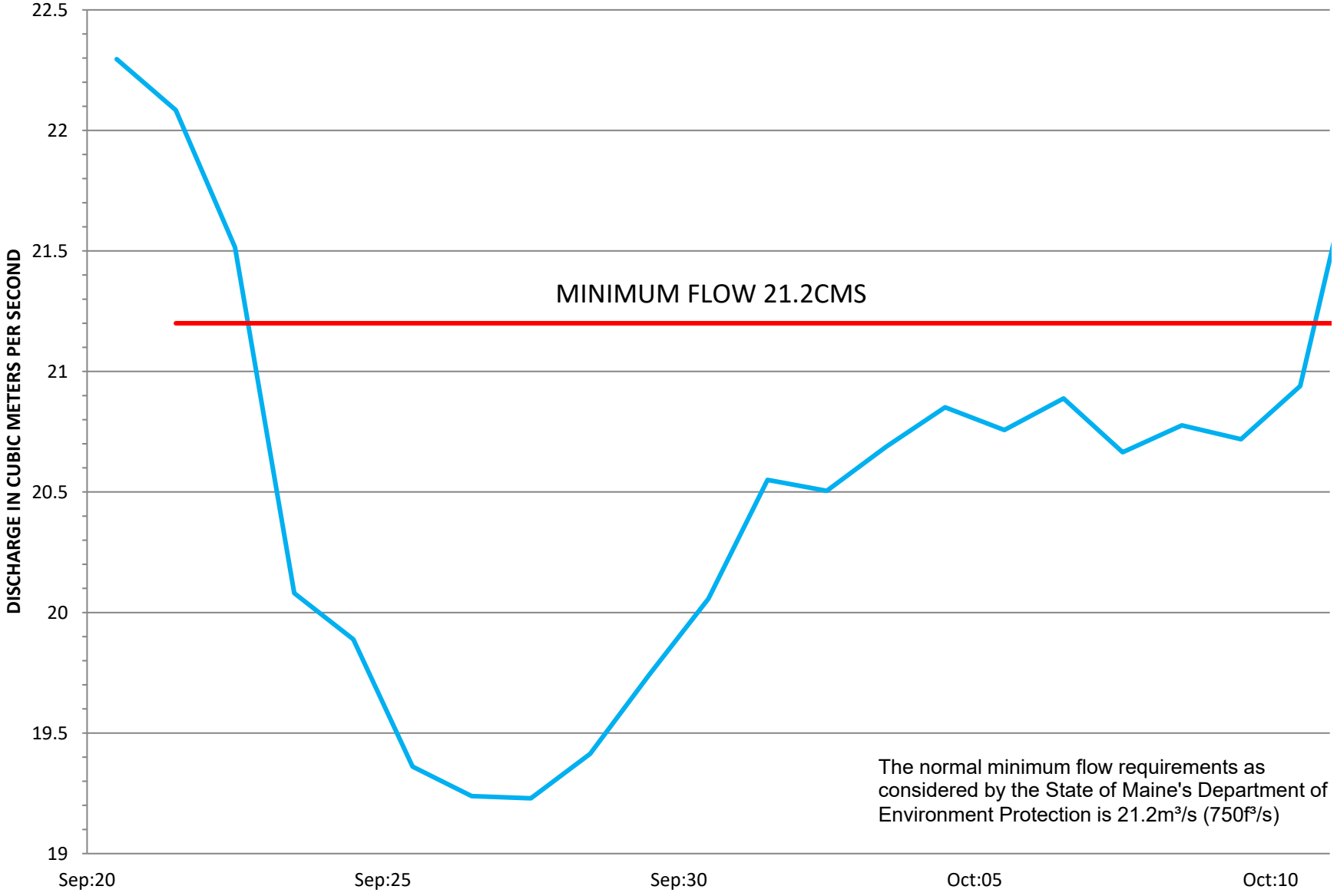
YEAR: 2020 STATION ID: 01AR005 - ST. CROIX RIVER AT BARING MAINE

FIGURE VI



YEAR: 2020 STATION ID: 01AR005 - ST. CROIX RIVER AT BARING MAINE

FIGURE VI-I



YEAR: 2020 STATION ID: 01AR014 - ST. CROIX RIVER AT MILLTOWN DAM

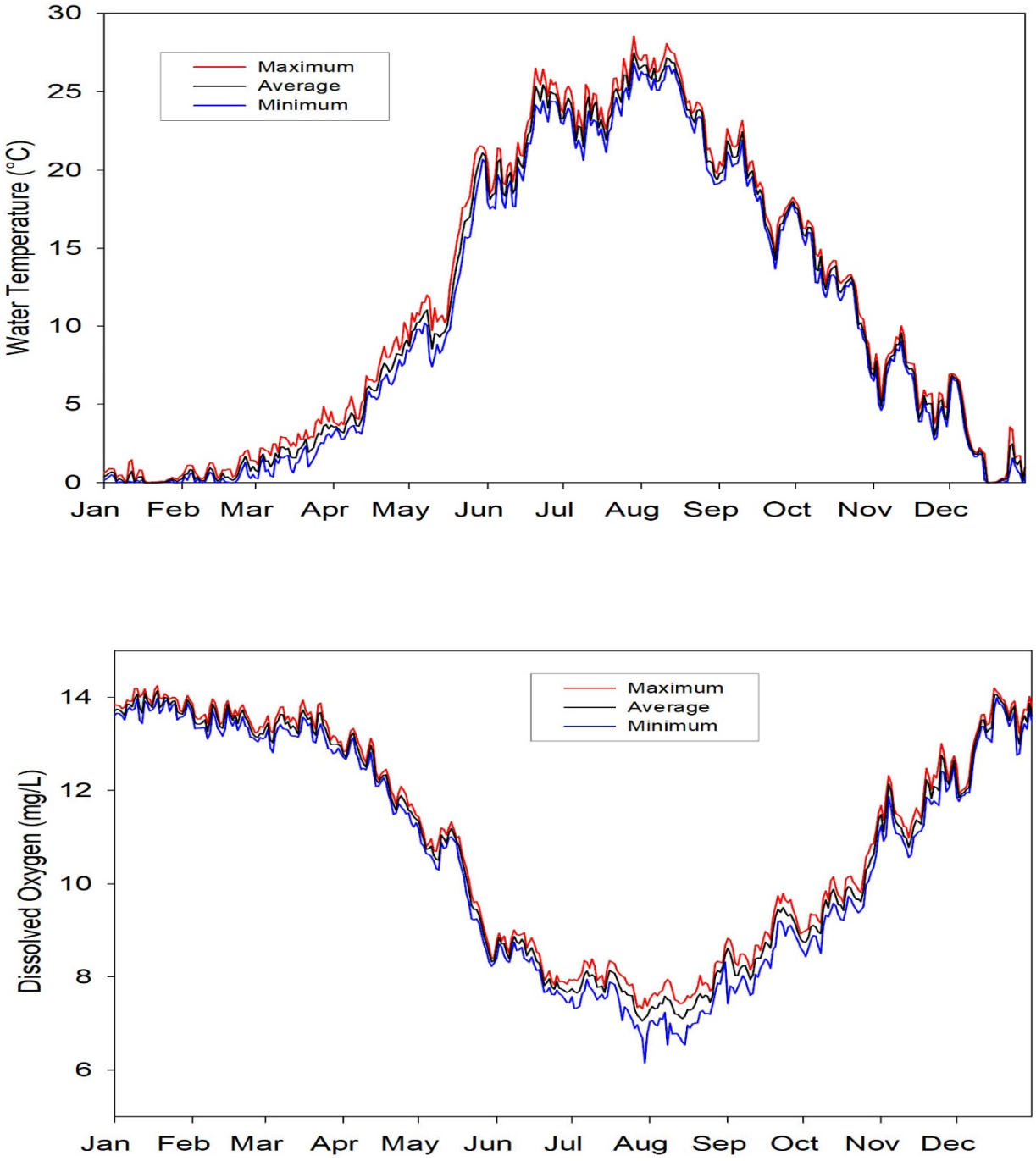
FIGURE VII

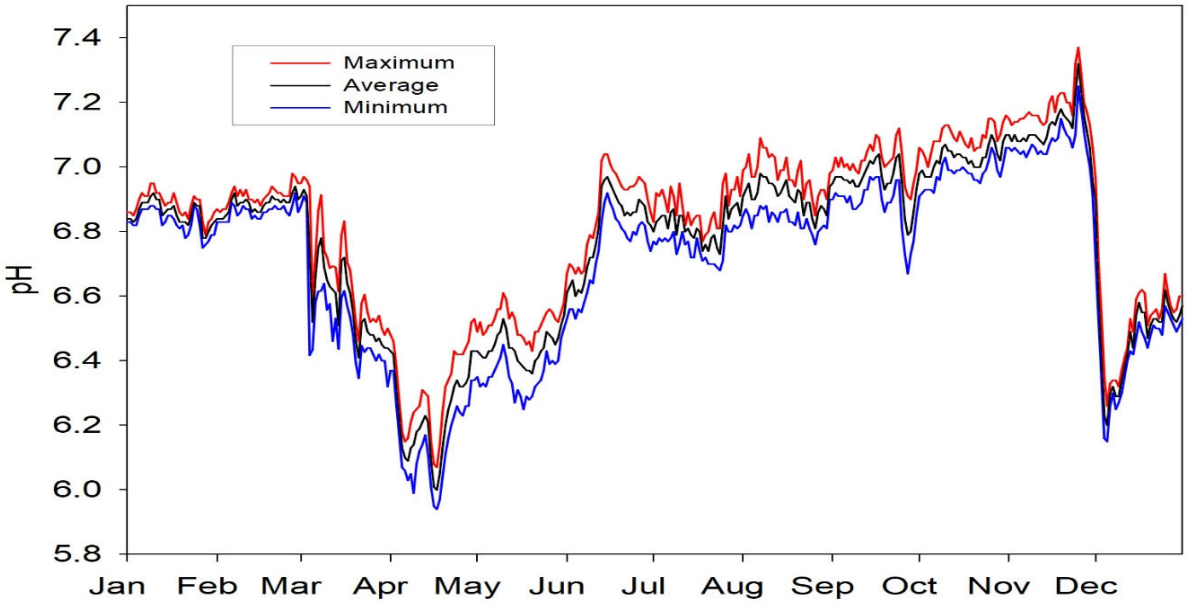
APPENDIX 5

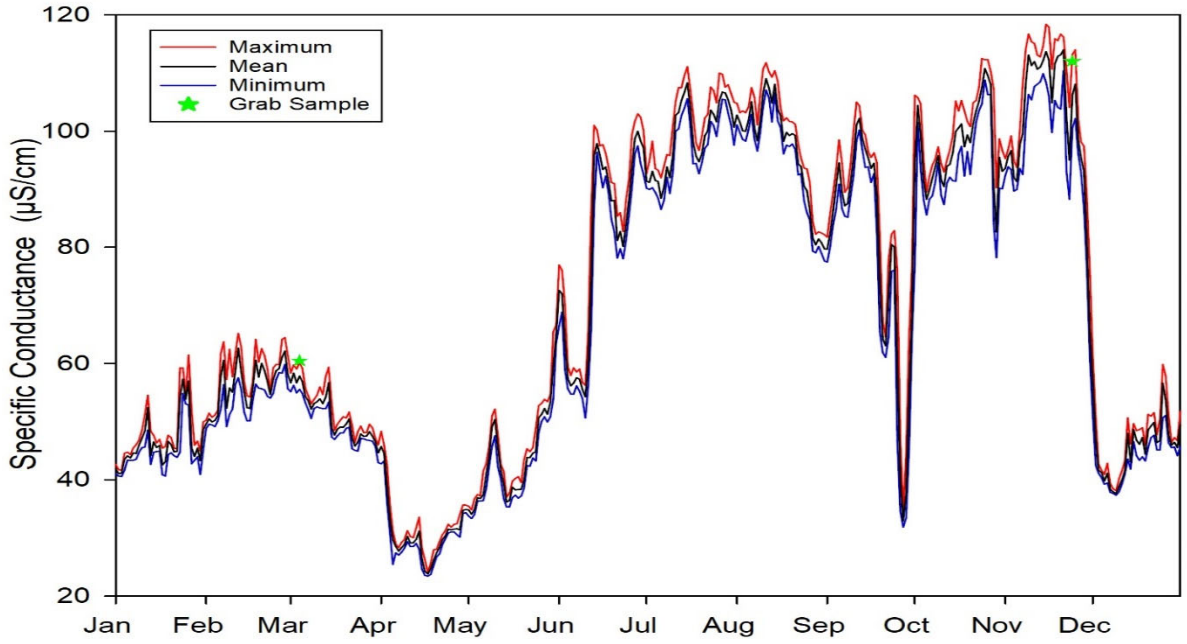
WATER QUALITY DATA
2020

Milltown Station, Real Times Data (operated by Environment and Climate Change Canada)

Figure 1: Daily mean, maximum and minimum temperature, dissolved oxygen, pH, specific conductance, and turbidity on the St. Croix River at Milltown, NB, 2020.




Maximum
Average
Minimum
pH
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Maximum
Mean
Minimum
Grab Sample
Specific Conductance (µS/cm)
120
100
80
60
40
20
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

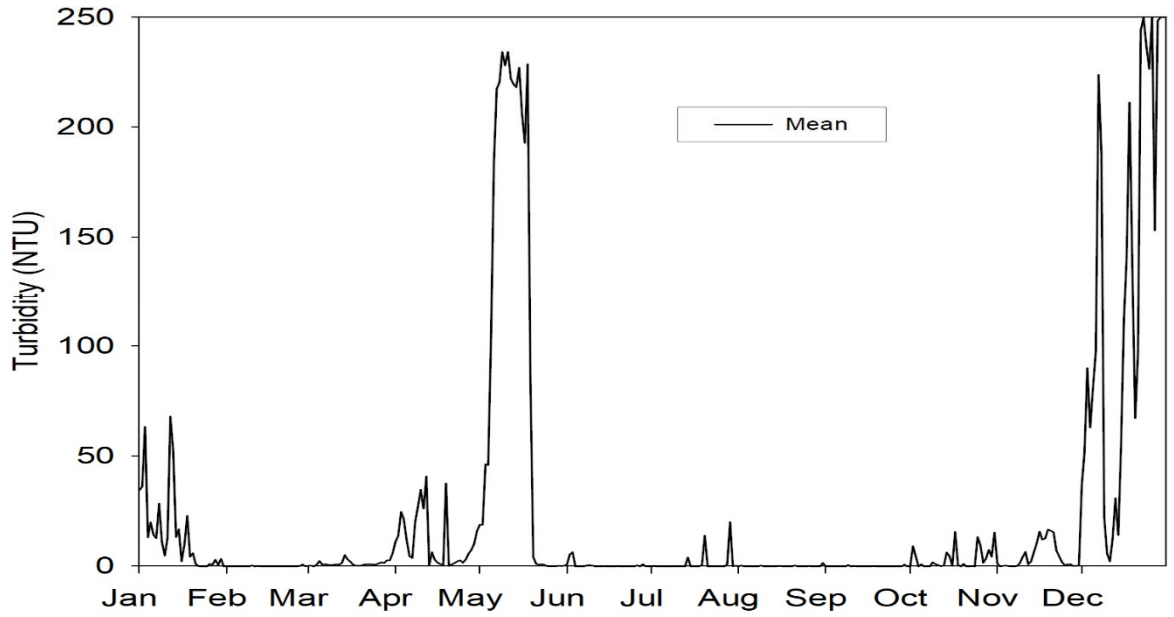


Table 1: Monthly mean, maximum and minimum temperature, dissolved oxygen, pH, specific conductance, and turbidity on the St. Croix River at Milltown, NB, 2020.

St. Croix River at Milltown, NB - 2019

Temperature °C

	January	February	March	April	May	June	July	August	September	October	November	December
Min	**0.01**	**0.01**	**0.27**	**2.79**	**7.42**	**17.53**	**20.63**	**19.08**	**13.65**	**6.76**	**2.74**	**0.02**
Max	**1.47**	**2.10**	**4.87**	**10.23**	**21.55**	**26.51**	**28.55**	**28.07**	**23.16**	**18.03**	**10.01**	**6.98**
Mean	**0.23**	**0.59**	**2.15**	**5.75**	**13.20**	**21.73**	**24.20**	**24.53**	**18.77**	**13.15**	**6.27**	**2.30**

Dissolved Oxygen (mg/L)

	January	February	March	April	May	June	July	August	September	October	November	December
Min	**13.44**	**13.05**	**12.80**	**11.22**	**8.23**	**7.45**	**6.16**	**6.55**	**7.43**	**8.44**	**10.57**	**11.77**
Max	**14.25**	**13.97**	**13.94**	**13.33**	**11.44**	**9.01**	**8.39**	**8.68**	**9.79**	**11.53**	**13.01**	**14.20**
Mean	**13.84**	**13.49**	**13.35**	**12.30**	**10.19**	**8.30**	**7.72**	**7.53**	**8.70**	**9.69**	**11.71**	**13.21**

pH (pH units)

	January	February	March	April	May	June	July	August	September	October	November	December
Min	**6.75**	**6.83**	**6.32**	**5.94**	**6.25**	**6.53**	**6.68**	**6.76**	**6.67**	**6.91**	**6.91**	**6.15**
Max	**6.95**	**6.98**	**6.97**	**6.53**	**6.61**	**7.04**	**6.98**	**7.09**	**7.12**	**7.16**	**7.37**	**6.96**
Mean	**6.86**	**6.88**	**6.60**	**6.23**	**6.44**	**6.80**	**6.82**	**6.91**	**6.95**	**7.03**	**7.12**	**6.48**

Specific Conductance (µS/cm)

	January	February	March	April	May	June	July	August	September	October	November	December
Min	**40.60**	**48.90**	**43.00**	**23.50**	**33.40**	**50.70**	**86.60**	**77.70**	**31.90**	**77.20**	**61.00**	**37.40**
Max	**61.50**	**65.20**	**60.20**	**48.40**	**66.70**	**103.00**	**111.10**	**111.80**	**105.00**	**112.50**	**118.40**	**61.10**
Mean	**46.44**	**56.37**	**51.15**	**30.82**	**43.68**	**79.60**	**99.04**	**97.10**	**79.52**	**97.46**	**102.43**	**45.61**

Turbidity (NTU)

	January	February	March	April	May	June	July	August	September	October	November	December
Min	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**
Max	**250.00**	**21.70**	**28.70**	**250.00**	**250.00**	**228.70**	**250.00**	**76.50**	**31.80**	**250.00**	**93.50**	**250.00**
Mean	**14.80**	**0.06**	**1.44**	**11.47**	**101.94**	**0.53**	**1.30**	**0.12**	**0.06**	**3.32**	**4.70**	**132.26**

Table 2: Grab samples results for water quality at Milltown and Forest City, 2020. Metals samples from March 2020 were lost due to laboratory closure from COVID-19.

Analyte	**Units**	**Guideline[1]**	**Milltown (NB01AR0021)**		**Forest City (NB01AR0151)**	
			04-Mar[4]	**24-Nov[5]**	**04-Mar[4]**	**24-Nov[5]**
Alkalinity (as CaCO3)	mg/L		13.6	21	11.3	12
Aluminum	mg/L	0.1		0.117		0.013
Ammonia (as N)	mg/L			< 0.05		< 0.05
Antimony	mg/L			< 0.0001		< 0.0001
Arsenic	mg/L	0.005		< 0.001		< 0.001
Barium	mg/L			0.013		0.002
Beryllium	mg/L			< 0.0001		< 0.0001
Bicarbonate (as CaCO3) (calculated)	mg/L			20.9		11.9
Bismuth	mg/L			< 0.001		< 0.001
Boron	mg/L			0.006		0.003
Bromine	mg/L			0.03		< 0.01
Cadmium	mg/L	0.00004[2]		0.00006		< 0.00001
Calcium	mg/L			5.65		3.90
Calcium	mg/L			5.65		3.90
Carbon - Total Organic	mg/L		7.20	8.1	4.02	3.9
Carbonate (as CaCO3) (calculated)	mg/L			0.098		0.045
Chloride	mg/L	120	5.7	11.7	1.9	2.1
Chromium	mg/L	0.0089		< 0.001		< 0.001
Cobalt	mg/L			< 0.0001		< 0.0001
Colour	TCU		64	40	13	6
Conductivity	µS/cm		60.5	112	34.0	36
Copper	mg/L	0.002[2]		0.001		< 0.001
Fluoride	mg/L		0.03	0.11	0.02	0.05
Hardness (as CaCO3) (calculated)	mg/L			17.7		12.0
Iron	mg/L	0.3		0.19		< 0.02
Lead	mg/L	0.001[2]		0.0003		< 0.0001
Lithium	mg/L			0.0003		0.0001
Magnesium	mg/L			0.88		0.56
Magnesium	mg/L			0.88		0.56
Manganese	mg/L	0.073		0.069		0.007
Molybdenum	mg/L			0.0002		< 0.0001
Nickel	mg/L	0.025[2]		< 0.001		< 0.001

Nitrate (as N)	mg/L	2.9		0.06		< 0.05
Nitrate + Nitrite (as N)	mg/L		0.04	0.06	<0.02	< 0.05
Nitrite (as N)	mg/L		<0.007	< 0.05	<0.007	< 0.05
Nitrogen - Total	mg/L		0.33	0.4	0.17	0.2
pH	units	6.5 - 9.0	7.29	7.7	7.26	7.6
Phosphorus - Total	mg/L	0.03[3]	0.014	0.032	0.003	0.008
Potassium	mg/L			1.66		0.22
Potassium	mg/L			1.66		0.22
Rubidium	mg/L			0.0040		0.0004
Selenium	mg/L	0.001		< 0.001		< 0.001
Silver	mg/L	0.0001		< 0.0001		< 0.0001
Sodium	mg/L			14.1		1.37
Sodium	mg/L			14.1		1.37
Strontium	mg/L			0.026		0.020
Sulfate	mg/L			15		< 1
Total Dissolved Solids (calculated)	mg/L			71		19
Tellurium	mg/L			< 0.0001		< 0.0001
Thallium	mg/L	0.0008		< 0.0001		< 0.0001
Tin	mg/L			< 0.0001		< 0.0001
Turbidity	NTU	15	1.8	2.7	0.4	0.8
Uranium	mg/L			< 0.0001		< 0.0001
Vanadium	mg/L			< 0.001		< 0.001
Zinc	mg/L	0.033[2]		0.013		< 0.001

Notes:

µg/L - microgram per litre; mg/L - milligrams per litre; $CaCO_3$ - calcium carbonate; µS/cm - microSiemens per centimetre; NTU - nephelometric turbidity units; RepT – temporal replicate sample; FB – field blank

Highlighted cells indicates exceedances.

[1] Guidelines refer to the Canadian Council of Ministers of the Environment (CCME) guidelines unless otherwise indicated.

[2] Calculated guideline value, CCME and BC MOE.

[3] OMOE, 1994.

[4] Analysed by Atlantic Laboratory for Environmental Testing

[5] Analysed by RPC Laboratory

APPENDIX 6

MILLTOWN FISH DATA

Table 1. St. Croix River ME/NB alewife/gaspereau/blueback herring spawning runs, 1981- present

Sources: Fisheries & Oceans Canada (1981-1990), Atlantic Salmon Federation (2012-2014), St. Croix International Waterway Commission (1991-2011, 2015-present).

YEARS >>>	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Apr 14 - Apr 29	--	--	--	--	--	--	--	--	--	--
Apr 30 - May 2	--	0	0	0	0	5,460	0	0	0	0
May 3 - May 9	--	0	0	0	0	16,410	9,400	24,410	0	29,690
May 10 - May 16	7,510	32,160	16,970	6,000	0	75,150	171,500	468,750	0	305,370
May 17 - May 23	47,450	64,120	**44,050**	40,300	70,000	429,400	559,500	760,280	200,610	319,380
May 24 - May 30	47,770	**74,800**	33,760	**67,100**	**149,890**	**772,800**	**674,700**	**764,990**	**464,390**	**411,090**
May 31 - Jun 6	**48,310**	56,930	20,770	26,200	96,740	628,300	645,300	370,750	424,550	141,490
Jun 7 - Jun 13	16,000	4,610	35,650	13,300	26,900	57,200	480,400	187,800	63,940	132,030
Jun 14 - Jun 20	1,760	250	620	0	21,040	0	83,900	13,770	11,370	0
Jun 21 - Jun 27	790	210	0	0	1,060	0	0	0	0	0
Jun 28 - Jul 4	30	20	0	0	3,270	0	0	0	0	0
Jul 5 - Jul 11	0	1	130	0	0	0	0	0	0	0
Jul 12 - Jul 18	0	1	0	0	0	0	0	0	0	0
Jul 19 - Jul 25	0	0	2	0	0	0	0	0	0	0
Jul 26 - later			0	0	0	0	0	0	0	0
Escapement	169,620	233,102	151,952	152,900	368,900	1,984,720	2,624,700	2,590,750	1,164,860	1,339,050
Harvest	0	0	0	0	0	0	0	0	0	192,200
Total	**169,620**	**233,102**	**151,952**	**152,900**	**368,900**	**1,984,720**	**2,624,700**	**2,590,750**	**1,164,860**	**1,531,250**

YEARS >>>	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Apr 14 - Apr 29	--	--	--	--	--	--	--	--	--	--
Apr 30 - May 2	0	0	0	0	0	0	0	0	0	0
May 3 - May 9	170	0	0	0	0	2,814	0	0	0	**3,966**
May 10 - May 16	14,740	8,910	0	0	5,898	11,178	0	**77,394**	195	142
May 17 - May 23	133,820	**74,120**	12,000	94,304	**109,388**	202,188	**122,478**	25,705	5,933	2,011
May 24 - May 30	**154,560**	45,520	**146,600**	99,150	99,847	188,538	93,000	71,534	**13,615**	377
May 31 - Jun 6	51,110	24,780	102,800	**125,900**	50,946	**231,870**	4,091	2,684	5,476	2,067
Jun 7 - Jun 13	4,010	50,420	2,260	15,400	0	9,390	5,951	0	108	6
Jun 14 - Jun 20	0	0	26,060	0	0	0	0	0	0	0
Jun 21 - Jun 27	0	0	0	0	0	0	0	0	0	0
Jun 28 - Jul 4	0	0	0	0	0	0	0	0	0	0
Jul 5 - Jul 11	0	0	0	0	0	0	0	0	0	0
Jul 12 - Jul 18	0	0	0	0	0	0	0	0	0	0
Jul 19 - Jul 25	0	0	0	0	0	0	0	0	0	0
Jul 26 - later	0	0	0	0	0	0	1	0	0	0

Escapement	358,410	203,750	289,720	334,754	266,079	645,978	225,521	177,317	25,327	8,569
Harvest	228,500	0	8,000	15,400	8,000	0	0	0	0	0
Total	**586,910**	**203,750**	**297,720**	**350,154**	**274,079**	**645,978**	**225,521**	**177,317**	**25,327**	**8,569**

Table 1. St. Croix River ME/NB alewife/gaspereau/blueback herring spawning runs, 1981- present

Sources: Fisheries & Oceans Canada (1981-1990), Atlantic Salmon Federation (2012-2014), St. Croix International Waterway Commission (1991-2011, 2015-present).

YEARS >>>	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Apr 14 - Apr 29	--	--	--	--	--	--	--	--	--	--
Apr 30 - May 2	0	0	0	0	0	0	--	--	--	--
May 3 - May 9	0	2	0	0	0	18	0	0	0	0
May 10 - May 16	160	6	3	0	0	577	0	4	1	9,748
May 17 - May 23	505	23	603	0	2	3,111	0	33	12	**17,731**
May 24 - May 30	**2,625**	325	2,115	0	20	**3,155**	2	119	3,740	17,008
May 31 - Jun 6	1,735	**494**	**3,163**	0	5,277	2,540	0	**11,797**	42	8,520
Jun 7 - Jun 13	123	35	999	**951**	**6,220**	1,096	**1,225**	61	2	4,700
Jun 14 - Jun 20	54	15	1,018	108	113	1,227	66	23	**6,627**	1,126
Jun 21 - Jun 27	0	0	0	79	0	105	1	221	26	255
Jun 28 - Jul 4	0	0	--	150	--	--	--	3	0	45
Jul 5 - Jul 11	0	0	--	11	--	--	--	--	--	9
Jul 12 - Jul 18	0	0	--	0	--	--	--	--	--	3
Jul 19 - Jul 25	0	0	--	0	--	--	--	--	--	--
Jul 26 - later	0	0	--	0	--	--	--	--	--	--
Escapement	5,202	900	7,901	1,299	11,632	11,829	1,294	12,261	10,450	59,145
Harvest	0	0	0	0	0	0	0	0	0	0
Total	**5,202**	**900**	**7,901**	**1,299**	**11,632**	**11,829**	**1,294**	**12,261**	**10,450**	**59,145**

YEARS >>>	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Apr 30 - May 2	--	--	--	--	0	0	0	0	--	0
May 3 - May 9	0	993	342	0	0	0	0	5	60	0
May 10 - May 16	1,657	343	362	7	16	125	369	13,028	417	0
May 17 - May 23	**13,053**	**22,260**	178	16	126	269	29,946	43,260	13	249,507
May 24 - May 30	1,227	11,190	**10,542**	29	**32,637**	**14,304**	**44,110**	**130,538**	63,941	258,678
May 31 - Jun 6	7,750	1,175	5,107	**19,971**	16,875	12,781	42,406	43,657	**252,631**	54,870
Jun 7 - Jun 13	1,387	197	37	6,775	27,150	3,038	27,681	29,292	129,387	12,792
Jun 14 - Jun 20	50	10	83	95	11,871	2,000	8,790	7,804	34,221	25,122
Jun 21 - Jun 27	10	0	23	143	3,817	471	3,787	2,163	4,220	6,084
Jun 28 - Jul 4	7	--	3	267	816	27	571	821	809	2,520
Jul 5 - Jul 11	1	--	--	9	161	1	69	86	743	1,386
Jul 12 - Jul 18	--	--	--	--	34	--	21	5	58	786
Jul 19 - Jul 25	--	--	--	--	--	--	0	0	-	144

Escapement	25,142	36,168	16,677	27,312	93,503	33,016	157,750	270,659	486,500	611,907
Harvest	0	0	0	0	0	0	0	0	0	0
Total	**25,142**	**36,168**	**16,677**	**27,312**	**93,503**	**33,016**	**157,750**	**270,659**	**486,500**	**611,907**

Table 2. St. Croix River ME/NB alewife/gaspereau/blueback herring spawning runs, 1981- present

Sources: Fisheries & Oceans Canada (1981-1990), Atlantic Salmon Federation (2012-2014), St. Croix International Waterway Commission (1991-2011, 2015-present).

Note 3. **Upstream passage.** Beginning in 1995, the State of Maine blocked the upstream fishways at Woodland and Grand Falls to spawning river herring. In 2001, Fisheries & Oceans Canada began to truck a portion of the spawning run from Milltown to Woodland Flowage. Number of river herring transported to Woodland: 2001 (3756), 2002 (807), 2003 (6805), 2004 (392), 2005 (7100), 2006 (6653), 2007 (1169). In 2008, Maine removed the Woodland fishway barrier, allowing river herring direct access to Woodland Flowage, and Fisheries & Oceans discontinued its trucking operation. In 2013, Maine removed the Grand Falls fishway barrier, allowing river herring access the upper watershed.

Note 4. **Duration of count.** Monitoring was discontinued on June 27 in 2006, 2007 and 2012; on July 3 in 2008; July 4 in 2009 and 2013; July 8 in 2014; July 11 in 2011 and 2016; July 18 in 2015 and July 19 in 2010 at the presumed end of each year's run. Any fish entering the river after these dates were not recorded.

Note 5. **Correction of 1994, 1995 and 2010 counts**. In 2016, errors in the day counts for these three years was discovered and corrected. This increased earlier reported totals for 1995 and 2010 and decreased 1994.