INTERNATIONAL ST. CROIX RIVER WATERSHED BOARD

ANNUAL REPORT

2011

ST. CROIX RIVER
MAINE AND NEW BRUNSWICK

2011 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

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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 2012

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1.0 GENERAL

1.1 Synopsis for 2011

2011 was an above average water year for the St. Croix River system. During the year, lake levels operated within normal levels and flows in the river provided satisfactory conditions for activities such as power generation, canoeing and kayaking, and for support of aquatic life.

In 2011 the water quality in the system remained in good condition.

In 2011, the International St. Croix River Watershed Board continued to work in cooperation with the Passamaquoddy, the State of Maine, and interested parties to facilitate a resolution of the alewife passage issue in the St. Croix River Watershed. The Board and the International Joint Commission (IJC) support the proposal entitled "An Adaptive Plan for Managing Alewife in the St. Croix River Watershed, Maine and New Brunswick" (AMP) prepared in 2010 by the St. Croix Fisheries Steering Committee at the request of the IJC and the Board.

The Board Co-Chair (Colonel Feir) and Board member Joan Trial met with the Passamaquoddy Chiefs in February 2011 to present the AMP and answer questions on the AMP.

The Board held its annual public meeting in the Basin in June 2011 in St. Stephen, New Brunswick. The meeting included a presentation on the study of smallmouth bass spawning habitat as a function of lake level in Spednic Lake. At the public meeting the Board and the IJC Commissioners noted their continued support for implementation of the AMP in the watershed as a comprise solution.

In 2011, the Board began a new International Watershed Initiative (IWI) project to establish a consistent vertical and horizontal local control network for the St. Croix River and reference this network to international and local datums in both Maine and New Brunswick, and tie all of the hydraulically important features along the St. Croix River to this control network. This work is being done by the USGS in cooperation with Environment Canada and Woodland Pulp LLC.

1.2 Board Membership

Board membership as of December 2011 is provided below. In July 2011, Colonel Philip T. Feir retired from the Military and Colonel Charles P. Samaris was appointed to replace Colonel Feir as U.S. Section Co-Chair. Colonel Samaris is the Commander of the New England District of the U.S. Army Corps of Engineers.

International St. Croix River Watershed Board	
Canadian Section	**U.S. Section**
Bill Appleby *(Canadian Co-Chair)* Director-Atlantic Meteorological Services of Canada Environment Canada Dartmouth, NS	**Colonel Charles P. Samaris** *(U.S. Co-Chair)* U.S. Army Corps of Engineers New England District Concord, MA
Darryl Pupek Director, Environmental Evaluation & Reporting, New Brunswick Department of the Environment Fredericton, NB	**Matt Schweisberg** Office of Ecosystem Protection U.S. Environmental Protection Agency New England Region Boston, MA
Jessie Davies Resident St. Andrews, NB	**Edward Logue** Regional Director, Eastern Maine Maine Dept. of Environmental Protection Bangor, ME
Robert Stephenson, Ph.D. Principal Investigator Canadian Capture Fisheries Research Network, Visiting Research Professor University of New Brunswick, Research Scientist, St. Andrews Biological Station, Department of Fisheries and Ocean St. Andrews, NB	**Joan Garner Trial**, Ph.D. Senior Atlantic Salmon Biologist Bureau of Sea Run Fisheries and Habitat Department of Marine Resources Bangor, ME
Jean-François Bibeault Acting Manager - Atlantic Fresh Water Quality Monitoring, Manager of the National Water Quality Indicators Program Environment Canada Montréal, QC	**Robert Lent, Ph.D.** Maine District Chief United States Geology Survey Augusta, ME

Secretariat	
Rene Savoie, P Eng (acting) Manager Regional Hydrometric, Engineering Atlantic Water Survey Section, Dartmouth, NS Nadine MacKay Strategic Analysis and Policy Division Environment Canada, Dartmouth, NS	Barbara Blumeris Engineering/Planning Division U.S. Army Corps of Engineers Concord, MA

1.3 Annual Public / Stakeholder Meeting in Basin

The annual public meeting was held in St. Stephen, New Brunswick on the evening of June 29th, 2011 at the Royal Canadian Legion Hall, at 444 Milltown Blvd. There were about 20 people in attendance not including the Board, IJC Commissioners, and staff.

The meeting began with opening remarks from Bill Appleby, the Board Co-Chair and then opening remarks from IJC Commissioners Sam Speck and Pierre Trepanier. It was noted that the proposal "An Adaptive Plan for Managing Alewife in the St. Croix River Watershed, Maine and New Brunswick" (AMP) was released in 2010. The IJC and the Board consider the AMP a compromise option that could lead to the opening of fishways on the St. Croix River to alewives. However, in 2011, Maine Legislation blocking alewife passage above Grand Falls Dam remained in place. The Commissioners noted that the Board and the IJC would continue to engage stakeholders to encourage the implementation of the AMP to restore alewife in the St. Croix River Watershed.

Bob Lent, USGS, provided an informational presentation on a recent study that assessed historic bass spawning habitat availability in Spednic Lake as a function of lake level. The USGS report on this study entitled "A Digital Terrain Model of Bathymetry and Shallow-Zone Bottom-Substrate Classification for Spednic Lake and Estimates of Lake-Level-Dependent Habitat to Support Smallmouth Bass Persistence Modeling**"** can be accessed at http://pubs.usgs.gov/sir/2010/5255/. The next step in modeling historic smallmouth bass year-class persistence is to combine this analysis of habitat availability with meteorological conditions. This is planned for 2012.

Following the presentation there was an opportunity for public comments. Comments on the presentation related to the bass spawning time period and water temperature

triggers to bass spawning. There was a comment that variation in flows below Woodland Dam is a concern for river outfitters using the river for raft/canoe excursions. There was some additional discussion on the AMP and the IJC's role. It was noted that the Board and IJC would continue to engage the interested parties and encourage Maine government to pass legislation that would allow implementation of the AMP.

1.4 Annual Site Visit of Facilities in the Basin

Board members met with New Brunswick Power Corporation officials on the morning of June 29th to tour the Milltown Dam operations. Board members met with Woodland Pulp, LLC, officials in the Woodland Mill at Baileyville, Maine on the morning of June 30th and then toured the Grand Falls, Vanceboro and Forest City dam sites. (Visit notes and information describing the dams is provided in Appendix 2.)

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 New Brunswick Power) in the owners' hands.

During the 2011 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; and monthly reports received from New Brunswick Power indicating daily forebay elevations obtained during regular work days at the Milltown Dam and water level data from a continuous monitoring station in the head pond at Milltown Dam operated by Environment Canada. Data are discussed in Section 2.

2.0 MANAGEMENT OF WATER LEVELS AND FLOWS

2.1 Summary

In 2011, the annual mean water level at East Grand Lake was 131.994 metres (433.05 feet), which is higher than the long term mean value of 131.809 metres (432.44 feet).

The annual mean flow from the lake at Forest City Stream was 8.74 m^3/s (309 cfs), 35% higher than the long term mean value of 6.46 m^3/s (228 cfs).

The annual mean water level for the year at Spednic Lake was 116.489 metres (382.18 feet), which is higher than the long term mean value of 116.312metres (381.60 feet).

The annual mean flow as recorded at Vanceboro was 28.6 m^3/s (1010 cfs), 38 % higher than the long term mean of 20.7 m^3/s (731 cfs).

The annual mean water level for the year at Grand Falls Flowage was 61.789 metres (202.72 feet), which is higher than the long term mean value of 61.759 metres (202.62 feet)

The annual mean flow at Baring was 86.6 m^3/s (3060 cfs), which is 16.9% higher than the long term mean at Baring of 74.1 m^3/s (2620 cfs).

2.2 East Grand Lake Reservoir and Discharges Below Forest City Dam

During the period from January 1 to December 31, the reservoir was operated between a maximum daily mean water level of 132.482 metres (434.65 feet) on 18th of May and a minimum daily mean of 131.533 metres (431.54 feet) on the 10th of November. The maximum lake level as prescribed by the Commission's Order is 132.570 metres (434.94 feet): the minimum is 130.436 metres (427.94 feet). The Order was maintained throughout the year. The daily mean elevations are presented in Table I and depicted in Figure I of the Appendix.

Table II and Figure II of the Appendix presents the daily mean discharges below the Forest City Dam at the outlet of East Grand Lake for 2011. The maximum daily mean for the reporting period was 28.9 m^3/s (1020 cfs) on the 22nd of April and the minimum daily mean was 1.78 m^3/s (62.9 cfs) on the 8th of August. The mean discharge for the year was 8.74 (309 cfs).

The Commission's Order of 2.12 (75 cfs) as a minimum flow, was exceeded for the period July 26 at 11:30 EDT to August 17 at 10: 30 EDT. Water flow during this time was low by about 0.3 m^3/s (10.6 cfs) due to a gauge recording issue as explained below. This issue was corrected and no impacts were reported due to the low flow.

The USGS established a new gauge at Forest City on behalf of Environment Canada to assist Water Survey when the former gauge burned in December 2010. After a review of the data collected between Dec 2010 and October 2011, the USGS have identified an error in the rating used to produce flows to the web. The stage\discharge model had an accumulated error in the levels due to a miscommunication during station establishment back in Dec 2010 (Datum Error). This was first observed during a March 2011 visit by Environment Canada staff but was only noted and not immediately acted on due to uncertainty of cause. A follow up visit in May by Environment Canada confirmed there was a difference between the outside water level and the present reading on the logger. The initial assumption by Environment Canada was the end of the orifice that sensed the water level had moved, thus water levels needed to be adjusted to correct for this difference in elevation.

A request was made by Environment Canada to the USGS to correct levels accordingly. A correction to levels was made by the USGS however it was not discovered until data was reviewed for the 2011 calendar year that the orifice had not moved but in fact the wrong elevation had been used to establish the gauge back in December 2010. This unknowingly compounded the correction by applying two corrections to the rating, producing higher flows.

For the period December 10, 2010 to October 13, 2011, Woodland Pulp LLC used the flows from the USGS website to assist them in making gate changes. Therefore the gate change made on July 26, 2011 by Woodland was considered appropriate at the time as flows data indicated the flows to be in acceptable range when in fact they were being reported too high. The resulting change to the gate unknowingly brought flows below the Commission's Order of 2.12 m^3/s.

The USGS logger that was initially installed at the site after the fire was replaced on October 13, 2011 with one from Environment Canada and water level data redirected to Environment Canada's real-time website. Since that time, the gauge elevation has been correct and Woodland has been provided with a table to extract corresponding flow values. In the very near future, the addition of flow values for this site can be

posted to Environment Canada's real-time web. This option will be discussed with Woodland Pulp LLC and Environment Canada in 2012.

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 of 117.468 metres (385.39 feet) on the 19th of April, to a minimum daily mean of 115.500 metres (378.94 feet) on the 10th of November. The maximum limit specified in the Commission's Order is 117.610 metres (385.86 feet). The allowable minimum level is 113.233 metres (371.50 feet) for the period January 1 to 30 April and 1 October to December 31 inclusive, and 114.757 meters (376.50 feet) for the period 1 May to 30 September 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 of the Appendix.

The maximum daily mean discharge recorded from the outflow at the reservoir at Vanceboro was 109 m^3/s (3850 cfs) on the 22nd of April and the minimum daily mean discharge recorded was 8.89 m^3/s (314), on the 7th of September. The Commission's Order of a minimum flow of 5.66 m^3/s (200 cfs) was maintained throughout the year.

Daily mean discharges are presented in Table IV and depicted in Figure IV of the Appendix.

2.4 Water Levels above Grand Falls Dam

Table V of the Appendix and Figure V include a list of the water level elevations of the headpond above the Grand Falls Dam. The recorded maximum daily mean elevation was 61.935 metres (203.20 feet) on 3rd of January and the minimum recorded elevation was 61.662 metres (202.30 feet) on the 20th of July. The maximum prescribed elevation of 62.106 metres (203.76 feet), as set by the Commission, was not exceeded at any time during the year.

2.5 Discharges at Baring, Maine

Table VI of the Appendix and Figure VI present and depict the daily mean discharges of the St. Croix River at Baring, Maine. The mean discharge for the report period was 86.6 m^3/s (3060 cfs). The maximum daily mean was 275 m^3/s (9710 cfs) on the 14th of March. The minimum daily mean was 27.1 m^3/s (957 cfs) on the 29th of July.

Woodland Pulp met the minimum flow requirements set at 21.2 m^3/s (750 cfs). (This is the minimum flow requirement as considered by the Maine Department of Environmental Protection.)

2.6 Headwater Elevations above Milltown Dam

Table VII and Figure VII of the Appendix present and depict daily water elevations in the forebay of the NB 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 2011 was extracted from this gauging station located in the headpond.

3.0 WATER QUALITY

3.1 USGS Milltown Monitor

Water-quality values for the St. Croix River at the Milltown monitor were within the extreme values for the period of daily record during the summer of 2011 based on record since September 1969. Values were above the water-quality objectives for the river.

TABLE 1
St. Croix River at Milltown, USGS Station # 01021050
Water-Quality Monitor, June – September 2011.

Dissolved Oxygen (mg/L)- IJC objective = 5.0 mg/L minimum
Maximum for the season: 9.8 mg/L on June 4-6
Minimum for the season: 6.5 mg/L on August 15

	June	July	August	September
Maximum	9.8	8.2	7.8	8.7
Minimum	7.8	7.0	6.5	6.8
Mean	8.8	7.7	7.2	7.8

Notes: Missing DO record: June 10-16 and July 20 to August 5.
June 1-16 data rated poor, September 1-30 data rated fair.

Water Temperature (degrees Celsius)

	June	July	August	September
Maximum	22.7	26.9	25.2	22.8
Minimum	16.5	21.0	20.8	17.0
Mean	21.8	24.3	23.0	19.7

Notes: Missing water temperature record: June 10-16. All record rated good.

pH (standard units)

	June	July	August	September
Maximum	7.1	7.1	7.2	7.0
Minimum	6.8	6.8	6.6	6.6
Median	6.9	7.0	7.0	6.8

Notes: Missing pH record: June 10-16. All record rated good.

TABLE 1 (continued)

Specific conductance (microsiemens per centimeter at 25 C)

	June	July	August	September
Maximum	92	110	111	118
Minimum	50	54	46	45
Mean	67	78	82	71

Notes: Missing specific conductance record: June 10-16. All record rated good.

3.2 Environment Canada Monitoring Stations – Forest City and Milltown

Environment Canada, in partnership with the New Brunswick Department of Environment, maintained one real-time water quality monitoring station on the St. Croix River system, located at the Milltown dam in Milltown (St. Stephen), New Brunswick. The former real-time monitoring location in Forest City, Maine, was destroyed by fire during a flooding event in December 2010. The Milltown station recorded hourly measurements of temperature, dissolved oxygen, pH, specific conductance and turbidity. In order to re-calibrate the measuring devices and to collect a grab sample for water quality analysis, the site was visited every 8 to 9 weeks during the warmer months of the year, and less frequently during the colder months when fouling of the sensors is less prominent. One grab sample was collected in Forest City in 2011.

Real time monitoring allows an observer to assess several river water quality parameters quickly at any particular instant in time. This can alert managers to sudden changes in the characteristics of the river and relate them to particular events such as rapid spilling of water, accidental discharges from industry, severe weather events or remote introduction of atmospheric or other pollutants which might threaten the health of aquatic organisms or humans using the river. It could also allow responsible agencies to take rapid intervention to correct the problem.

3.2.1 Interpretation of Real-Time Monitoring Data

Monthly summaries of the real-time data and annual charts showing daily means from the Milltown station for each parameter are presented in Appendix 5. This station, owned by Environment Canada (EC), is located just above the Milltown dam at a depth of 1.8 to 3.0 metres depending on head pond elevation. This station and the USGS

station reported in Section 3.1 above monitor water quality in the “urban” area below Baileyville but generally above St. Stephen/Calais.

The real-time water quality station operated without major problems for the entire year. A slight gap in the data occurs on August 10-11 when the water level was dropped at the dam and the sensors were no longer in the water. The turbidity sensor experienced two periods of excessive fouling, from May 10 to June 16, and from August 26 to November 11, where recorded readings were discarded from the reviewed data set.

Temperature

Water temperature at the site increased gradually until it reached its highest of 27.1 ˚C on July 24, and decreased gradually after. The daily mean water temperature stayed over 20˚C for 76 consecutive days between June 28 and September 11.

Dissolved Oxygen

Dissolved oxygen readings followed a similar inverse trend to water temperature, reaching the lowest concentration of 7.5 mg/L on July 23, and the highest concentration of 14.8 mg/L on December 26. All dissolved oxygen values measured in 2011 were above the minimum CCME Guideline for the Protection of Aquatic Life of 6.5 mg/L.

pH

As in 2010, measurements of pH stayed around the minimum CCME guideline of 6.5 pH units during the coldest half of the year, actually staying below the minimum guideline for a total period of 75 days in 2011, while they stabilized between 7 and 7.5 pH units during the warmer months. The minimum pH measurement was 5.66 pH units and was recorded on March 18; and the maximum pH was 7.56 and was recorded on August 25.

Specific Conductance

Specific conductance readings fluctuated moderately between 30 and 70 µS/cm during the colder months, and largely between 40 and 110 µS/cm during the warmer months. Measurements of specific conductance reached their highest of 113 µS/cm on September 8, and their lowest of 23.7 µS/cm on April 23.

Turbidity

Daily mean turbidity values stayed below 1 NTU over 78% of the period of the record. Turbid events (spikes) occurred once or twice per month (for the period of the record). The maximum turbidity value was of 365 NTU and was recorded on March 19. There was a period of snowmelt in the week before that may have been a contributing factor for the higher turbidity readings.

3.2.2 Interpretation of Grab Samples Results

Staff from Environment Canada's Water Quality Monitoring and Surveillance group along with staff from the New Brunswick Department of Environment collected four grab samples at the Milltown station, and one at the Forest City station, in 2011. Grab samples were analysed at Environment Canada's Atlantic Laboratory for Environmental Testing located in Moncton, NB. This laboratory is accredited by the Canadian Association for Laboratory Accreditation (CALA) for all the parameters reported here.

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 aquatic life. Where no CCME guideline existed for a parameter, the most pertinent guidelines from another province were used as reference. Missing results reported as "VNA" either indicate problems with individual parameter analysis (e.g. data outlier) or the results were still pending at the time of this report. A summary of the parameters analyzed that exceeded their applicable guideline is included below.

- Total aluminum exceeded the CCME guideline of 100 micrograms per litre (µg/L) in one sample in 2011. Elevated levels of aluminum are fairly common in areas of Atlantic Canada although the aquatic life seems to be in good health. 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. Preliminary work currently conducted by Environment Canada supports this theory and in fact, for several samples collected from the St. Croix River in previous years, the concentration of free aluminum was below 10 µg/L.

- One of the four samples taken had a total phosphorous concentration of 0.042 mg/L which is above the Ontario Ministry of the Environment (OMOE, 1994) phosphorous guideline of 0.03 mg/L indicating possible eutrophic conditions in

the river. Eutrophic conditions indicate increased potential for excess plant and algal growth.

Historical data for this station are available at:

http://map.ns.ec.gc.ca/envirodat/root/main/en/extraction_page_e.asp?stations=NB01AR0021

St. Croix River at Forest City, ME

Results for the sample taken at Forest City are shown in Appendix 5, along with the applicable guideline for the protection of aquatic life. Where no CCME guideline existed for a parameter, the most pertinent guidelines from another province were used as reference. No parameter exceeded the applicable guidelines in the sample from this monitoring location in 2011.

Historical data for this station are available at:

http://map.ns.ec.gc.ca/envirodat/root/main/en/extraction_page_e.asp?stations=NB01AR0151

Water Quality Index

The CCME water quality index (WQI) is a useful tool to assess water quality at monitoring sites visited regularly. 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 can be calculated annually, or as a three-year roll-up when sampling frequency is lower. Due to the lower sampling frequency in 2011, the WQI has been re-calculated based on the three-year roll-up as opposed to last year's report when annual scores were presented. The parameters and guidelines used in the index are included in Table 2. These are consistent with parameters used by New Brunswick Department of Environment in the Canadian Environmental Sustainability Indicators project with the exception of ammonia as this is not part of the laboratory analysis at these two sites.

Guidelines used are for the protection of aquatic life so the WQI scores will reflect this intended water use only.

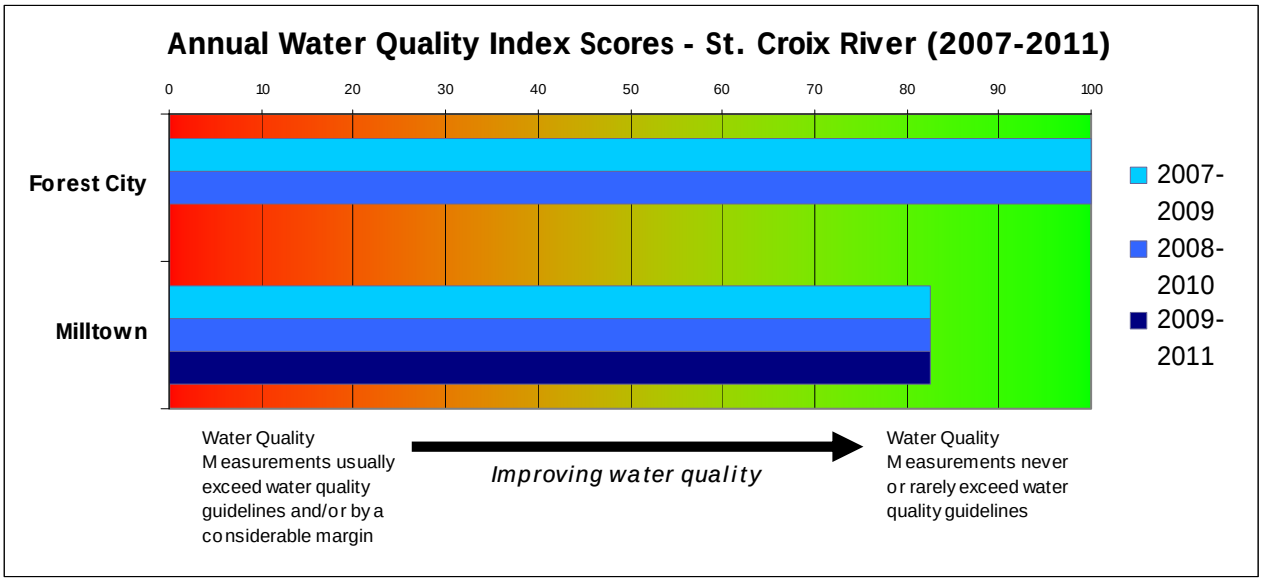
TABLE 2
Parameters and Guidelines used in the WQI Calculations

Parameter	Units	Lower Guideline	Upper Guideline	Guideline Source
Arsenic	µg/L		5	CCME, 2005
Chloride	mg/L		150	BC MOE, 2001
Copper	µg/L		2	CCME, 2005
Iron	mg/L		0.3	CCME, 2005
Nitrate	mg/L as Nitrogen		2.9	CCME, 2005
Dissolved Oxygen	mg/L	6.5		CCME, 2005
Phosphorous	mg/L		0.03	OMOE, 1994
pH	pH units	6.5	9.0	CCME, 2005
Turbidity	NTU		10	CCME, 2005
Zinc	µg/L		calculated	BC MOE, 2001

Notes: µg/L – micrograms per Litre; mg/L – milligrams per Litre; NTU – nephelometric turbidity units

Three-year roll-up WQI scores, on a scale of 0 to 100, are presented in the next chart. The WQI score for the 2009-2011 index period is missing for Forest City because the WQI requires the computation of water quality results from multiple grab samples each year and only one grab sample was collected at the Forest City location in 2011. The WQI scores for the Milltown monitoring station stayed consistently between 82.5 and 82.6 for the three index periods, indicating that the water quality ranking at this site is good and occasionally exceeds water quality guidelines for some parameters included in the calculations. It is not always the same parameters that have exceedences from year to year. Exceedences occasionally occur for total phosphorous, zinc and/or iron at the Milltown station. Both Forest City WQI scores are 100 indicating that the water quality ranking at this site is excellent and never exceeds the water quality guidelines for

the protection of aquatic life for the parameters included in the index calculation.



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[BC MOE] British Columbia Ministry of the Environment, 2001. BC Approved Water Quality Guidelines (criteria) 1998 edition. Environmental Protection Division, British Columbia Ministry of Environment, Victoria, British Columbia. Updated August 24, 2001 (http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html).

[CCME] Canadian Council of Ministers of the Environment. 2005. Canadian Environmental Quality Guidelines. Update 5.0. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba (www.ccme.ca/publications/cegg_rcge.html).

[OMOE] Ontario Ministry of the Environment. 1994. Water Management Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment [reprinted February 1999]. Ontario Ministry of the Environment. 67 pp.

4.0 STATUS OF POLLUTION ABATEMENT

4.1 Maine

Baileyville: Effective July 1, 2010 the Town of Baileyville assumed responsibility for the operation of the municipal wastewater treatment facility from the Baileyville Utility District. There were no major changes to the facility in 2011. The facility did have a few minor Sanitary Sewer Overflows (SSO) in 2011 associated with heavy rains and snow melt. The facility is currently in good compliance.

Calais: The City of Calais is continuing to implement its approved combined sewer overflow (CSO) Removal Plan. Three CSO remediation projects were completed in 2011. Their wastewater permit with the State was renewed in 2011. Overall compliance was good during 2011.

Woodland Pulp: The mill did construct a gas pipeline from the Maritimes Northeast pipeline into their facility and converted their kiln and power boilers from oil to gas. They plan to convert their recovery boiler from oil to gas in 2012. They are considering running gas to the adjacent OSB plant and operating the power boiler at that facility. The chip handling system has been working well in 2011. Their State wastewater license was renewed in 2011. Reductions were made to their maximum flow to more accurately reflect current operating conditions and discharge parameter limits have been adjusted to reflect this change in licensed flow. There were no wastewater spills reported in 2011.

4.2 New Brunswick

McAdam: The McAdam wastewater treatment facility continues to meet the effluent requirements of the Province of New Brunswick. The McAdam wastewater treatment facility is an oxidation ditch system that uses an activated sludge process.

The town's collection system has an infiltration problem and the town with their own funding and provincial funding are conducting a Wastewater Characterization Environmental Risk Assessment as required under the Canada-wide strategy for the management of municipal wastewater effluent. This assessment will identify the areas of concern and if additional treatment will be required as part of a proposed upgrade. The assessment is schedule for completion in 2013.

St. Stephen: The new municipal aerated lagoon system along Dennis Stream continue to operate within effluent limits.

Champlain Industrial Park: The extended aeration facility treats the domestic wastewater of its employees as well as the industrial wastewater from the industrial park. At its current capacity and flow, it continues to meet provincial requirements.

East Coast Village Mobile Home Park: 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. There was a change in ownership in early 2011 and problems during the ownership transition with operation of the Lagoon have been resolved.

Oak Bay Park: The Oak Bay Campground uses a trickling filter system to treat the domestic wastewater from 110 campsites prior to discharging the treated disinfected effluent to Oak Bay. There were no significant issues in 2011. The system is planned for an upgrade in 2012.

5.0 FISHERIES

5.1 Anadromous Fisheries

Adult alewives (*Alosa pseudoharengus*) and Atlantic salmon (*Salmo salar*) returning to the St. Croix River have been counted at the Milltown Dam fishway since 1981. This head-of-tide dam is owned and operated by New Brunswick Power Corporation (NB Power). The Milltown fishway and research trap are on the Canadian side of the river and are under the jurisdiction of Canada's Department of Fisheries & Oceans (DFO).

Due to funding constraints, since 2007 the Milltown research trap has been operated for a May-July period that focuses on the alewife spawning run.

In 2011, the Milltown fishway and research trap were activated on May 9 when spring flows fell to levels that allowed for effective fishway operation. The research trap was operated continuously, with all fish counted individually, until July 11 when, based on the lack of alewife returns, it was lifted for the year. After July 11, the fishway remained open to undocumented fish passage under management by NB Power.

A total of 25,142 alewives passed through the Milltown fishway during the nine weeks of monitoring in 2011. This was the second largest run since 1999 – exceeded only by the previous year’s return of 58,776 fish – and was more than double that of any run in the

last 13 years except for 2010. The general upward trend in run size is presumed to be due, in large part, to the availability of additional spawning habitat in Woodland Flowage since 2001. The smaller 2011 return, compared to 2010, may be due in part to an exceptionally small alewife run in 2007, which would have spawned many of the fish that returned in 2011.

No Atlantic salmon or other sea run fish were recorded at the trap in 2011; however three freshwater species were counted in small numbers.

Appendix 6 provides data on alewife returns to the St. Croix River from 1981 (the first year of recent record) to the present.

As noted above, the 2011 run of 25,142 alewives was the second highest return since 1999, surpassed only by the exceptional return of 58,776 alewives in 2010. Both years warrant comment.

Last year's report suggested that the 2010 exceptional return may have been due, in part, to the cumulative effect of consecutive years of spawning success as a result of a Canadian trap-and-truck operation that partially restored access to alewife spawning habitat between the Woodland and Grand Falls dams, beginning in 2001. Subsequent scale aging data suggests this to be the case.

In 1995, the State of Maine blocked alewife access at the Woodland dam, which left less than 0.2% of the St. Croix's believed historic alewife spawning habitat available to this fish. A trap-and-truck operation by DFO in 2001-2007 and the State's reopening of the Woodland fishway to alewives starting in 2008 has given St. Croix alewives access to an additional 475 hectares (1174 acres) of spawning habitat in Woodland Flowage for the last decade. [Maine still maintains an alewife barrier at the Grand Falls dam, upstream, which blocks access to further spawning habitat.]

Compared to 2010, the lower return in 2011 may be due in part to the small size of the 2007 alewife run. Scale aging suggests that St. Croix alewife generally spawn first at Age 4 or 5. The 2007 alewife run that produced the Age 4 alewives returning in 2011 totaled just 1294 fish, compared to returns exceeding 10,000 fish in the immediately preceding and following years. The effect of the small 2007 run might also be felt in 2012, when Age 5 fish from this spawning will return for the first time.

Similar to recent years, the 2011 run tended to enter the fishway in concentrated bursts with two days, May 22 and 23, accounting for 52% of the run.

5.2 Shellfish Harvesting

New Brunswick - Shellfish harvesting in Oak Bay includes areas designated as conditional, restricted-depuration area, and closed area. Environment Canada sampled St. Croix and Oak Bay marine water quality stations on five occasions from August and November 2011. No significant change in bacteriological water quality was observed in 2011. Fecal Coliform densities were consistent with those observed in previous years (i.e., 2000, 2003, 2006, 2007, 2008 and 2009).

Maine - The shoreline along Calais and Robbinston, Maine has limited habitat for commercial shellfish. The area is classified as prohibited to shellfishing by the Maine Department of Marine Resources, Division of Shellfish Management. There was no change to this classification in 2011.

6.0 WATERSHED INITIATIVES

6.1 Alewife Adaptive Management Plan

A proposal entitled “An Adaptive Plan for Managing Alewife in the St. Croix River Watershed, Maine and New Brunswick” (AMP) was prepared in 2010 by the St. Croix Fisheries Steering Committee (FSC) at the request of the IJC and the Board. The FSC drew on their accumulated decades of expertise and experience in the watershed, along with the body of relevant scientific evidence to develop the plan. The AMP and supporting materials (including the original & updated FAQ) and written comments on the draft plan, are available on the Board’s Publications page on the IJC website.

http://www.ijc.org/conseil_board/st_croix_river/en/stcroix_home_accueil.htm

6.2 USGS/IJC Datum study

Work has begun on the collaborative agreement between the USGS Maine Water Science Center and the IJC to address concerns regarding elevations for tablets, dams, lake level gages, and streamflow gages along the St. Croix River. The goal is to establish a consistent vertical and horizontal control network for the River. The USGS has conducted an extensive search of control tablets along the River corridor, and established some new points where tablets do not exist. High precision GPS instrumentation and differential leveling has been used to begin to tie these points together. A report will be available in late 2012.

7.0 ADDITIONAL ITEMS TO REPORT

7.1 Maine FERC Dam Re-licensing

On March 1, 2011, Woodland Pulp LLC filed a notice of intent to start the re-licensing process for Vanceboro Dam which expires in 2016. The process is on-going and the U.S. Federal Energy Regulatory Commission (FERC) Docket number is P-2492-000. In 2011 the primary focus was on preparing the proposed study plan for the relicensing.

The Forest City Dam (Forest City Project) and the West Grand Lake and Sysladobsis and Farm Cove Dams (West Branch Project) on the St. Croix River system owned by Woodland Pulp LLC are also in the FERC re-licensing process. The Forest City Dam crosses the international boundary. The West Grand, Sysladobsis Dams and Farm Cove Dams are located entirely in Maine. In March 2006, the owner filed with FERC to renew. In May 2006, FERC approved the use of the traditional licensing process for both these projects. In 2007, the owner worked on studies related to the re-licensing efforts. In 2008, the owner filed the draft licenses and met with stakeholders to discuss the draft license applications. Final license applications were filed in March 2009. The next step is preparation of a draft Environmental Impact Statement (EIS) for the re-licensing of these dams. The FERC process would include public comments on the draft EIS. Docket numbers are DI10-9-000, P-2618-000, P-2660-000.

Woodland Pulp LLC has request that FERC find that these projects were not required to be licensed under FERC. However, FERC in a declaratory order dated July 19, 2011 found that the projects discussed above were required to be re-licensed.

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

7.2 LNG Facilities Proposals

There are currently no Liquid Natural Gas (LNG) licensing projects pending with the State of Maine on the St. Croix River/Passamaquoddy Bay. There are two applications on file with FERC and these are listed below.

DOWNEAST LNG: The proposed project would consist of an onshore LNG import and storage terminal (located on Mill Cove in the Town of Robbinston, Maine) and about a 30-mile natural gas send out pipeline to an interconnect point with the existing pipeline near the Town of Baileyville, Maine. The FERC Draft (EIS) on the project was issued

on May 15, 2009. The draft is still in the FERC review process and no date has been set for the final EIS. FERC Docket numbers are CP07-52, CP07-53, CP07-54, CP07-55, PF06-13.

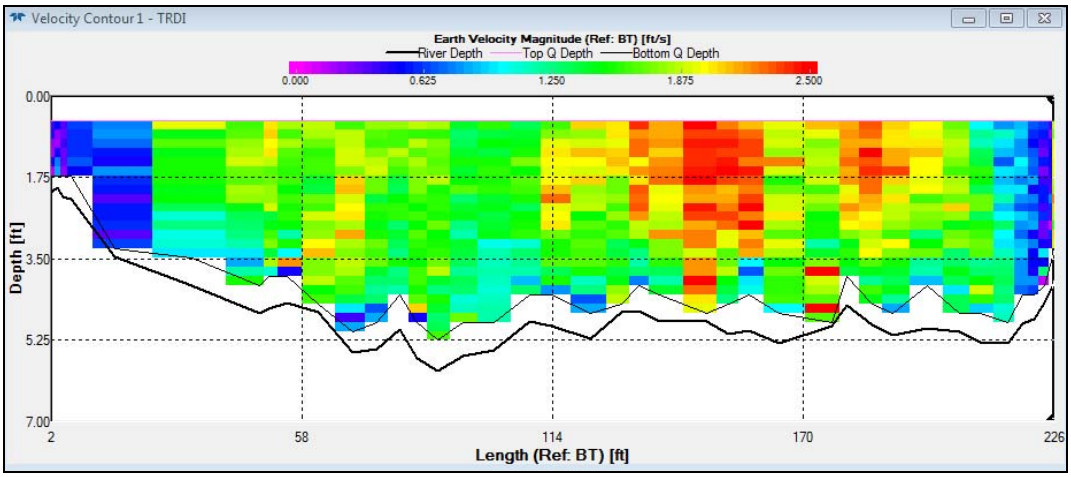
CALAIS LNG: Calais LNG is proposing to construct and operate a Liquefied Natural Gas receiving terminal and storage facility on the outskirts of Calais, Maine. The proposed site is located approximately seven miles south of downtown Calais along the deepwater banks of the St. Croix River and Passamaquoddy Bay. The Calais LNG project appears to be on-hold due to loss of financial backing. At present this project remains an active docket in the FERC with no announced time line. FERC Docket Number is CP10-31-000.

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

7.3 USGS Baring Gage Project

In 2011, USGS installed a bank operated cableway at the Baring streamflow gage on the St. Croix River. This equipment provides for velocity measurements across the channel. Photographs of the install and an example plot of channel cross-section data are shown below. The equipment will be used by USGS for periodic gage calibration.

Example cross-section velocity plot of St. Croix River at Baring streamflow measurement using the bank operated cableway.



	
Cutting some brush	Tower install on U.S. side
	
Tower Install on Canadian side	Acoustic Doppler Current Profile measurement using the bank operated cableway

ACKNOWLEDGEMENTS

The International St. Croix River Watershed Board gratefully acknowledges the valuable input and efforts in support of this report provided by the following groups/ individuals and without which the preparation of this report would not be possible.

- Lee Sochasky - St. Croix International Waterway Commission Consultant
- Paul Noseworthy - Environment Canada
- Denis Parent - Environment Canada
- Bernard Richard - Environment Canada
- Brad McPherson - New Brunswick Department of the Environment
- Ed Logue - Maine Department of Environmental Protection
- Gregory Stewart - U.S. Geological Survey
- Jay Beaudoin - Woodland Pulp LLC
- Barbara Blumeris - U.S. Army Corps of Engineers
- Rene Savoie, P Eng (acting) Manager - Regional Hydrometric Engineering, Environment Canada

APPENDIX 1

SUMMARY - ORDERS OF APPROVAL & BASIN MAP

SUMMARY - ST. CROIX RIVER 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.

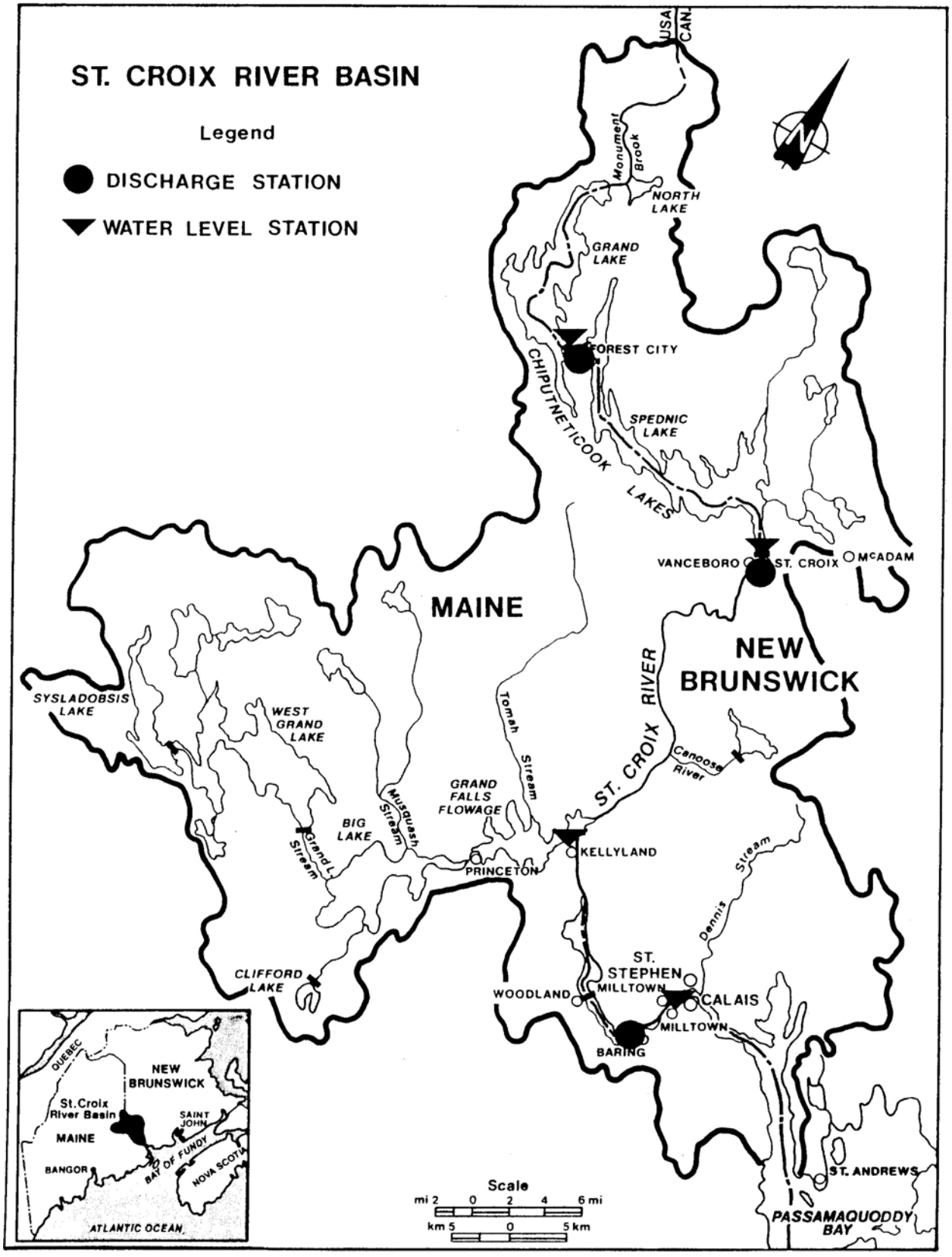
6 October, 1931- For the obstructions of the waters of t he St. Croix River at Grand Falls in the State of Maine and the Province of New Brunswick. Increase in elevation to 203.5 feet m.s.l.

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.


ST. CROIX RIVER BASIN
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
BAY OF FUNDY
BANGOR
NOVA SCOTIA
ATLANTIC OCEAN

APPENDIX 2

MILLTOWN, GRAND FALLS, VANCEBORO AND FOREST CITY DAMS

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 7 hydroelectric generating units (installed capacity is 3.96 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 on the left side of the dam and consists of 10 bays or pools. There are 5 vertical lift wooden gates to regulate flow through the ladder. The trash rack on the upstream face of the fish passage consists of steel bars spaced approximately 1 foot in the horizontal direction and 3 feet in the vertical.

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 left side (facing downstream) of the dam and consists of timber baffle system with an upstream timber trash rack.

FACITILY SITE VISITS IN 2011

Board members met with New Brunswick Power Corporation officials (NB Power) on June 29, 2011 at the Milltown Dam in New Brunswick and participated in a site visit of the facility.

Board members met with Woodland Pulp LLC officials on June 30, 2011 at the Woodland Mill at Baileyville, Maine and then Board members participated in site visits at Grand Falls, Vanceboro, and Forest City Dams.

Participants included in the NB Power and Woodland Pulp LLC meetings and site visits are shown below:

Name	Affiliation
Sam Speck	IJC Commissioner/ U.S. Section
Pierre Trepanier	IJC Commissioner/ Canadian Section
Nick Heisler	IJC staff
Robert Reynolds	IJC staff
Jesse Davies	St. Croix Board, Canadian Section
Rene Savoie	Acting Secretary, St Croix Board, Canadian Section
Colonel Philip “Tom” Feir	St. Croix Board, Co-Chair, U.S. Section
Barbara Blumeris	Secretary, St. Croix Board, U.S. Section
Lee Sochasky	St. Croix International Waterway Commission

Facility Representatives

Glen Hanscom	Hydro Technical Services, NB Power
Jeff Babcock	Hydro Manager, NB Power
Kevin Dean	Hydro-Superintendent, Woodland Pulp LLC
Jay Beaudoin	Environmental Manager, Woodland Pulp LLC

General Comments and Photographs of Facilities

Forest City Dam. Woodland Staff reported that the facility remained in good condition and that the monitoring of the fishway continued to show no movement.

Forest City Dam, June 2011

Forest City Dam, view downstream

Vanceboro Dam. Woodland staff reported that in 2011 they replaced the chain on one of the Tainter gates.

Vanceboro Dam, June 2011, flow through gate next to fishway

(photograph from August 2010)

Grand Falls Dam. Woodland staff reported that a periodic dam inspection was planned for summer 2011.

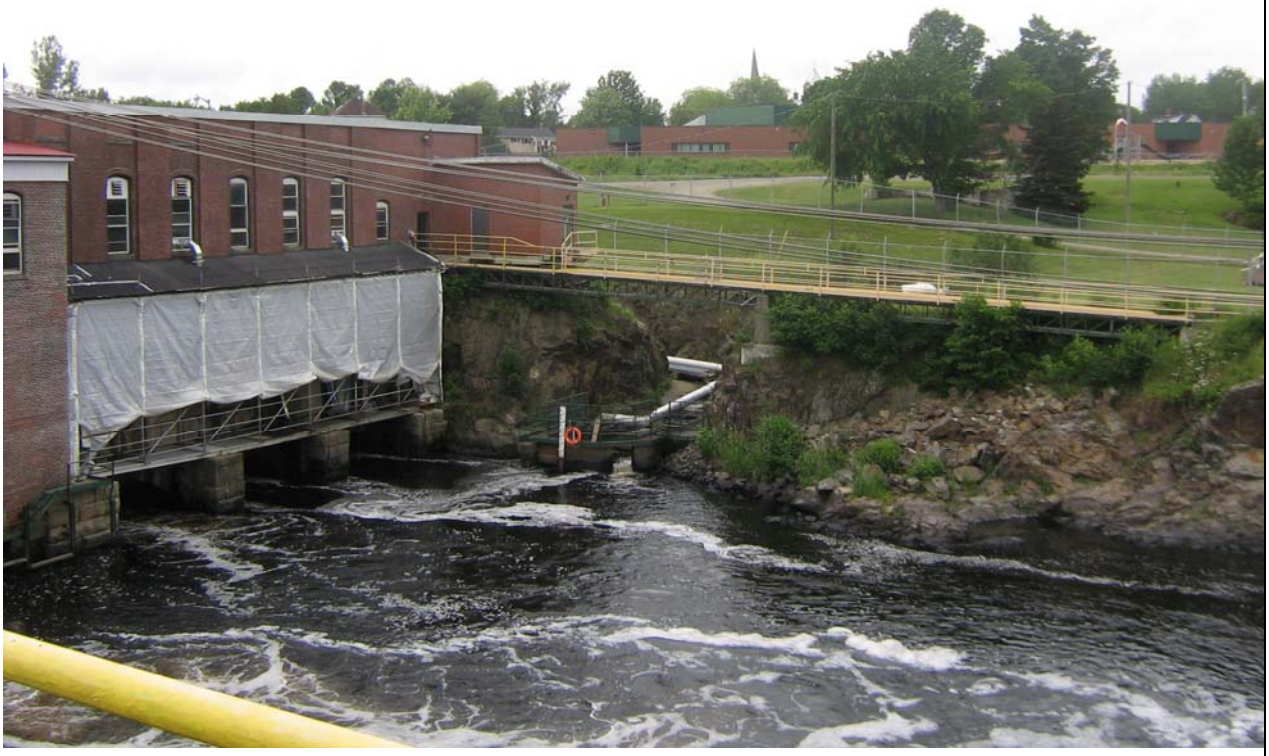
Grand Falls Dam, June 2011

Portion of Grand Falls Dam fishway, June 2011

Milltown Dam. During the Board's annual site visits, it has been observed that there is a crack in the floor of the powerhouse near units 5/6/7. This is not a new issue as the crack has been apparent since the 1980s. However, several years ago NB Power reported to the Board that there was increased movement in the crack. At that time (2003) NB Power took actions to assess the situation and established procedures to prevent further movement of the wall. NB Power set up heated hoarding on the outside face of the wall to prevent freezing and thawing action and has continued to use this method. NB Power will continue to monitor the wall to make sure that additional actions are not required. NB power engages an independent engineering consultant to provide periodic review of the facilities. NB Power continues to maintain the fishway in good condition.

Milltown Dam and powerhouse (photograph from August 2010)

Milltown Dam, portion of powerhouse and fishway, June 2011



APPENDIX 3

HYDROGRAPHS

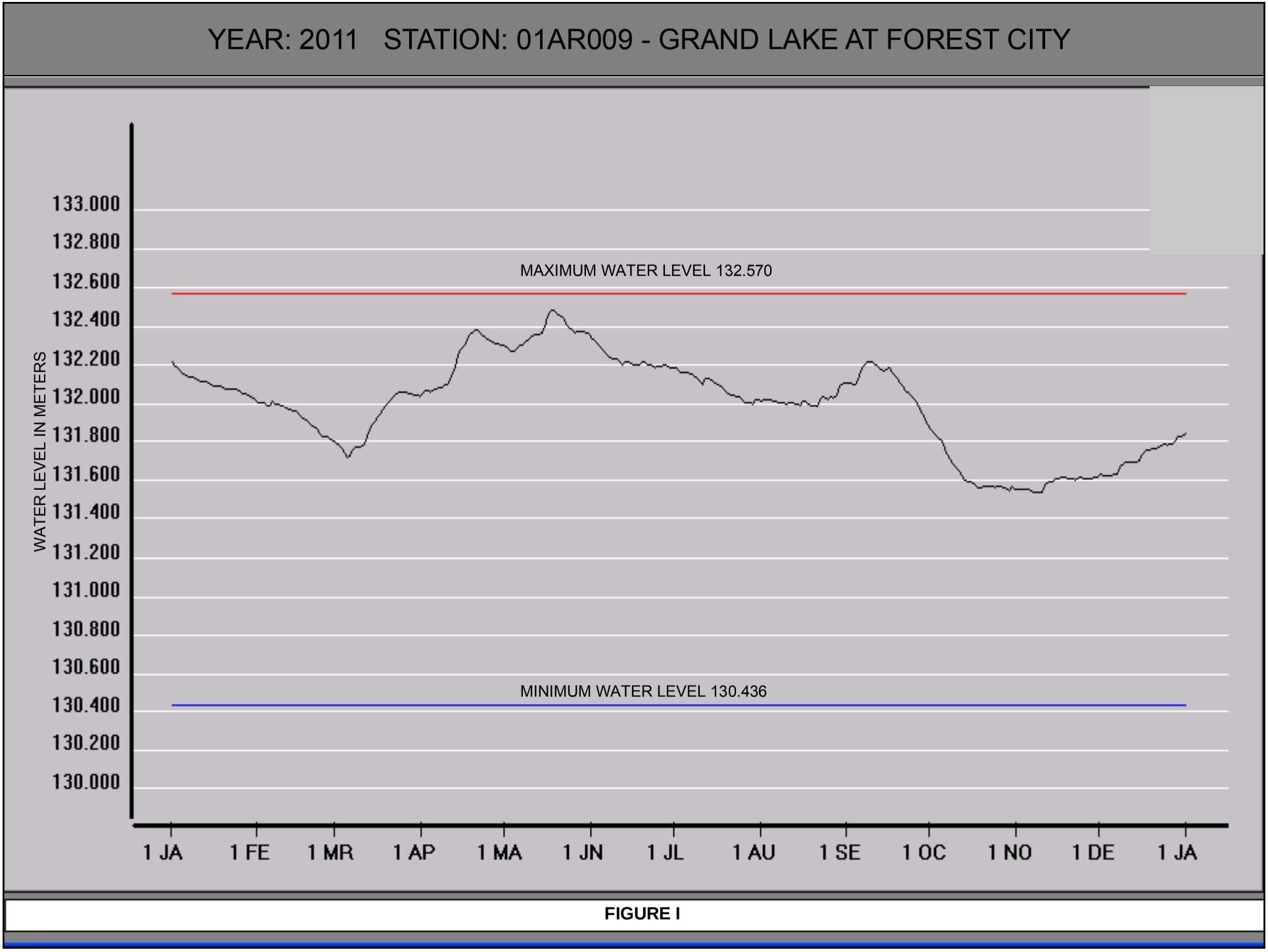

YEAR: 2011 STATION: 01AR009 - GRAND LAKE AT FOREST CITY
WATER LEVEL IN METERS
133.000
132.800
132.600
132.400
132.200
132.000
131.800
131.600
131.400
131.200
131.000
130.800
130.600
130.400
130.200
130.000
MAXIMUM WATER LEVEL 132.570
MINIMUM WATER LEVEL 130.436
1 JA
1 FE
1 MR
1 AP
1 MA
1 JN
1 JL
1 AU
1 SE
1 OC
1 NO
1 DE
1 JA

FIGURE I

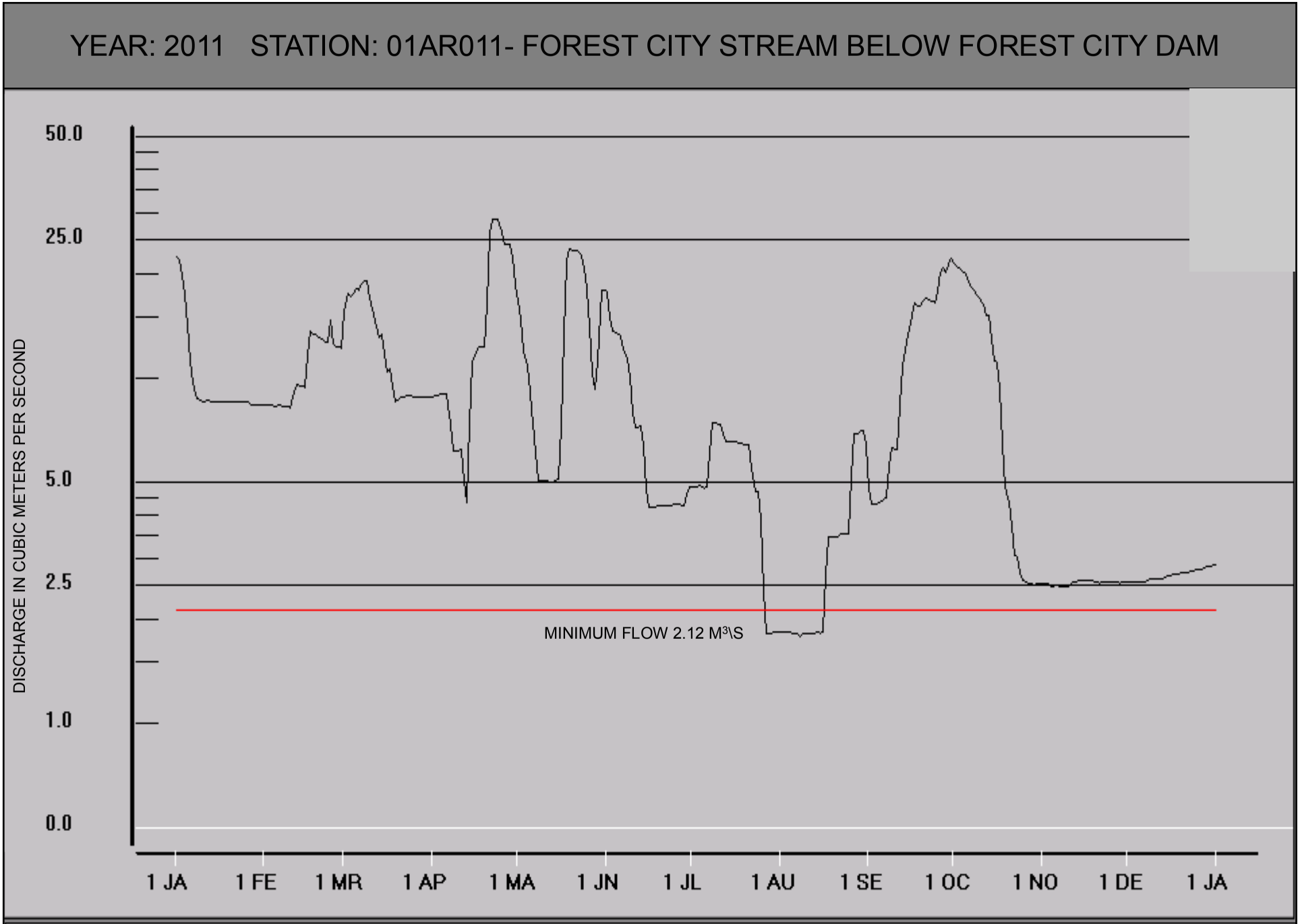

YEAR: 2011 STATION: 01AR011- FOREST CITY STREAM BELOW FOREST CITY DAM
DISCHARGE IN CUBIC METERS PER SECOND
50.0
25.0
5.0
2.5
1.0
0.0
MINIMUM FLOW 2.12 M3\S
1 JA
1 FE
1 MR
1 AP
1 MA
1 JN
1 JL
1 AU
1 SE
1 OC
1 NO
1 DE
1 JA

FIGURE II

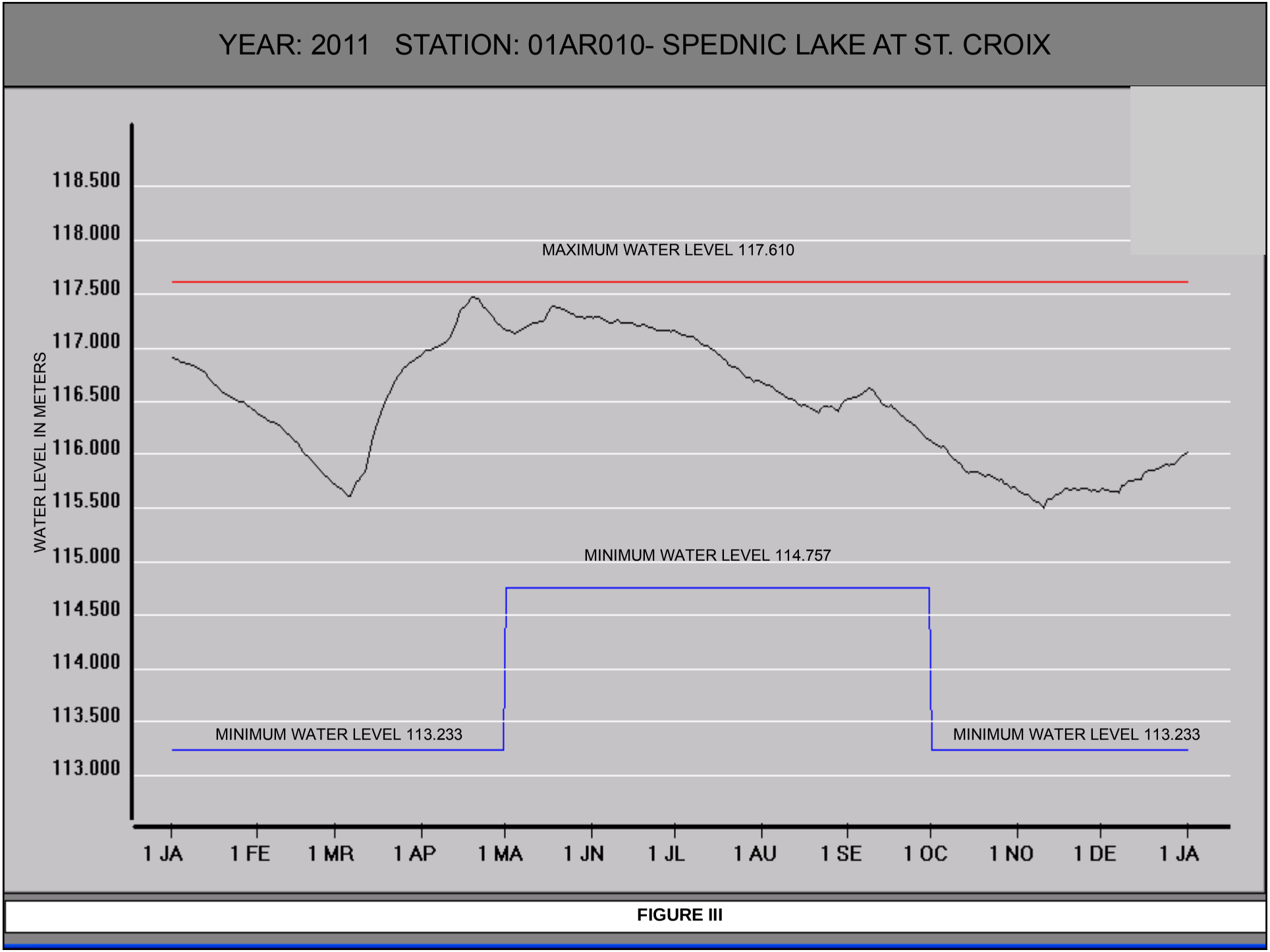

YEAR: 2011 STATION: 01AR010- SPEDNIC LAKE AT ST. CROIX
WATER LEVEL IN METERS
118.500
118.000
117.500
117.000
116.500
116.000
115.500
115.000
114.500
114.000
113.500
113.000
MAXIMUM WATER LEVEL 117.610
MINIMUM WATER LEVEL 114.757
MINIMUM WATER LEVEL 113.233
MINIMUM WATER LEVEL 113.233
1 JA
1 FE
1 MR
1 AP
1 MA
1 JN
1 JL
1 AU
1 SE
1 OC
1 NO
1 DE
1 JA

FIGURE III

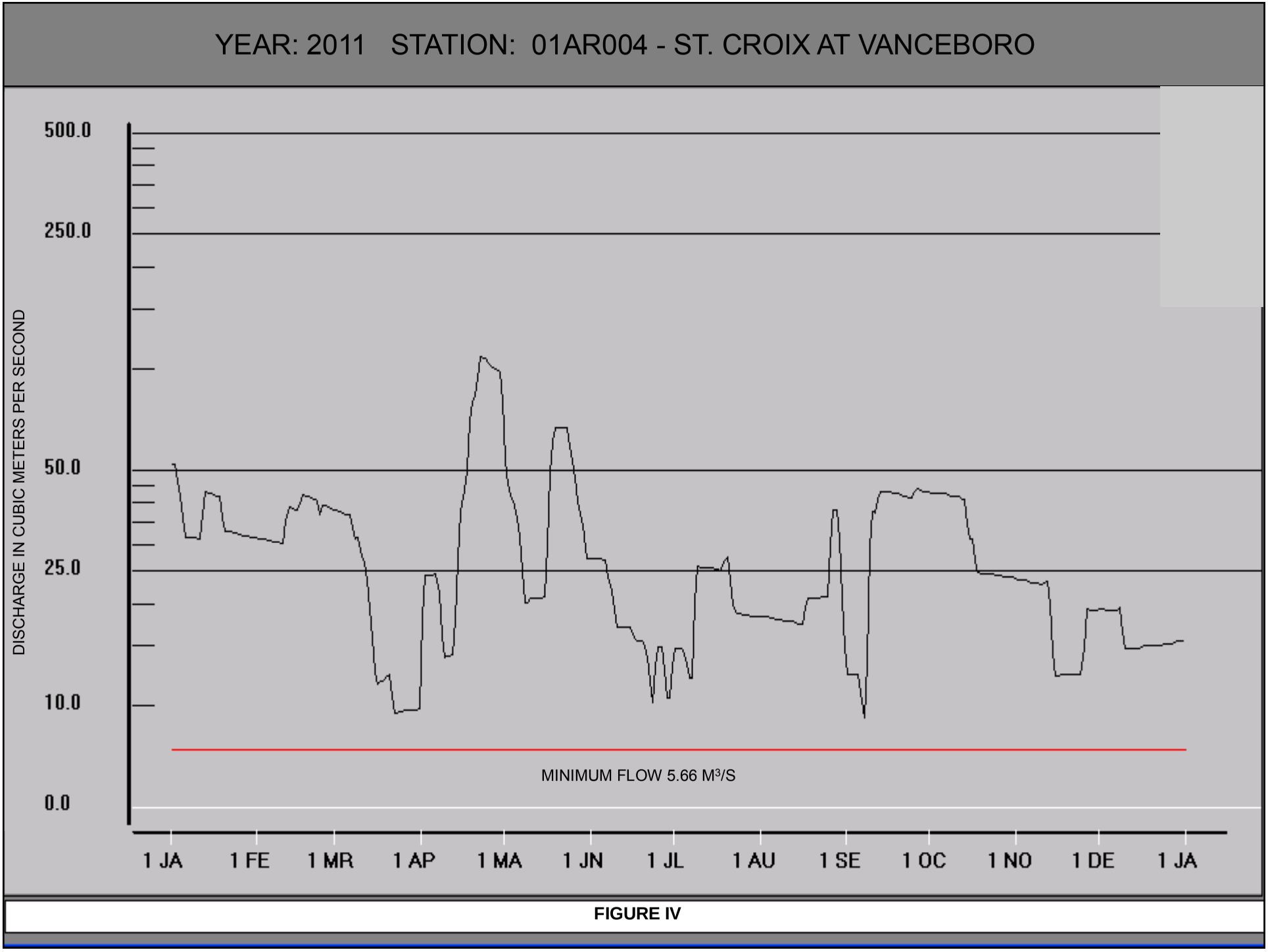

YEAR: 2011 STATION: 01AR004 - ST. CROIX AT VANCEBORO
DISCHARGE IN CUBIC METERS PER SECOND
500.0
250.0
50.0
25.0
10.0
0.0
MINIMUM FLOW 5.66 M³/S
1 JA
1 FE
1 MR
1 AP
1 MA
1 JN
1 JL
1 AU
1 SE
1 OC
1 NO
1 DE
1 JA

FIGURE IV

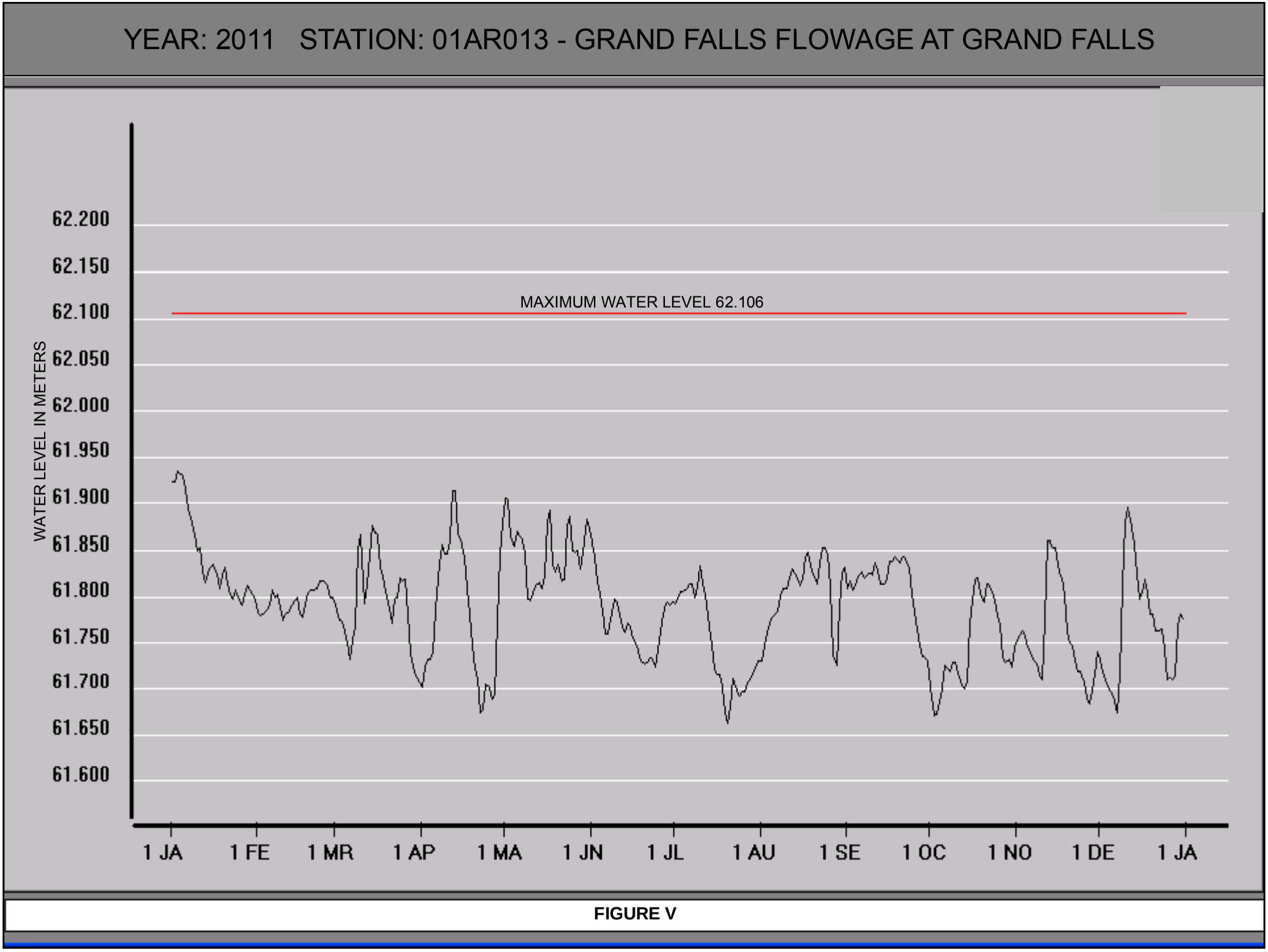

YEAR: 2011 STATION: 01AR013 - GRAND FALLS FLOWAGE AT GRAND FALLS
WATER LEVEL IN METERS
62.200
62.150
62.100
62.050
62.000
61.950
61.900
61.850
61.800
61.750
61.700
61.650
61.600
MAXIMUM WATER LEVEL 62.106
1 JA
1 FE
1 MR
1 AP
1 MA
1 JN
1 JL
1 AU
1 SE
1 OC
1 NO
1 DE
1 JA

FIGURE V

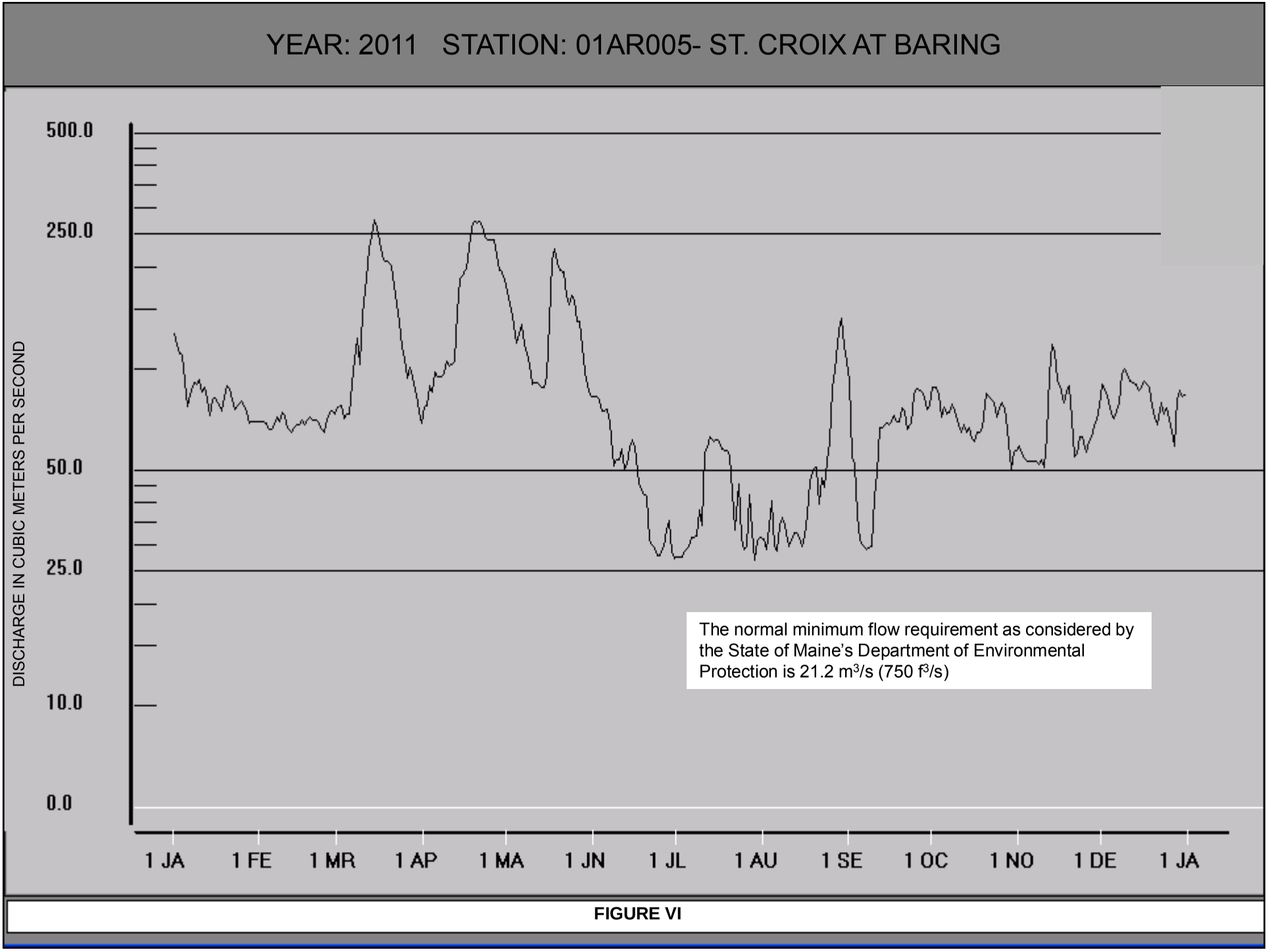

YEAR: 2011 STATION: 01AR005- ST. CROIX AT BARING
DISCHARGE IN CUBIC METERS PER SECOND
500.0
250.0
50.0
25.0
10.0
0.0
1 JA
1 FE
1 MR
1 AP
1 MA
1 JN
1 JL
1 AU
1 SE
1 OC
1 NO
1 DE
1 JA
The normal minimum flow requirement as considered by the State of Maine's Department of Environmental Protection is 21.2 m3/s (750 f3/s)

FIGURE VI

YEAR: 2011 STATION: 01AR014 – ST. CROIX RIVER AT MILLTOWN DAM

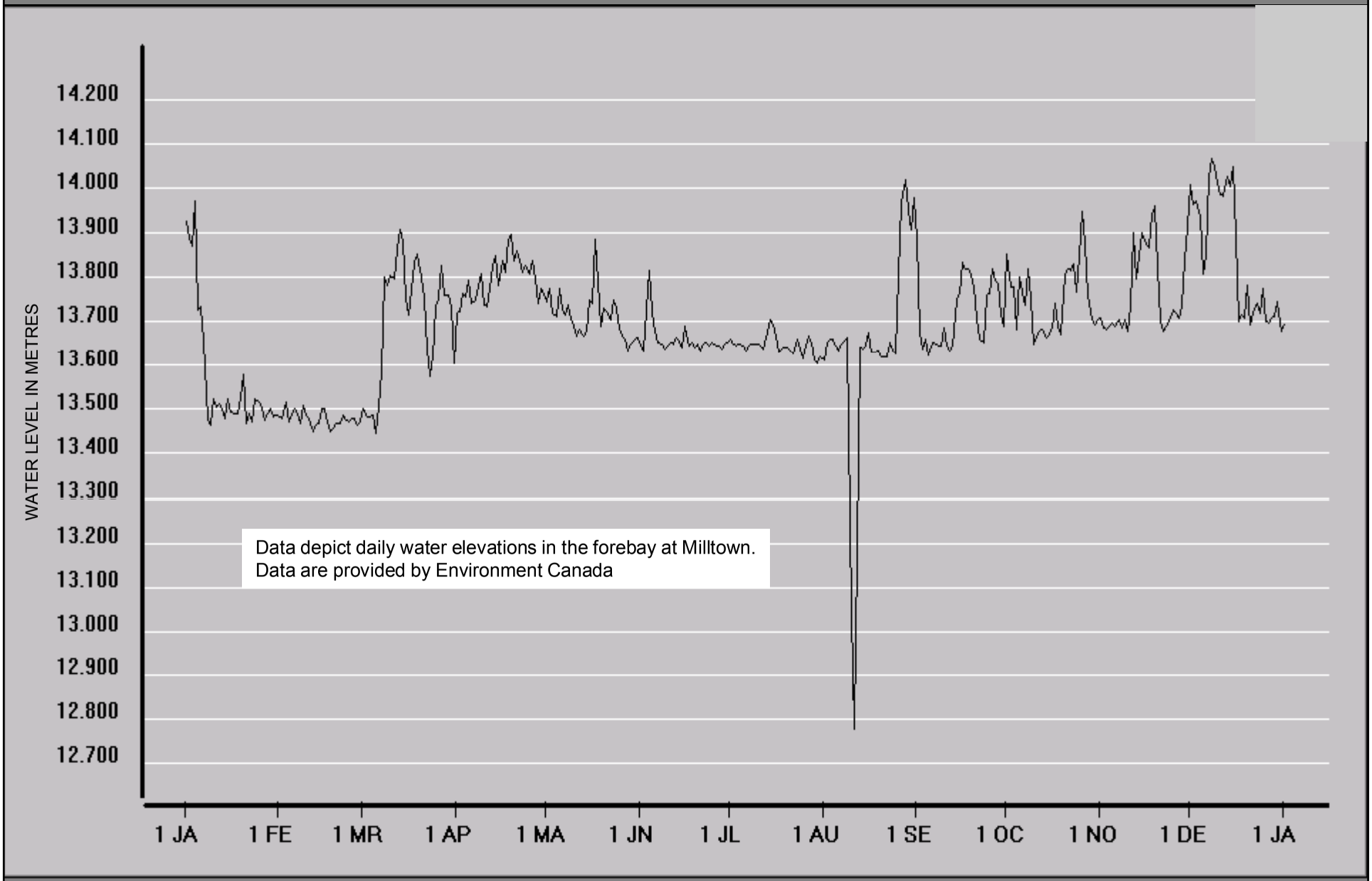


FIGURE VII

APPENDIX 4

WATER LEVELS AND FLOWS

TABLE I
GRAND LAKE AT FOREST CITY
DAILY MEAN WATER LEVELS IN METRES FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	132.217	132.004	131.798	132.051	132.295	132.335	132.184	132.014	132.106	131.868	131.551	131.628	1
2	132.198	132.006	131.778	132.067	132.285	132.324	132.175	132.018	132.104	131.842	131.551	131.625	2
3	132.183	132.004	131.76	132.065	132.276	132.314	132.163	132.021	132.101	131.828	131.55	131.626	3
4	132.169	131.994	131.741	132.063	132.274	132.292	132.164	132.02	132.101	131.812	131.555	131.619	4
5	132.154	131.989	131.718	132.068	132.291	132.276	132.162	132.015	132.124	131.798	131.549	131.621	5
6	132.144	132.012	131.722	132.076	132.299	132.264	132.154	132.011	132.189	131.763	131.543	131.627	6
7	132.14	131.999	131.756	132.081	132.306	132.247	132.153	132.004	132.202	131.731	131.539	131.632	7
8	132.136	131.999	131.771	132.087	132.321	132.231	132.139	132.008	132.213	131.706	131.538	131.672	8
9	132.128	131.994	131.774	132.096	132.327	132.233	132.128	132.003	132.218	131.688	131.535	131.68	9
10	132.122	131.988	131.775	132.103	132.342	132.233	132.117	131.996	132.215	131.669	131.533	131.691	10
11	132.115	131.975	131.787	132.12	132.354	132.217	132.103	132.002	132.202	131.645	131.574	131.691	11
12	132.114	131.97	131.828	132.153	132.357	132.205	132.132	132.005	132.194	131.62	131.585	131.692	12
13	132.115	131.957	131.861	132.192	132.358	132.219	132.131	131.999	132.181	131.601	131.587	131.696	13
14	132.107	131.957	131.885	132.246	132.365	132.217	132.119	131.995	132.172	131.589	131.595	131.696	14
15	132.1	131.952	131.904	132.281	132.397	132.211	132.11	131.992	132.177	131.59	131.603	131.699	15
16	132.096	131.937	131.924	132.304	132.45	132.204	132.099	132.015	132.188	131.58	131.604	131.734	16
17	132.094	131.922	131.945	132.33	132.474	132.198	132.088	132.011	132.166	131.572	131.613	131.746	17
18	132.092	131.911	131.969	132.355	132.482	132.204	132.08	132.001	132.148	131.563	131.613	131.754	18
19	132.084	131.901	131.994	132.366	132.475	132.216	132.07	131.994	132.13	131.558	131.605	131.756	19
20	132.078	131.889	132.011	132.38	132.464	132.214	132.054	131.989	132.107	131.564	131.605	131.765	20
21	132.077	131.874	132.026	132.384	132.452	132.204	132.046	131.98	132.089	131.564	131.606	131.76	21
22	132.077	131.862	132.041	132.369	132.432	132.199	132.047	132.022	132.067	131.565	131.599	131.774	22
23	132.077	131.844	132.053	132.353	132.404	132.192	132.04	132.039	132.05	131.566	131.609	131.78	23
24	132.077	131.829	132.058	132.341	132.392	132.184	132.035	132.031	132.037	131.562	131.612	131.788	24
25	132.07	131.823	132.058	132.326	132.383	132.191	132.019	132.022	132.023	131.566	131.607	131.782	25
26	132.056	131.823	132.057	132.317	132.365	132.196	132.004	132.033	132.003	131.567	131.609	131.787	26
27	132.05	131.81	132.055	132.314	132.374	132.198	132.008	132.027	131.978	131.558	131.604	131.784	27
28	132.041	131.804	132.05	132.308	132.376	132.192	132.008	132.045	131.945	131.556	131.609	131.804	28
29	132.034		132.045	132.305	132.373	132.186	131.997	132.09	131.918	131.546	131.611	131.828	29
30	132.026		132.041	132.304	132.369	132.186	132.018	132.099	131.89	131.566	131.615	131.826	30
31	132.018		132.039		132.358		132.023	132.106		131.555		131.834	31
TOTAL	4095.189	3694.029	4089.224	3966.8	5 4103.47	0 3966.78		4094.77	4092.607	3963.238	4080.758	3947.509	4083.397 TOTAL
MEAN	132.103	131.93	131.91	132.227	132.37	132.226		132.089	132.02	132.108	131.637	131.584	131.722 MEAN
MAX	132.217	132.012	132.058	132.384	132.482	132.335		132.184	132.106	132.218	131.868	131.615	131.834 MAX
MIN	132.018	131.804	131.718	132.051	132.274	132.184		131.997	131.98	131.89	131.546	131.533	131.619 MIN

SUMMARY FOR THE YEAR 2011
Mean water level, 131.994 Metres
Maximum daily water level, 132.482 Metres On 2011-05-18
Minimum daily water level, 131.533 Metres On 2011-11-10

NOTES: WATER LEVELS ARE IN METRES AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. THE WATER LEVEL DATA ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC

TABLE II
FOREST CITY STREAM BELOW FOREST CITY DAM
DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	22.3	8.38	15.5	8.89	16.7	17.8	4.85	1.84	4.81	21.5	2.52	2.55	1
2	21.9	8.38	17.6	8.95	14.9	15	4.85	1.84	4.31	20.9	2.53	2.56	2
3	19.8	8.38	17.2	8.95	12	13.7	4.85	1.84	4.31	20.6	2.53	2.55	3
4	17.7	8.3	17.7	9.02	10.9	13.6	4.87	1.84	4.31	20.1	2.5	2.55	4
5	14.3	8.3	18.1	9.02	9.09	13.5	4.81	1.82	4.35	19.9	2.49	2.55	5
6	11.3	8.38	17.9	9.02	7.46	13.3	4.85	1.82	4.45	19.2	2.51	2.55	6
7	9.73	8.3	18.7	7.34	6.08	12.1	6.08	1.82	4.49	18.4	2.49	2.56	7
8	8.75	8.3	19.1	6.13	5.05	11.5	7.46	1.78	5.51	17.9	2.48	2.6	8
9	8.69	8.3	19.1	6.18	5.05	10.1	7.4	1.82	6.28	17.4	2.49	2.61	9
10	8.62	8.24	17.1	6.18	5.05	8	7.34	1.82	6.23	17	2.5	2.62	10
11	8.62	8.82	15.4	6.23	5.05	7.17	7.34	1.82	6.23	16.4	2.53	2.62	11
12	8.69	9.58	14.2	5.05	5	7.17	6.93	1.82	8.38	15.2 E	2.55	2.63	12
13	8.62	9.5	13.2	4.35	5	7.23	6.54	1.82	10.9	15.2 A	2.57	2.63	13
14	8.62	9.5	13.5	7.46	5.05	6.39	6.54	1.84	12.7	13	2.58	2.64	14
15	8.62	9.43	11.8	11.2	5.09	4.72	6.54	1.82	13.9	11.3	2.59	2.66	15
16	8.62	11.7	10.5	12	7.23	4.22	6.54	1.84	15.3	11.1	2.59	2.68	16
17	8.62	13.7	10.7	12.3	13.4	4.22	6.49	2.68	16.5	9.48	2.58	2.69	17
18	8.62	13.5	9.5	12.4	21.8	4.22	6.49	3.46	16.3	6.49	2.59	2.7	18
19	8.56	13.4	8.62	12.4	23.6	4.26	6.44	3.46	16.2	4.82	2.57	2.71	19
20	8.56	13.2	8.75	16.4	23.4	4.26	6.44	3.46	16.7	4.35	2.56	2.72	20
21	8.56	13	8.82	26.1	23.4	4.26	6.44	3.46	17.1	3.73	2.55	2.73	21
22	8.62	12.8	8.89	28.9	23.1	4.26	5.46	3.55	16.9	3.05	2.56	2.74	22
23	8.62	12.7	8.95	28.9	22.7	4.26	4.67	3.55	16.7	3.04	2.57	2.74	23
24	8.56	14.7	8.95	28.9	20.9	4.26	4.67	3.55	16.6	2.73	2.57	2.75	24
25	8.56	12.6	8.89	26.4	18.2	4.31	3.89	3.55	17.8	2.58	2.56	2.77	25
26	8.56	12.4	8.89	24.4	14.1	4.31	2.4	5.23	20.2	2.56	2.56	2.78	26
27	8.44	12.3	8.89	24.4	10.4	4.26	1.82	6.87	20.8	2.54	2.55	2.79	27
28	8.44	12.2	8.82	24.4	9.36	4.26	1.82	6.93	20.2	2.53	2.55	2.82	28
29	8.44		8.82	22.5	11.3	4.58	1.82	7.04	21.3	2.52	2.56	2.83	29
30	8.38		8.82	18.6	18	4.85	1.84	7.04	22.1	2.54	2.56	2.84	30
31	8.38		8.89		17.9		1.84	6.44		2.53		2.86 A	31
TOTAL	322.8	298.29	391.8	432.97	396.26	226.07	160.32	99.47	371.86	330.59	76.34	83.03	TOTAL
MEAN	10.4	10.7	12.6	14.4	12.8	7.54	5.17	3.21	12.4	10.7	2.54	2.68	MEAN
DAM3	27900	25800	33900	37400	34200	19500	13900	8590	32100	28600	6600	7170	DAM3
MAX	22.3	14.7	19.1	28.9	23.6	17.8	7.46	7.04	22.1	21.5	2.59	2.86	MAX
MIN	8.38	8.24	8.62	4.35	5	4.22	1.82	1.78	4.31	2.52	2.48	2.55	MIN

SUMMARY FOR THE YEAR 2011
Total discharge, 276000 DAM3
Mean discharge, 8.74 M3/S
Maximum daily discharge, 28.9 M3/S On 2011-04-22
Minimum daily discharge, 1.78 M3/S On 2011-08-08

NOTES: THE DISCHARGE ARE PROVISIONAL AND ARE SUPPLIED BY
ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC
E - ESTIMATED
A - PARTIAL DAY

TABLE III
SPEDNIC LAKE AT ST. CROIX
DAILY MEAN WATER LEVELS IN METRES FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	116.909	116.372	115.707	116.951	117.158	117.277	117.152	116.666	116.526	116.113	115.648	115.675	1
2	116.893	116.36	115.68	116.977	117.155	117.295	117.136	116.659	116.533	116.084	115.635	115.662	2
3	116.886	116.344	115.665	116.978	117.141	117.293	117.12	116.653	116.54	116.075	115.62	115.661	3
4	116.872	116.32	115.637	116.976	117.135	117.268	117.116	116.637	116.541	116.057	115.624	115.649	4
5	116.862	116.298	115.612	116.987	117.148	117.26	117.11	116.621	116.555	116.068	115.601	115.646	5
6	116.854	116.305	115.605	117.006	117.167	117.251	117.101	116.602	116.588	116.039	115.574	115.645	6
7	116.849	116.283	115.667	117.023	117.173	117.24	117.1	116.581	116.602	115.998	115.555	115.642	7
8	116.833	116.271	115.729	117.038	117.196	117.231	117.078	116.575	116.618	115.971	115.544	115.703	8
9	116.819	116.252	115.755	117.054	117.202	117.247	117.064	116.557	116.616	115.949	115.523	115.706	9
10	116.804	116.232	115.789	117.073	117.218	117.256	117.041	116.532	116.594	115.931	115.5	115.736	10
11	116.788	116.204	115.835	117.102	117.232	117.238	117.014	116.523	116.554	115.897	115.559	115.744	11
12	116.777	116.173	115.937	117.159	117.236	117.226	117.018	116.512	116.523	115.862	115.584	115.75	12
13	116.758	116.141	116.048	117.219	117.241	117.235	117.007	116.492	116.481	115.838	115.586	115.758	13
14	116.723	116.116	116.153	117.298	117.247	117.238	116.981	116.47	116.456	115.823	115.604	115.763	14
15	116.696	116.096	116.239	117.36	117.277	117.231	116.961	116.451	116.444	115.832	115.626	115.766	15
16	116.666	116.054	116.313	117.39	117.332	117.219	116.936	116.465	116.467	115.833	115.633	115.813	16
17	116.638	116.021	116.385	117.421	117.374	117.207	116.916	116.46	116.433	115.832	115.66	115.828	17
18	116.611	115.991	116.455	117.464	117.381	117.206	116.896	116.435	116.407	115.822	115.671	115.844	18
19	116.586	115.968	116.528	117.468	117.378	117.225	116.873	116.413	116.385	115.807	115.659	115.845	19
20	116.567	115.939	116.588	117.457	117.372	117.208	116.841	116.401	116.361	115.796	115.666	115.852	20
21	116.554	115.907	116.638	117.454	117.363	117.196	116.821	116.389	116.341	115.801	115.672	115.855	21
22	116.546	115.878	116.691	117.418	117.351	117.183	116.816	116.424	116.311	115.789	115.664	115.875	22
23	116.53	115.85	116.735	117.374	117.325	117.176	116.806	116.461	116.293	115.779	115.669	115.886	23
24	116.514	115.815	116.772	117.352	117.315	117.168	116.785	116.448	116.273	115.759	115.683	115.898	24
25	116.499	115.795	116.804	117.316	117.318	117.166	116.755	116.435	116.257	115.755	115.674	115.896	25
26	116.502	115.777	116.83	117.284	117.294	117.169	116.731	116.452	116.233	115.756	115.667	115.902	26
27	116.486	115.745	116.851	117.252	117.292	117.168	116.725	116.421	116.206	115.724	115.653	115.901	27
28	116.46	115.722	116.872	117.223	117.284	117.159	116.71	116.402	116.172	115.717	115.657	115.925	28
29	116.439		116.89	117.198	117.275	117.149	116.682	116.47	116.144	115.682	115.651	115.962	29
30	116.418		116.905	117.178	117.285	117.156	116.7	116.492	116.128	115.697	115.65	115.982	30
31	116.395		116.922		117.284		116.695	116.515		115.671		115.999	31
TOTAL	3616.734	3250.229	3604.237	3516.45	3635.149	3516.54	1 3624.68	3611.614	3492.582	3591.757	3468.712	3589.769	TOTAL
MEAN	116.669	116.08	116.266	117.215	117.263	117.218	116.925	116.504	116.419	115.863	115.624	115.799	MEAN
MAX	116.909	116.372	116.922	117.468	117.381	117.295	117.152	116.666	116.618	116.113	115.683	115.999	MAX
MIN	116.395	115.722	115.605	116.951	117.135	117.149	116.682	116.389	116.128	115.671	115.5	115.642	MIN

SUMMARY FOR THE YEAR 2011
Mean water level, 116.489 Metres
Maximum daily water level, 117.468 Metres On 2011-04-19
Minimum daily water level, 115.500 Metres On 2011-11-10

NOTES: WATER LEVELS ARE IN METRES AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. THE WATER LEVEL DATA ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC

TABLE IV
ST. CROIX RIVER AT VANCEBORO
DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	52.3	31.1	37.9	18.2	53.8	27.2	14.7	18.3	12.4	42.8	22.3	18.2	1
2	52.1	31.1	37.6	24.4	45.3	27.3	14.7	18.3	12.4	42.5	22.2	18.2	2
3	46.4	31.1	37.4	24.4	42.2	27.3	14.7	18.3	12.4	42.5	22.1	18.2	3
4	41.9	30.9	37.1	24.4	39.1	27.2	14.6	18.2	12.4	42.2	22.1	18.1	4
5	36.2	30.9	36.8	24.4	36.2	27.1	13.3	18.1	12.4	42.2	21.9	18.1	5
6	31.4	30.6	36.8	24.5	31.7	27.1	12.1	18	10.3	41.9	21.8	18.1	6
7	31.4	30.6	34	21.6	25.1	24.1	12.1	18	8.89	41.6	21.7	18.1	7
8	31.4	30.6	31.1	16	20.1	21.8	20.3	17.9	13.3	41.3	21.6	18.4	8
9	31.4	30.3	31.4	13.9	20.1	19.3	25.8	17.8	29.7	41.1	21.5	15.7	9
10	31.1	30.3	28.6	14	20.8	17.1	25.7	17.8	37.7	40.8	21.3	14	10
11	31.1	35.4	26.4	14	20.8	17	25.5	17.8	37.4	40.5	21.8	14	11
12	36.8	38.8	23.7	14.2	20.9	17	25.6	17.7	41.1	39.9	21.9	14.1	12
13	43	38.5	19.4	17.9	20.9	17.1	25.5	17.6	43.3	39.6	18.7	14.1	13
14	42.8	38.2	15.8	27.1	20.9	17	25.5	17.5	43	33.7	13.8	14.1	14
15	42.5	37.9	12.6	37.7	21.1	17	25.4	17.4	43	29.7	11.8	14.1	15
16	42.2	39.9	11.6	43.6	30	16.2	25.3	17.5	43.3	29.7	11.8	14.2	16
17	41.9	42.2	11.8	49.8	48.7	15.6	25.2	19.6	42.8	25.7	11.9	14.3	17
18	41.6	41.9	11.9	69.7	61.2	15.6	25.9	20.9	42.5	23.3	12	14.3	18
19	36.2	41.6	12.1	81	67.1	15.6	27.1	20.8	42.5	23.2	11.9	14.3	19
20	32.8	41.3	12.3	83	67.1	15	27.5	20.7	42.2	23.1	11.9	14.3	20
21	32.8	40.8	10.7	94.6	67.1	13.8	23.5	20.7	41.9	23.2	11.9	14.4	21
22	32.8	40.5	9.26	109	67.1	11.8	19.7	20.9	41.6	23.1	11.9	14.4	22
23	32.6	37.1	9.35	108	66.8	10.2	18.7	21	41.3	23.1	11.9	14.5	23
24	32.6	39.1	9.4	108	58.9	13	18.7	21	41.3	22.9	12	14.6	24
25	32.3	39.1	9.46	104	53.2	14.9	18.6	21	43	22.9	14.2	14.5	25
26	32	38.8	9.52	101	47.6	14.9	18.5	30	43.9	22.9	18.2	14.5	26
27	32	38.5	9.54	100	40.5	12.7	18.5	38.2	43.6	22.7	18.1	14.5	27
28	32	38.2	9.6	99.4	37.4	10.6	18.4	37.9	43.3	22.7	18.1	14.6	28
29	31.7		9.6	98.8	34.3	10.6	18.3	31.1	43	22.5	18.1	14.8	29
30	31.4		9.63	80.4	27.3	13	18.4	20.8	43	22.5	18.1	14.8	30
31	31.4		9.68		27.3		18.4	14.9		22.4		14.8	31
TOTAL	1130.1	1015.3	612.04	1647	1240.6	534.1	636.2	645.7	1008.89	978.2	518.5	477.3	TOTAL
MEAN	36.5	36.3	19.7	54.9	40	17.8	20.5	20.8	33.6	31.6	17.3	15.4	MEAN
DAM3	97600	87700	52900	142000	107000	46100	55000	55800	8720 0	84500	44800	41200	DAM3
MAX	52.3	42.2	37.9	109	67.1	27.3	27.5	38.2	43.9	42.8	22.3	18.4	MAX
MIN	31.1	30.3	9.26	13.9	20.1	10.2	12.1	14.9	8.89	22.4	11.8	14	MIN

SUMMARY FOR THE YEAR 2011
Total discharge, 902000 DAM3
Mean discharge, 28.6 M3/S
Maximum daily discharge, 109 M3/S On 2011-04-22
Minimum daily discharge, 8.89 M3/S On 2011-09-07

NOTES: DATA ARE SUPPLIED BY THE UNITIED STATES GEOLOGICAL SURVEY
AND ARE PROVISIONAL

TABLE V
GRANDFALLS FLOWAGE AT GRANDFALLS
DAILY MEAN WATER LEVELS IN METRES FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	61.924	61.783	61.791	61.701	61.906	61.858	61.793	61.731	61.809	61.701	61.752	61.732	1
2	61.924	61.78	61.774	61.725	61.903	61.843	61.797	61.747	61.817	61.67	61.758	61.719	2
3	61.935	61.783	61.773	61.732	61.862	61.818	61.806	61.762	61.808	61.671	61.763	61.71	3
4	61.932	61.786	61.764	61.732	61.855	61.802	61.806	61.772	61.813	61.685	61.759	61.698	4
5	61.93	61.79	61.751	61.74	61.869	61.784	61.809	61.777	61.822	61.7	61.745	61.694	5
6	61.914	61.808	61.733	61.787	61.865	61.76	61.814	61.781	61.827	61.726	61.741	61.686	6
7	61.894	61.8	61.754	61.835	61.862	61.761	61.815	61.785	61.821	61.722	61.73	61.674	7
8	61.879	61.802	61.767	61.856	61.846	61.784	61.799	61.801	61.824	61.719	61.728	61.716	8
9	61.866	61.789	61.851	61.847	61.798	61.798	61.81	61.809	61.826	61.728	61.715	61.812	9
10	61.849	61.775	61.866	61.847	61.796	61.794	61.834	61.809	61.824	61.729	61.710 A	61.879	10
11	61.853	61.781	61.793	61.86	61.805	61.781	61.816	61.821	61.837	61.713	61.777	61.896	11
12	61.829	61.785	61.812	61.913	61.812	61.766	61.803	61.831	61.828	61.703	61.86	61.882	12
13	61.815	61.792	61.845	61.913	61.815	61.762	61.779	61.826	61.814	61.699	61.859	61.857	13
14	61.826	61.796	61.876	61.867	61.809	61.772	61.747	61.821	61.814	61.708	61.853	61.826	14
15	61.832	61.799	61.867	61.862	61.824	61.768	61.722	61.812	61.82	61.772	61.854	61.797	15
16	61.835	61.781	61.866	61.844	61.879	61.755	61.716	61.819	61.839	61.796	61.827	61.804	16
17	61.825	61.779	61.832	61.809	61.893	61.748	61.716	61.844	61.838	61.818	61.82	61.819	17
18	61.81	61.793	61.822	61.781	61.835	61.736	61.701	61.848	61.844	61.821	61.802	61.805	18
19	61.824	61.804	61.806	61.747	61.826	61.73	61.676	61.829	61.84	61.805	61.762	61.782	19
20	61.832	61.807	61.787	61.723	61.836	61.728	61.662	61.821	61.837	61.795	61.75	61.782	20
21	61.814	61.807	61.772	61.711	61.817	61.73	61.679	61.813	61.844	61.813	61.747	61.763	21
22	61.803	61.809	61.797	61.674	61.82	61.734	61.711	61.837	61.841	61.813	61.731	61.763	22
23	61.797	61.816	61.799	61.676	61.876	61.733	61.699	61.854	61.833	61.806	61.72	61.765	23
24	61.807	61.816	61.82	61.704	61.885	61.724	61.692	61.853	61.803	61.796	61.719	61.745	24
25	61.795	61.815	61.818	61.701	61.849	61.742	61.696	61.846	61.784	61.779	61.706	61.71	25
26	61.791	61.813	61.819	61.688	61.849	61.773	61.697	61.811	61.765	61.77	61.69	61.713	26
27	61.803	61.799	61.782	61.693	61.85	61.788	61.706	61.737	61.747	61.734	61.684	61.709	27
28	61.813	61.799	61.738	61.775	61.83	61.795	61.709	61.725	61.735	61.728	61.696	61.715	28
29	61.808		61.718	61.845	61.849	61.791	61.716	61.79	61.734	61.733	61.717	61.769	29
30	61.802		61.712	61.878	61.882	61.795	61.723	61.827	61.73	61.725	61.741	61.782	30
31	61.797		61.706		61.872		61.731	61.833		61.745		61.774	31
TOTAL	1917.158	1730.287	1915.611	1853.466	1917.275	1853.153	1914.18	1915.972	1854.318	1914.123	1852.716	1914.778	TOTAL
MEAN	61.844	61.796	61.794	61.782	61.848	61.772	61.748	61.806	61.811	61.746	61.757	61.767	MEAN
MAX	61.935	61.816	61.876	61.913	61.906	61.858	61.834	61.854	61.844	61.821	61.86	61.896	MAX
MIN	61.791	61.775	61.706	61.674	61.796	61.724	61.662	61.725	61.73	61.67	61.684	61.674	MIN

SUMMARY FOR THE YEAR 2011
Mean water level, 61.789 Metres
Maximum daily water level, 61.935 Metres On 2011-01-03
Minimum daily water level, 61.662 Metres On 2011-07-20

NOTES: WATER LEVELS ARE IN METRES AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. THE WATER LEVEL DATA ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH WOODLAND PULP LLC

TABLE VI
ST. CROIX RIVER AT BARING
DAILY MEAN DISCHARGE IN CUBIC METRES PER SECOND FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	127	69.9 B	77 B	77	170	83.3	27.6	31.1	92	88.9	59.2	90	1
2	119	69.9 B	78.2 B	78.4	157	83.5	27.6	28.9	54.7	88.9	56.4	87.5	2
3	112	69.1 B	70.8 B	89.5	143	81.3	27.7	34	51.8	83.8	54.1	83	3
4	110	66 B	73.1 B	85.5	120	74.8	28.6	40.5	37.1	71.6	53.2	73.9	4
5	92 B	66.5 B	73.1	98.8	127	74.8	29.7	29.7	30.9	77.3	53	71.4	5
6	77 B	68.2 B	91.7	95.4	136	75.9	31.7	28.6	29.5	73.1	53	75.3	6
7	83.8 B	71.6 B	107	95.4	119	68.8	31.4	34.3	28.9	74.2	53.2	80.1	7
8	91.4	69.9 B	124	97.1	111	51.3	32	36	29.2	78.7	52.1	97.7	8
9	90	73.9 B	104	106	104	53.5	37.9	34.2	29.5	74.8	53.5	100	9
10	93.2	72.5 B	145	102	90.6	53.5	34.3	29.5	41.6	70.1	51	97.4	10
11	85.5	66.8 B	185	103	91.2	58	56.4	30.9	48.7	65.1	63.7	92.3	11
12	88.1	64.8 B	226	106	91.5	50.7	58.3	32.6	66.8	68.2	97.7	91.5	12
13	82.4	66.8 B	249	148	88.9	51.8	62.6	32.6	67.1	65.1	119	90	13
14	72.5	68.2 B	275	185	88.6	58.6	61.2	31.4	69.1	67.1	113	87.2	14
15	81.3 B	68.5 B	261	190	94.9	61.7	61.4	29.7	68	62	93.4	88.1	15
16	82.7 B	70.2 B	238	198	138	59.2	60.6	32	69.4	61	87.2	92	16
17	78.7 B	68.5 B	217	228	208	45.9	58	37.1	72.5	64.6	79.6	90.3	17
18	75.3 B	70.5	208	263	227	43.9	57.2	46.4	69.4	64.8	86.1	88.3	18
19	83.5 B	71.9 B	208	274	207	42.2	57.2	50.7	69.7	67.1	89.8	77.3	19
20	89.2 B	70.2 B	201	271	196	41.9	55.5	51	76.7	84.7	70.8	71.9	20
21	87.8 B	70.2 B	178	273	193	31.1	43	39.6	75	83.3	54.9	68.2	21
22	81.8 B	69.1 B	155	264	166	30	33.1	47.3	66.5	81.6	56.1	79.6	22
23	75.6 B	66 B	138	247	155	29.2	45.3	44.7	68.8	80.1	62.9	73.3	23
24	77.9 B	65.1 B	117	242	165	27.8	31.4	52.9	83.8	72.2	62.6	76.2	24
25	80.7 B	70.2 B	108	241	161	27.9	28.9	60	87.5	76.7	56.4	71.1	25
26	78.4 B	73.9 B	94.3	240	139	29.5	29.5	88.3	86.4	79.9	61.2	65.7	26
27	74.5 B	75 B	101	217	138	33.1	42.2	99.4	86.1	76.5	62.6	58.9	27
28	69.1 B	73.3 B	95.4	196	117	35.4	33.4	130	83.5	66.3	67.4	81.8	28
29	69.7 B		84.1	193	98.5	28.6	27.1	141	75.6	50.4	70.2	87.2	29
30	69.7 B		74.8	185	87.2	27.4	30.9	117	78.2	56.6	78.4	83	30
31	69.9 B		68.8		83.5		31.7	106		56.9		85.2	31
TOTAL	2649.7	1946.7	4426.3	5189.1	4211.9	1514.6	1273.4	1627.4	1894	2231.6	2071.7	2555.4	TOTAL
MEAN	85.5	69.5	143	173	136	50.5	41.1	52.5	63.1	72	69.1	82.4	MEAN
DAM3	229000	168000	382000	448000	364000	131000	110000	141000	164000	193000	179000	221000	DAM3
MAX	127	75	275	274	227	83.5	62.6	141	92	88.9	119	100	MAX
MIN	69.1	64.8	68.8	77	83.5	27.4	27.1	28.6	28.9	50.4	51	58.9	MIN

SUMMARY FOR THE YEAR 2011

Mean discharge, 86.6 M3/S
Maximum daily discharge, 275 M3/S On 2011-03-14
Minimum daily discharge, 27.1 M3/S On 2011-07-29
Total discharge 2730000 DAM3
NOTES: DATA ARE SUPPLIED BY THE UNITIED STATES GEOLOGICAL SURVEY
AND ARE PROVISIONAL
B - ICE CONDITIONS

TABLE VII
ST. CROIX RIVER AT MILLTOWN DAM
DAILY MEAN WATER LEVELS IN METRES FOR 2011

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	DAY
1	13.926	13.481	13.503	13.718	13.746	13.648	13.659	13.614	13.888	13.854	13.708	14.008	1
2	13.889	13.481	13.482	13.723	13.775	13.634	13.649	13.655	13.676	13.78	13.685	13.964	2
3	13.872	13.515	13.485	13.766	13.72	13.726	13.644	13.66	13.638	13.78	13.682	13.973	3
4	13.972	13.473	13.487	13.755	13.713	13.817	13.649	13.659	13.661	13.683	13.688	13.939	4
5	13.726	13.488	13.447	13.793	13.774	13.724	13.645	13.646	13.624	13.802	13.699	13.809	5
6	13.734	13.502	13.507	13.742	13.73	13.68	13.634	13.633	13.651	13.767	13.690 A	13.85	6
7	13.656 A	13.49	13.586	13.747	13.716	13.651	13.646	13.649	13.65	13.739	13.706	14.026	7
8	13.481	13.47	13.802	13.783	13.739	13.649	13.65	13.658	13.646	13.819 A	13.688	14.067	8
9	13.465	13.51	13.784	13.807	13.709	13.638	13.649	13.664 A	13.644	13.754	13.703	14.049	9
10	13.525	13.487	13.804	13.74	13.69	13.647	13.649	13.041	13.685	13.649	13.678	14.01	10
11	13.504	13.48	13.796	13.735	13.667	13.652	13.644	12.775	13.646	13.674	13.734	13.984	11
12	13.512	13.449	13.864	13.774	13.683	13.649	13.637	13.182	13.633	13.683	13.902	13.984	12
13	13.501	13.466	13.907	13.826	13.668	13.664	13.663	13.641	13.647 A	13.68	13.797	14.027	13
14	13.481	13.47	13.882	13.85	13.679	13.656	13.704	13.637	13.748	13.662	13.849	14.004	14
15	13.523	13.503	13.754	13.782	13.749	13.644	13.695	13.644	13.764	13.671	13.899	14.048	15
16	13.496	13.502	13.717	13.837	13.742	13.689	13.669	13.677	13.834	13.685	13.874	13.894	16
17	13.49	13.47	13.77	13.812	13.885	13.645	13.63	13.631 A	13.82	13.741	13.867	13.702	17
18	13.492	13.451	13.834	13.886	13.79	13.653	13.637	13.63	13.82	13.691	13.941	13.717 A	18
19	13.527	13.457	13.853	13.898	13.69	13.643	13.642	13.634	13.809	13.673	13.959	13.708	19
20	13.577	13.467	13.801	13.839	13.731	13.649	13.64	13.619	13.777	13.808	13.822	13.782	20
21	13.469	13.468	13.756	13.861	13.72	13.636	13.635	13.62	13.707	13.82	13.699	13.692	21
22	13.489	13.487	13.637	13.836	13.706	13.65	13.627 A	13.619	13.66	13.817	13.679	13.732	22
23	13.471	13.477	13.575	13.813	13.751	13.654	13.659	13.652	13.653	13.83	13.688	13.742	23
24	13.522	13.471	13.618	13.828	13.731	13.646	13.64	13.634	13.761	13.767	13.702	13.718	24
25	13.517	13.479	13.733	13.809	13.685	13.654	13.617	13.626	13.765	13.851	13.727 A	13.777	25
26	13.506	13.478	13.752	13.837	13.667	13.647	13.645	13.804	13.82	13.95	13.718	13.701	26
27	13.477	13.466	13.828	13.799	13.659	13.646	13.669	13.968	13.793	13.88	13.708	13.697	27
28	13.492	13.471	13.762	13.743	13.636	13.636	13.652	14.018	13.787	13.758	13.734	13.709	28
29	13.5		13.758	13.775	13.65	13.648	13.614	13.951	13.715	13.703 A	13.838	13.711	29
30	13.481		13.735	13.765	13.661	13.652	13.606	13.907	13.689	13.695	13.914	13.744	30
31	13.486		13.603		13.665		13.62	13.977		13.706		13.678 A	31
TOTAL	420.759	377.409	424.822	413.879	425.127	409.827	423.019	422.725	411.611	426.372	412.978	429.446	TOTAL
MEAN	13.573	13.479	13.704	13.796	13.714	13.661	13.646	13.636	13.72	13.754	13.766	13.853	MEAN
MAX	13.972	13.515	13.907	13.898	13.885	13.817	13.704	14.018	13.888	13.95	13.959	14.067	MAX
MIN	13.465	13.449	13.447	13.718	13.636	13.634	13.606	12.775	13.624	13.649	13.678	13.678	MIN

SUMMARY FOR 2011

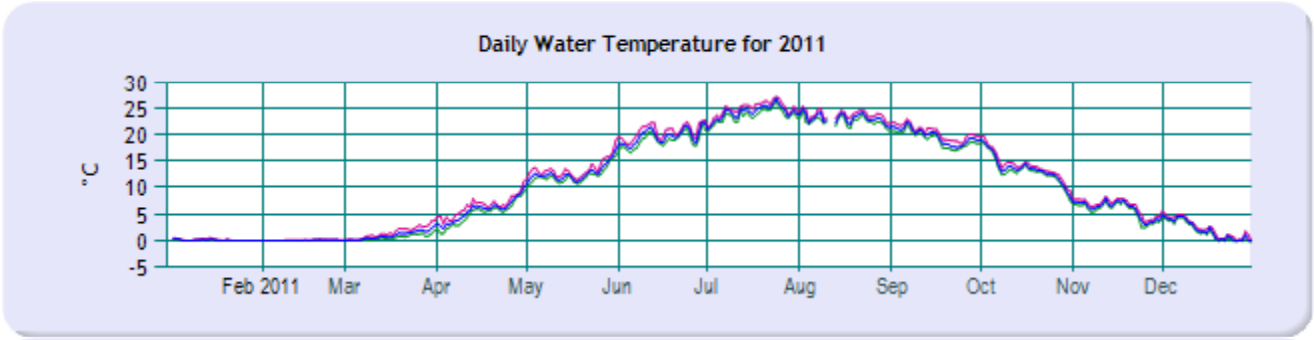
NOTES: WATER LEVELS ARE IN METRES AND ARE REFERENCED TO GEODETIC SURVEY OF CANADA DATUM. THE WATER LEVEL DATA ARE PROVISIONAL AND ARE SUPPLIED BY ENVIRONMENT CANADA IN COOPERATION WITH NEW BRUNSWICK POWER

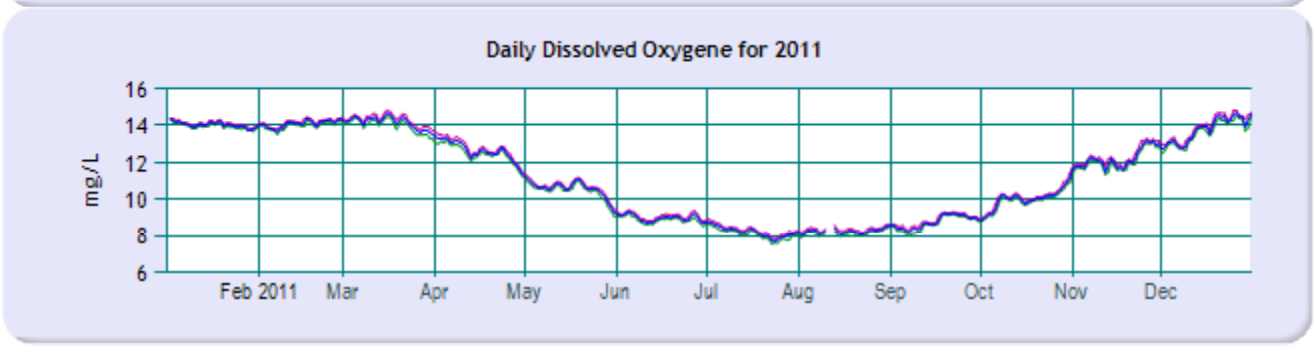
A- PARTIAL DAY

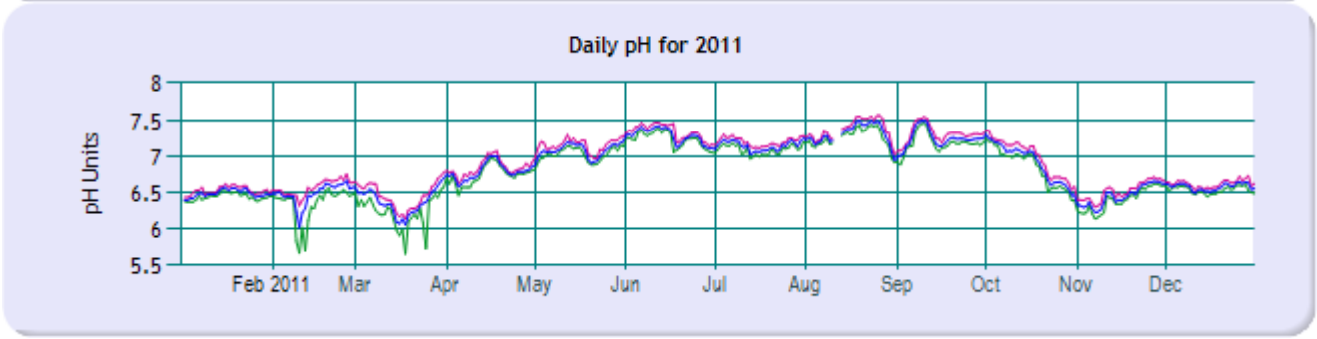
APPENDIX 5

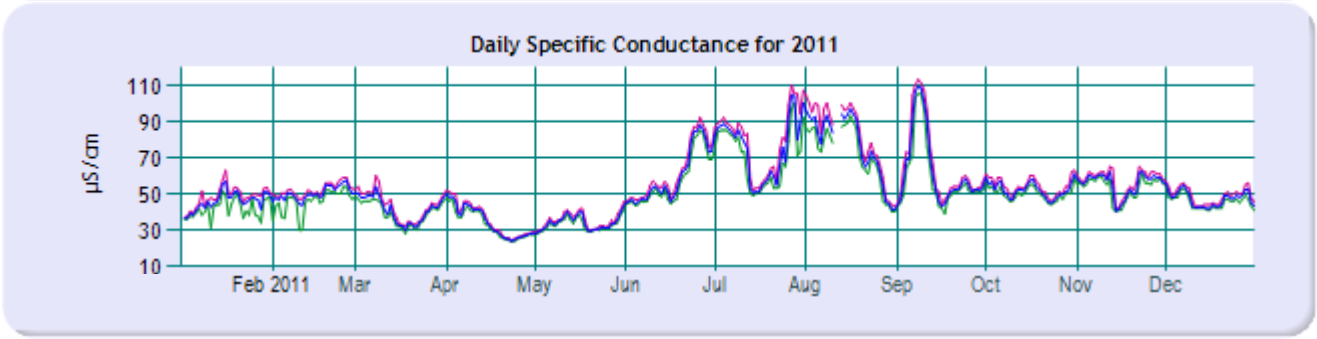
WATER QUALTIY DATA

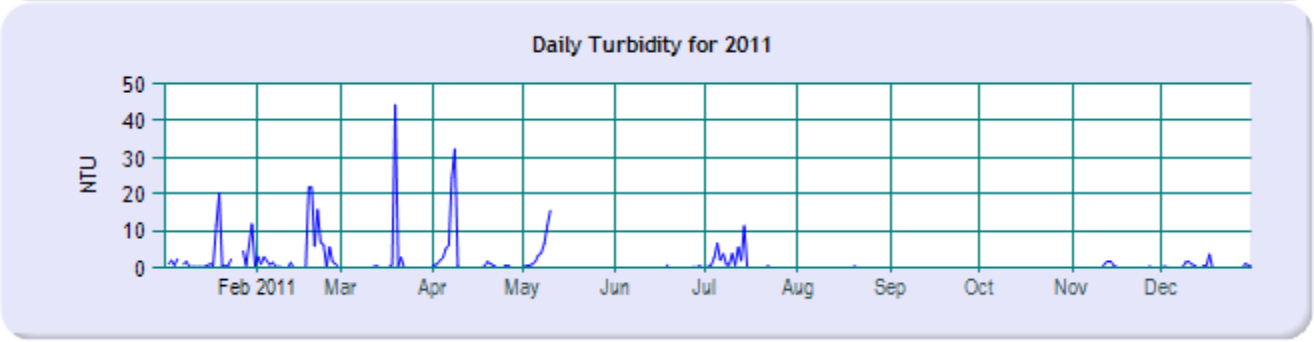
St. Croix River at Milltown, NB











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St. Croix River at Milltown, NB - 2011

Temperature (°C)

	January	February	March	April	May	June	July	August[1]	September	October	November	December
Min	-0.1	-0.1	0.0	1.3	10.6	16.5	21.2	20.6	17.0	6.8	2.4	-0.1
Max	0.5	0.2	4.6	11.7	19.7	22.7	27.1	25.3	22.9	19.6	8.3	5.1
Mean	0.0	0.0	1.1	5.9	12.9	19.8	24.3	23.0	19.6	13.3	5.9	1.8
% of monthly data used	100	100	100	100	100	100	100	97	100	100	100	100

Dissolved Oxygen (mg/L)

	January	February	March	April	May	June	July	August[1]	September	October	November	December
Min	13.7	13.5	13.0	11.1	9.1	8.5	7.5	7.9	8.0	8.9	11.3	12.6
Max	14.4	14.4	14.8	13.5	11.3	9.4	8.9	8.6	9.3	11.8	13.3	14.8
Mean	14.0	14.1	14.1	12.6	10.5	9.0	8.2	8.3	8.8	10.1	12.2	13.8
% of monthly data used	100	100	100	100	100	100	100	97	100	100	100	100

pH (pH units)

	January	February	March	April	May	June	July	August[1]	September	October	November	December
Min	6.4	5.7	5.7	6.5	6.9	7.0	7.0	6.9	6.9	6.3	6.1	6.4
Max	6.6	6.8	6.8	7.1	7.3	7.5	7.3	7.6	7.5	7.4	6.7	6.7
Mean	6.5	6.5	6.4	6.8	7.1	7.3	7.1	7.3	7.3	6.9	6.5	6.6
% of monthly data used	100	100	100	100	100	100	100	97	100	100	100	100

Specific Conductance (µS/cm)

	January	February	March	April	May	June	July	August[1]	September	October	November	December
Min	31.3	30.0	28.0	23.7	28.1	43.4	49.0	40.0	39.0	44.0	40.0	41.0
Max	62.9	59.0	60.0	51.0	45.9	92.0	110.0	108.0	113.0	63.0	65.0	56.0
Mean	45.9	50.4	41.4	34.0	34.5	60.6	75.6	75.7	63.6	52.2	55.5	46.9
% of monthly data used	100	100	100	100	100	100	100	97	100	100	100	100

Turbidity (NTU)

	January	February	March	April	May[2]	June[2]	July	August[3]	September[3]	October[3]	November[3]	December
Min	0	0	0	0	0.2	0	0	0	0	0	0	0
Max	365.9	233.4	364.5	102.7	23.0	35.2	130.7	8.3	0	0	7.2	54.8
Mean	4.3	3.4	1.5	2.7	5.7	0.3	1.3	0	0	0	0.3	0.4
% of monthly data used	93	100	100	100	31	48	100	79	0	0	71	100

Notes:

1. No data recorded for approximately 24 hours on August 10-11 when the water level was dropped at the dam and the sensors were no longer in the water.
2. Turbidity sensor was experiencing excessive fouling between May 10 and June 16.
3. Turbidity sensor was experiencing excessive fouling between August 26 and November 11.

Grab Sample Results - 2011

PARAMETER	UNIT	GUIDELINES[1]	MILLTOWN				FOREST CITY
			Apr 11	Jun 16	Aug 16	Nov 9	Apr 11
ALUMINUM	µg/L	100	**124**	94	VNA	VNA	16
ANTIMONY	µg/L		0.04	0.05	0.05	VNA	0.04
ARSENIC	µg/L	5	0.39	0.51	0.8	VNA	0.29
BARIUM	µg/L		5	7	VNA	VNA	2
BERYLLIUM	µg/L		<0.01	0.01	<0.01	VNA	<0.01
CADMIUM	µg/L	calculated	0.02	0.02	0.06	VNA	<0.02
CALCIUM	mg/L		3.2	3.9	VNA	VNA	4.1
CHLORIDE	mg/L	150[2]	3.25	3.56	7.94	5.46	1.47
CHROMIUM	µg/L	8.9	0.18	0.17	0.16	VNA	0.08
COBALT	µg/L		<0.01	0.03	0.03	VNA	<0.01
COLOUR	Hazen Units		49	54	69	66	11
COPPER	µg/L	2	0.32	0.42	0.45	VNA	0.26
GRANULAR ALKALINITY	mg/L ($CaCO_3$)		9.02	10.98	18.74	14	11.11
IRON	mg/L	0.3	0.1	0.2	VNA	VNA	<0.02
LEAD	µg/L	1	0.12	0.11	0.12	VNA	<0.03
MAGNESIUM	mg/L		0.6	0.6	VNA	VNA	0.6
MANGANESE	µg/L		23.2	55.6	VNA	VNA	2.5
MOLYBDENUM	µg/L	73	0.06	0.11	0.16	VNA	0.05
NICKEL	µg/L	25	0.79	0.92	1	VNA	0.19
NITRATE	mg/L as Nitrogen	2.9	0.03	0.02	0.07	0.06	<0.02
pH - LAB	pH Units	6.5-9.0	7.11	7.17	7.4	7.2	7.33
PHOSPHOROUS	mg/L	0.03[3]	0.014	0.024	**0.042**	0.022	0.004
POTASSIUM	mg/L		<0.40	0.5	VNA	VNA	<0.40
SELENIUM	µg/L		0.04	0.06	0.05	VNA	0.04
SILVER	µg/L	0.05	<0.01	<0.01	<0.01	VNA	<0.01
SODIUM	mg/L		4.5	4.7	VNA	VNA	1.4
SPECIFIC CONDUCTANCE - LAB	µS/cm		43.9	48.1	95.1	62.4	32.9
STRONTIUM	µg/L		15.1	18.9	VNA	VNA	21.6
SULPHATE	mg/L		4.82	4.12	10.6	5.98	1.91
THALLIUM	µg/L		<0.01	<0.01	<0.01	VNA	<0.01
TIN	µg/L		<0.05	<0.05	<0.05	VNA	<0.05
TITANIUM	µg/L		1.03	1.08	0.88	VNA	0.21
TOTAL ALKALINITY	mg/L ($CaCO_3$)		<20.0	<20.0	20.1	<20.0	<20.0
TOTAL NITROGEN	mg/L		0.26	0.34	0.39	0.34	0.18
TOTAL ORGANIC CARBON	mg/L		7.5	7.7	9.5	13.8	4
TURBIDITY - LAB	NTU		0.9	0.9	1.2	1.3	0.3
URANIUM	µg/L		0.06	0.08	0.07	VNA	0.03
VANADIUM	µg/L		0.41	0.43	0.75	VNA	0.1
ZINC	µg/L	calculated[2]	2.1	1.93	3.04	VNA	0.22

Notes:

"VNA" - Value Not Available; µg/L - microgram per litre; mg/L - milligrams per litre; $CaCO_3$ - calcium carbonate; µS/cm - microSiemens per centimetre; NTU - nephelometric turbidity units

1 - Guidelines refer to the Canadian Council of Ministers of the Environment (CCME) guidelines (2010 update) unless otherwise indicated. Bold and shading indicates exceedence.

2 - British Columbia Ministry of the Environment (BC MOE). 2001. BC Approved Water Quality Guidelines (criteria) 1998 edition. Environmental Protection Division, British Columbia Ministry of Environment, Victoria, British Columbia. Updated August 24, 2001 (http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html).

3 - Ontario Ministry of the Environment (OMOE). 1994. Water Management Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment [reprinted February 1999]. Ontario Ministry of the Environment. 67 pp. (http://www.ene.gov.on.ca/environment/en/resources/STD01_076352.html).

APPENDIX 6

ALEWIFE DATA

Table St. Croix River ME/NB alewife/gaspereau/blueback herring spawning runs, 1981- present (bold = 7-day peak) Verified to July 11, 2011

Source: St. Croix International Waterway Commission and Fisheries & Oceans Canada

YEARS >>>	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
April 30-May2	0	0	0	0	0	5460	0	0	0	0	0	0	0	0	0
May 3-9	0	0	0	0	0	16410	9400	24410	0	29690	170	0	0	0	0
May 10-16	7510	32160	16970	6000	0	75150	171500	468750	0	305370	14740	8910	0	0	5898
May 17-23	47450	64120	**44050**	40300	70000	429400	559500	760280	200610	319380	133820	**74120**	12000	102210	**109388**
May 24-30	47770	**74800**	33760	**67100**	**149890**	**772800**	**674700**	**764990**	**464390**	**411090**	**154560**	45520	**146600**	116020	99847
May 31- June 6	**48310**	56930	20770	26200	96740	628300	645300	370750	424550	141490	51110	24780	102800	**144700**	0
June 7-13	16000	4610	35650	13300	26900	57200	480400	187800	63940	132030	4010	50420	2260	0	0
June 14-20	1760	250	620	0	21040	0	83900	13770	11370	0	0	0	26060	0	0
June 21-27	790	210	0	0	1060	0	0	0	0	0	0	0	0	0	0
June 28 - July 4	30	20	0	0	3270	0	0	0	0	0	0	0	0	0	0
July 5-11	0	1	130	0	0	0	0	0	0	0	0	0	0	0	0
July 12-18	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
July 19-25	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
July 26 - later			0	0	0	0	0	0	0	0	0	0	0	0	0
Spawning escapement	169620	233102	151952	152900	368900	1984720	2624700	2590750	1164860	1339050	358410	203750	289720	362930	215133
Harvest	0	0	0	0	0	0	0	0	0	192200	228500	0	8000	15400	8000
TOTAL RUN	169620	233102	151952	152900	368900	1984720	2624700	2590750	1164860	1531250	586910	203750	297720	378330	223133

YEARS >>>	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
April 30-May2	0	0	0	0	0	0	0	0	0	0	0	0	--	--	--	--
May 3-9	2814	0	0	0	**3966**	0	2	0	0	0	18	0	0	0	0	0
May 10-16	11178	0	**77394**	195	142	160	6	3	0	0	577	0	4	1	9748	1657
May 17-23	202188	**122478**	25705	5933	2011	505	23	603	0	2	3111	0	33	12	**17731**	**13053**
May 24-30	188538	93000	71534	**13615**	377	**2625**	325	2115	0	20	**3155**	2	119	3740	17008	1227
May 31- June 6	**231870**	4091	2684	5476	2067	1735	**494**	**3163**	0	5277	2540	0	**11797**	42	8520	7750
June 7-13	9390	5951	0	108	6	123	35	999	**951**	**6220**	1096	**1225**	61	2	4446	1387
June 14-20	0	0	0	0	0	54	15	1018	108	113	1227	66	23	**6627**	1126	50
June 21-27	0	0	0	0	0	0	0	0	79	0	105	1	221	26	140	10
June 28 - July 4	0	0	0	0	0	0	0	0	150	0	--	--	3	0	45	7
July 5-11	0	0	0	0	0	0	0	0	11	0	--	--	--	--	9	1
July 12-18	0	0	0	0	0	0	0	0	0	0	--	--	--	--	3	--
July 19-25	0	0	0	0	0	0	0	0	0	0	--	--	--	--	--	--
July 26 - later	0	1	0	0	0	0	0	0	0	0	--	--	--	--	--	--
Spawning escapement	645978	225521	177317	25327	8569	5202	900	7901	1299	11632	11829	1294	12261	10450	58776	25142
Harvest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL RUN	645978	225521	177317	25327	8569	5202	900	7901	1299	11632	11829	1294	12261	10450	58776	25142

Note 1. Prior to 1999, alewife were enumerated by counting all fish for 10min/hr and multiplying by 6 to yield an hourly total, this done for each hour the fishway was open. In 1999 and 2000, "light" run periods were enumerated by shutting off the fishway exit for 4 hour intervals and then individually counting all fish in the trap, while "heavy" run periods were enumerated as in previous years. Since 2001, all fish have been counted individually.

Note 2. Beginning in 1995 the State of Maine blocked the upstream fishways at Woodland and Grand Falls to spawning alewives. In 2001, Fisheries & Oceans Canada began transporting a portion of the spawning run from Milltown to Woodland Flowage. Number of fish transported and released by year: 2001 (3756), 2002 (807), 2003 (6805), 2004 (392), 2005 (7100), 2006 (6653), 2007 (1169). In 2008, Maine removed the fishway barrier at Woodland, allowing alewives to directly enter the Woodland Flowage, and Fisheries & Oceans discontinued its trucking program.

Note 3. Monitoring was discontinued on June 27 in 2006-2007, July 3 in 2008, July 4 in 2009, July 19 in 2010 and July 11 in 2011 at the presumed end of the run; any fish entering after these dates are unrecorded