

## 2.0 St. John River Basin



### 2.1 Watershed Description

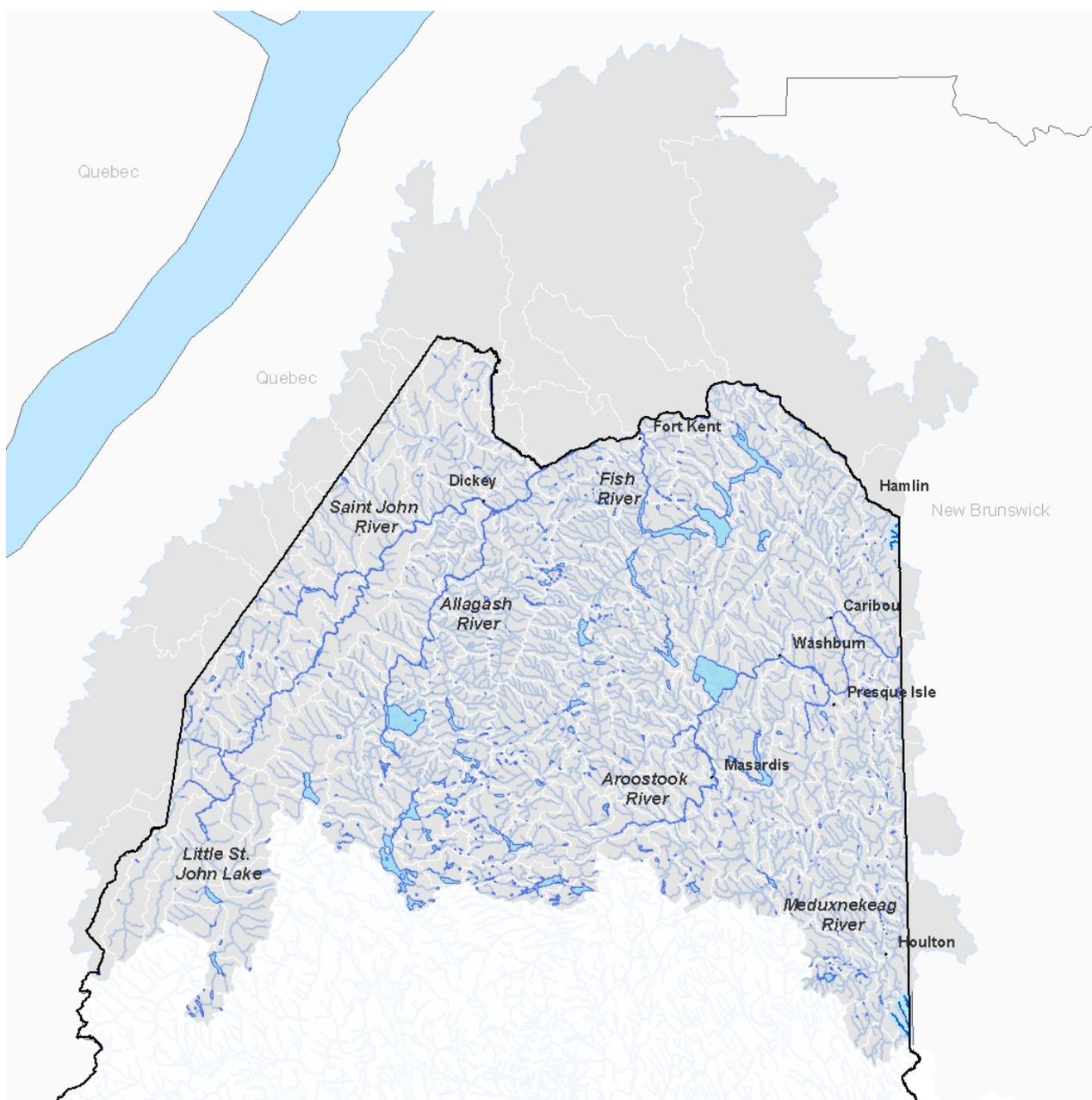
The St. John River Basin occupies approximately 21,400 square miles in Aroostook, Somerset, Piscataquis and Penobscot Counties, Maine and extends into the provinces of Quebec and New Brunswick, Canada. The St. John River originates at the Little St. John Lake in the unincorporated township of T5 R20 WLS Somerset County, Maine and ends at the Bay of Fundy near St. John, New Brunswick. The St. John River forms the US-Canada border between St. Francis, Maine and Grand Falls, New Brunswick where the river crosses exclusively into Canadian territory. The river is approximately 420 miles long. The topography within the drainage basin is generally flat with rolling hills. The drainage basin is largely undeveloped and much of the land is used as a forestry resource. Major

communities within the St. John River Basin include Fort Kent, Fort Fairfield, Houlton, Caribou, St. Agatha, Presque Isle, Van Buren, and Frenchville.

Table 3 presents the major Maine tributaries to the St. John River along with their respective drainage areas within Maine. Figure 2 illustrates the Maine portion of the St. John River basin including major tributaries and population centers.

**Table 3. St. John River, Tributaries from Upstream to Downstream and Drainage Areas**

<b>Tributary</b>	<b>Drainage Area (square miles)</b>
Allagash River	1,240
Fish River	890
Aroostook River	2,460
Big Presque Isle and Meduxnekeag River	750
<b>Total</b>	<b>11,580</b>



**Figure 2. St. John River Basin and Major Tributaries**

## **2.2 Dams and Reservoirs**

In 1987, the ACOE began compiling the National Inventory of Dams (NID) in cooperation with FEMA's National Dam Safety Program. The NID is a congressionally authorized dam safety and management tool that documents dams that are at least 25 feet in height or impound at least 50 acre-feet of water at maximum pool level. The Maine Department of Environmental Protection and the Bureau of Land and Water Quality (BL&WQ) have expanded on the ACOE NID database by adding smaller dams to the inventory and making the database available to MEMA for review and MEGIS for distribution.

In general, dams in Maine are not constructed as flood control structures. However, the dams with large impoundment capacity can be useful for controlling flood discharges if their reservoirs are below capacity. Many dams in the lower reaches of Maine's rivers are run-of-river dams, and have little or no capacity to capture and hold runoff during floods (MGS, 2005).

The collaborative dam database indicates that at the present (2007), the St. John River Basin contains over 50 dams. Nineteen dams are used for recreation, fifteen for flood control and stormwater management, ten for reservoir storage, two for debris control, and two for hydroelectric power generation. Sixteen are used for "other" purposes. The storage capacity of impoundments within the Maine portion of the St. John River Basin is approximately 71,800 acre-feet. Appendix E contains the list of dams located within the St. John River Basin and included in the collaborative dam database.

## **2.3 Precipitation**

The St. John River Basin to Hamlin, Maine, which includes the Allagash, Aroostook, and Fish River subbasins and other Canadian subbasins, occupies approximately 11,600 square miles of land. The annual average precipitation in the basin is approximately thirty-eight inches distributed uniformly throughout the year. Snowfall averages approximately 110 inches per year, the average water equivalent of the spring snowpack is approximately eight inches. The average annual runoff as recorded at the USGS stream gage in Hamlin (Station ID 01015100) indicates that 50% of all water running off the drainage basin occurs during the spring snowmelt period (ACOE, 1987).

## **2.4 Population**

Within Maine, the St. John River Basin contains all or portions of two cities (e.g., Presque Isle, Caribou), forty-four towns, 163 unincorporated territories, and falls within four counties. The St. John River Basin is sparsely populated; only three communities, Presque Isle, Caribou, and Houlton, have a population greater than 5,000 (US Census, 2000). Table 4 presents the population data within the drainage basin since 1970. Population within the basin has been decreasing steadily, which most of the losses occurring in the rural areas outside the cities.

**Table 4. St. John River Basin, Population within Maine**

<b>Census date</b>	<b>Population</b>	<b>Population in cities</b>
1970	89,000	22,000
1980	86,000	21,000
1990	81,000	20,000
2000	69,000	18,000

## **2.5 Historic Flooding Events (1970 – 2007)**

Flooding within the St. John River Basin is most often caused by a combination of precipitation, snowmelt, and ice jams. Conditions favorable for flooding typically occur during the month of April when the region transitions from winter to spring. As compared to all other major rivers basins in Maine, the St. John River Basin is the farthest north and the least developed and experiences the majority of ice jam flooding.

Table 5 presents the list of major and minor flood events identified within the St. John River basin between 1970 and the present using the sources of data described in Section 1 of this report. The flood events indicated with an “x” are described in greater detail in following sections of the report.

**Table 5. St. John River Basin, Identified Flood Events**

<b>Event Date</b>	<b>Flood Location</b>	<b>Flood Documentation</b>	<b>Damages</b>
December 1973	Aroostook River, Fort Fairfield	CRREL	Basement flooding
x April 1973	Fish River near Fort Kent Maine	USGS, ACOE	Second worst flood
x May 1974	St. John River at Ninemile Bridge	USGS, ACOE	Severe damages
x April 1976	Meduxnikeag River, town of Houlton	USGS, CRREL, ACOE	
August 1976	St. John River	FIS, Fort Kent	Tropical storm Belle
x April 1979	St. John River at Dickey	USGS, ACOE	
x April 1983	Aroostook River Masardis to Fort Fairfield	USGS, CRREL, ACOE	Flood of record on Aroostook.
August 1981	Upper St. John River Basin	ACOE, USGS	Large precipitation event
x April 1987		USGS	
April 1988	Allagash River	CRREL	High stage, low flows
April 1990	Aroostook River	CRREL	
x April 1991	St. John, Little Black, Allagash, and Aroostook	IHMT, CRREL, Photos, USGS	Severe damages
x April 1993	Flood warnings from interagency report	IHMT	
x April 1994	Fort Fairfield	IHMT, CRREL, Photos	
x December 1994		Photos	
April 1998	Aroostook River, Fort Fairfield, Crouseville	CRREL	Business district flooding
March 2000	Aroostook River	CRREL	
December 2003	Allagash River	CRREL	Row 18. 10-15 feet of ice
April 2005	Aroostook River, St. John	CRREL	Moderate damages
December 2005	Aroostook River	CRREL	Record high stages
April/May 2006	St. John River	CRREL	Minor road flooding
January 2007	Allagash River	CRREL	Minor road flooding
April 2007	St. John River	CRREL	Road flooding

CRREL – Ice jam database, USGS – Streamgage record, ACOE – 1987 study, FIS – Flood Insurance Study, IHMT – Interagency Hazard Mitigation Report

The USGS record of peak discharge and stage at streamgages within the St. John drainage basin indicate major high flow events, which may have resulted in flooding. Appendix B contains a streamgage inventory of all active and historical gages in the Penobscot River Basin. Table 6 presents the highest recorded daily discharge at selected streamgages. The streamgage record indicates that major flood events resulting from high flows occurred in April 1973, May 1974, April 1976, April 1979, April 1983, and April 1987.

**Table 6. St. John River Basin, Flood of Record at Streamgages**

Site	Site Name	Date	Discharge (cfs)	Gage Height
01010000	St. John River at Ninemile Bridge, Maine	5/1/1974	44,400	12.63
01010070	Big Black River near Depot Mtn, Maine	4/1/1987	8,680	15.62
01010500	St. John River at Dickey, Maine	4/29/1979	91,700	19.13
01011000	Allagash River near Allagash, Maine	4/18/1983	36,900	13.68
01013500	Fish River near Fort Kent, Maine	4/30/1973	15,800	12.43
01015800	Aroostook River near Masardis, Maine	4/19/1983	23,100	17.7
01017000	Aroostook River at Washburn, Maine	4/19/1983	43,400	13.73
01018000	Meduxnekeag River near Houlton, Maine	4/3/1976	6,640	9.98

### 2.5.1 April 1973

Between April 27 and 29 of 1973, the St. John River basin received approximately two inches of rainfall accompanied by warm temperatures and melting snowpack. The resulting runoff caused record flows on the Allagash and Fish Rivers and the fourth largest discharge observed on the St. John River at Fort Kent. Table 7 presents the observed stage, discharge, and recurrence interval (where available) for the April 1973 flood. The USGS estimated the return period of the flows on the Fish River to be one hundred to five hundred years and the St. John River and tributaries to be five to fifty years.

**Table 7. St. John River Basin, USGS Streamgage Peaks, April 1973**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years) <sup>a</sup>
01010500	St. John River at Dickey, Maine	16.98	72,000	5-10
01011000	Allagash River near Allagash, Maine	12.33	29,400	25-50
01013500	Fish River near Fort Kent, Maine	12.43	15,800	100-500
01014700	Factory Brook near Madawaska, Maine	9.63	253	5-10
01015700	Houlton Brook near Oxbow Maine	7.89	236	25-50
01015800	Aroostook River near Masardis, Maine	16.95	20,800	10-25
01016500	Machias River near Ashland, Maine	9.03	11,400	10-25
01017000	Aroostook River at Washburn, Maine	13.68	43,100	25-50
01018000	Meduxnekeag River near Houlton, Maine	9.32	6,460	10-25
01014700	St. John River at Fort Kent		136,000	25-50
	Grand Falls New Brunswick <sup>a</sup>		199,000	-

a. Recurrence intervals are adapted from the gage estimated recurrence intervals in USGS WSP 2502, 2474, and SIR 2005-5194.

b. ACOE, 1987.

### 2.5.2 May 1974

In May of 1974, the St. John River basin received 1.2 inches of rainfall accompanied by warm temperatures and melting snowpack. The simultaneous runoff and ice jams resulted in flooding. Table 8 presents the observed stage, discharge, and recurrence interval (where available) for the May 1974 flood. The USGS estimated the return period of the flows on the St. John River to be ten to fifty years and the Aroostook River to be twenty-five to fifty years.

**Table 8. St. John River Basin, USGS Streamgage Peaks, May 1974**

<b>Station</b>	<b>Name</b>	<b>Stage</b>	<b>Discharge (cfs)</b>	<b>Estimated Recurrence Interval (years)</b>
01010000	St. John River at Ninemile Bridge, Maine	12.63	44,400	25-50
01010500	St. John River at Dickey, Maine	18.67	87,200	10-25
01011000	Allagash River near Allagash, Maine	11.71	26,400	10-25
01013500	Fish River near Fort Kent, Maine	10.04	11,000	5-10
01014700	St. John River below Fish R, at Fort Kent, Maine	9.91	281	10-25
01015700	St. John River near Hamlin, Maine	6.75	168	5-10
01015800	Aroostook River near Masardis, Maine	15.56	17,200	2-5
01016500	Machias River near Ashland, Maine	7.62	8,560	2-5
01017000	Aroostook River at Washburn, Maine	13.58	42,500	25-50
01018000	Meduxnekeag River near Houlton, Maine	7.89	4,330	2-5

### 2.5.3 April 1976

The USGS historical record of discharge and stages, the CRREL ice jam database, and the ACOE investigation of the St. John River document a flood event occurring in April 1976. Information on this flood event is not comprehensive. The ACOE report indicates that extensive ice jams occurred on the mainstem Aroostook River from Masardis to Fort Fairfield (ACOE, 1987). Table 9 presents the observed stage, discharge, and recurrence interval (where available) for the May 1974 flood. The USGS estimated the return period of the flows on the Aroostook River to be five to twenty-five years and the St. John River to be two to ten years.

**Table 9. St. John River Basin, USGS Streamgauge Peaks, April 1976.**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01010000	St. John River at Ninemile Bridge, Maine		32,000	5-10
01010500	St. John River at Dickey, Maine	16.01	63,300	2-5
01011000	Allagash River near Allagash, Maine		18,000	5-10
01013500	Fish River near Fort Kent, Maine	8.92	8,740	2-5
01015800	Aroostook River near Masardis, Maine	16.81	20,500	10-25
01016500	Machias River near Ashland, Maine		10,000	5-10
01017000	Aroostook River at Washburn, Maine	11.84	32,200	5-10
01017900	Marley Brook near Ludlow, Maine	7.1	138	2-5
01018000	Meduxnekeag River near Houlton, Maine	9.98	6,640	10-25

#### 2.5.4 April 1979

In April of 1979, the St. John River basin received 1.5 inches of rainfall over 3 days accompanied by warming temperatures and melting snowpack. The runoff resulted in record flows between Dickey, Maine and Grand Falls, New Brunswick. Fort Kent sustained severe damages. Table 10 presents the observed stage, discharge, and recurrence interval (where available) for the May 1974 flood. The USGS estimated the return period of the flows on the Aroostook River to be five to twenty-five years and the St. John River to be five to fifty years.

**Table 10. St. John River Basin, USGS Streamgage Peaks, April 1979**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
	Grand Falls, New Brunswick <sup>a</sup>		226,000	
01010000	St. John River at Ninemile Bridge, Maine	11.05	34,700	5-10
01010500	St. John River at Dickey, Maine	19.13	91,700	25-50
01011000	Allagash River near Allagash, Maine	-	28,400	10-25
01013500	Fish River near Fort Kent, Maine	11.11	13,100	10-25
01015800	Aroostook River near Masardis, Maine	16.76	20,400	5-10
01016500	Machias River near Ashland, Maine	8.6	8,500	2-5
01017000	Aroostook River at Washburn, Maine	13.17	37,700	10-25
01017900	Marley Brook near Ludlow, Maine	7.14	141	2-5

a. ACOE, 1987.

### 2.5.5 April 1983

In April of 1983, the St. John River basin received approximately two inches of precipitation over two days accompanied by warm temperatures and melting snowpack. Table 11 presents the observed stage, discharge, and recurrence interval (where available) for the May 1974 flood. The USGS estimated the return period of the flows on the Allagash River to be one hundred to five hundred years and the St. John and Aroostook Rivers five to fifty years.

**Table 11. St. John River Basin, USGS Streamgage Peaks, April 1983**

Station	Name	Stage	Discharge (cfs)	Recurrence Interval (year)
01010000	St. John River at Ninemile Bridge, Maine	10.64	32,300	5-10
01010500	St. John River at Dickey, Maine	18.52	85,600	10-25
01011000	Allagash River near Allagash, Maine	13.68	36,900	100-500
01012520	Bald Mountain Brook near Bald Mt.	7.57	198	-
01013500	Fish River near Fort Kent, Maine	11.75	14,000	25-50
01015800	Aroostook River near Masardis, Maine	17.7	23,100	10-25
01016500	Machias River near Ashland, Maine	9.14	7,950	2-5
01017000	Aroostook River at Washburn, Maine	13.73	43,400	25-50
01019000	Grand Lake Stream at Grand Lake Stream, Maine	6.69	2,870	50-100

## 2.5.6 March/April 1987

In April 1987, runoff caused by a high volume rainfall following several days of warm temperatures and melting snowpack causing a new flood of record for many rivers in Maine. This event was caused by a coastal storm and resulted in only minor flooding the St. John River Basin. Table 12 presents the observed stage, discharge, and recurrence interval (where available) for the May 1974 flood. The USGS estimated the return period of the flows on the St. John River to be five to twenty-five years.

**Table 12. St. John River Basin, USGS Streamgage Peaks, April 1987**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01010000	St. John River at Ninemile Bridge, Maine	10.86	33,600	5-10
01010070	Big Black River near Depot Mtn, Maine	15.62	8,680	10-25
01010500	St. John River at Dickey, Maine	18.01	80,400	10-25
01011000	Allagash River near Allagash, Maine	10.66	21,200	5-10
01013500	Fish River near Fort Kent, Maine	8.67	8,390	2-5
01015800	Aroostook River near Masardis, Maine	16.28	19,100	5-10
01017000	Aroostook River at Washburn, Maine	12.14	34,000	5-10

## 2.5.7 April 1991

In April of 1991, rainfall, snowmelt, and ice jams combined to result in flooding along the St. John, Little Black, Allagash, and Aroostook Rivers. The runoff and backwater resulting from this combination of events resulted in severe damages to Allagash, Fort Fairfield, Grand Isle, Caribou, and the Crouseville area of Washburn. Table 13 presents the observed stage, discharge, and recurrence interval (where available) for the April 1991 flood. The USGS estimated the return period of the flows on the St. John River and tributaries to be two to five years and the Aroostook River to be five to ten years.

**Table 13. St. John River Basin, USGS Streamgage Peaks, April 1991**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01010000	St. John River at Ninemile Bridge, Maine	23	28,400	2-5
01010070	Big Black River near Depot Mtn, Maine		3,640	<2
01010500	St. John River at Dickey, Maine		56,200	2-5
01011000	Allagash River near Allagash, Maine	9.62	17,000	2-5
01017000	Aroostook River at Washburn, Maine		31,100	5-10



**Figure 3. Ice Jams and Flooding Along the Allagash River at Dickey, Maine, April 11, 1991**

### 2.5.8 April 1993

An interagency hazard mitigation team report describing flooding during the spring of 1993 indicates that flood warnings were issued on the Aroostook River in response to a moderate precipitation event falling on a snowpack with high water content. Information on this flood event is not comprehensive. Table 14 presents the observed stage, discharge, and recurrence interval (where available) for the April 1993 event. The USGS estimated the return period of the flows on the St. John River and tributaries to be two to five years.

**Table 14. St. John River Basin, USGS Streamgage Peaks, April 1993**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01010000	St. John River at Ninemile Bridge, Maine	8.98	23,500	<2
01010070	Big Black River near Depot Mtn, Maine		4,350	2
01010500	St. John River at Dickey, Maine	15.38	57,100	2-5
01011000	Allagash River near Allagash, Maine	9.85	17,800	2-5
01013500	Fish River near Fort Kent, Maine	8.15	7,480	<2
01015800	Aroostook River near Masardis, Maine	15.6	17,300	2-5
01017000	Aroostook River at Washburn, Maine	11.37	30,200	2-5

### 2.5.9 April 1994

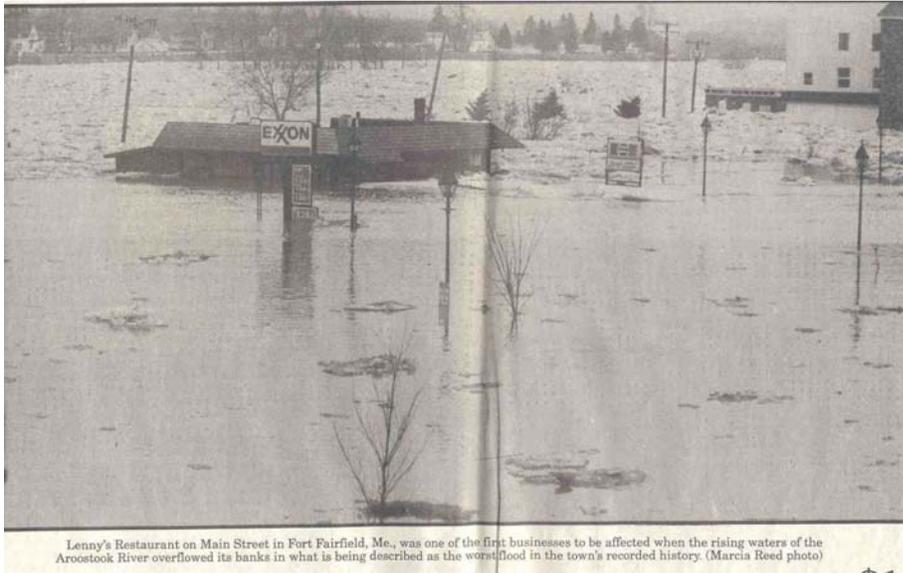
The CRREL ice jam database and an interagency hazard mitigation team report describe flooding occurring along the Aroostook River at Fort Fairfield during April of 1994. Photos presented in Figure 4, Figure 5, and Figure 6 illustrate the flooding. The Aroostook River basin received approximately one-half inch of rain accompanied by warm weather and melting snowpack. Rising waters caused a break-up ice jam that resulted in flooding at Fort Fairfield. Table 15 presents the observed stage, discharge, and recurrence interval (where available) for the April 1994 flood. The USGS estimated the return period of the flows on the St. John River and tributaries to be five to ten years.

**Table 15. St. John River Basin, USGS Streamgage Peaks, April 1994**

Station	Name	Stage	Discharge (cfs)	Estimated Recurrence Interval (years)
01010000	St. John River at Ninemile Bridge, Maine	11.42	38,700	10-25
01010070	Big Black River near Depot Mtn, Maine		6,160	5-10
01010500	St. John River at Dickey, Maine	16.71	69,700	5-10
01011000	Allagash River near Allagash, Maine	10.14	18,900	2-5
01015800	Aroostook River near Masardis, Maine	16.2	18,900	5-10
01017000	Aroostook River at Washburn, Maine	12.29	35,100	5-10



**Figure 4. Aroostook River, Main Street Fort Fairfield, April 1994**



**Figure 5. Aroostook River, April 1994**



Helen Underwood dwelling taken from the opposite side of the river during the flood event on April 16, 1994. Photo provided by the Fort Fairfield Code Officer.

**Figure 6. Aroostook River, April 1994**

### **2.5.10 December 1994**

The CRREL ice jam database and the photo record indicate that ice jams and flooding occurred along the St. John River at Dickey and Big Rapids, Maine during December 1994. Figure 7 and Figure 8 illustrate the ice coverage on the St. John River during this event.



**Figure 7. St. John River, Big Rapids Shearwall, December 29, 1994**



**Figure 8. Ice Jam on the St. John River, Route 161 at Dickey, December 29, 2004**