Hydrology

International Souris River Board

of the International Joint Commission

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Hydrologists study how water is distributed in, on and over the earth. For the International Souris River Board, the important features are the flows in the rivers, the levels in the reservoirs, and the effect of rainfall and snowmelt on both. Hydrologists compare present and forecast conditions with similar situations in the past. This helps in making informed decisions to control flows and to advise the public.

In a semi-arid zone

The Souris River flows through a semi-arid zone of continental climate. On average, annual precipitation across the area is low (250-500 mm. or 10-20 in.) with the higher amounts occurring in the east. Cold winters lock up snowfall until the spring melt, which provides most of the stream flow. The flat landscape leaves much of the water sitting in sloughs and ponds. Hot, dry summers quickly evaporate this water as well as that within reservoirs, plants, and soil. The annual potential evaporation rate is triple the average precipitation. With these conditions, not much water makes its way into the Souris River.

Low runnoff

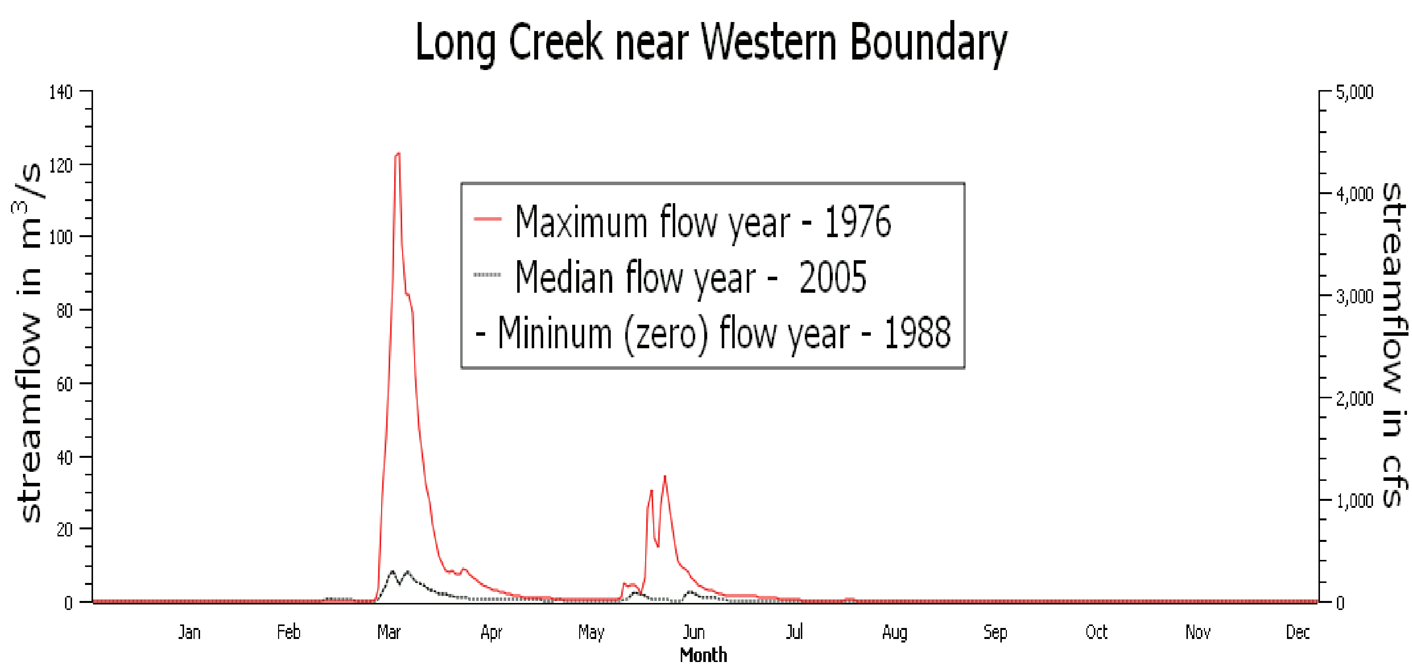
The flow of a river can be expressed as runoff, which is the depth equivalent over the drainage area. This allows comparisons to be made to rivers of different sizes and to the precipitation and evaporation. The runoff from the Souris basin is less than 1% of the precipitation it receives. Notably the Bow and Ohio Rivers that receive only twice the precipitation have over 100 times the runoff of the Souris River.

Average annual runoff

River	Location	mm	in.
Bow River	Calgary, AB	354	13.9
Souris River	Wawanesa, MB	3	0.1
Ohio River	Metropolis, IL	472	18.6

Highly variable flows

The low runoff makes the Souris River and its tributaries very sensitive to precipitation and runoff conditions. The hydrograph below shows the flows in Long Creek during three years. It illustrates the extreme variability from day to day and from year to year. 1976 was the year that had the most flow (as of 2009) since records began in1959. The flow can change from a trickle to a torrent in a few days. The flow in 1976 was ten times the median flow which occured in 2005. Half the years had more flow than 2005 – half had less flow than in 2005. In all of 1988 no water flowed in Long Creek across the western boundary.



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Hydrologic factors

The main hydrologic inputs affecting the natural streamflow are snowmelt and rainfall. Groundwater does not play a major role in the Souris' flow. As snow accumulates during the winter, sun and wind will dissipate some of it into the air through a process called sublimation. As sun and warm air cause the snow to melt, the snow soaks up the first of the melt. When precipitation, either as melted snow or rainfall, reaches the ground surface it may seep into sand, soak into dry loam, puddle on wet ground, or run off of ice-covered surfaces. Understanding these different infiltration rates and antecedent moisture conditions helps hydrologists determine how much of the rainwater and snowmelt could become streamflow. The rainfall and snow are measured at scattered sites throughout the Souris River basin. Hydrologists estimate the total precipitation over the watershed by monitoring, recording, and generalizing data from the gauges, and by using radar and satellite images.

Surface runoff gathers in low spots. It begins to flow across fields and down ditches into creeks. Eventually it flows into the Souris River. The exceptions are non-contributing areas such as sloughs and the land sloping into them. These do not have a stream draining them. Approximately 2/3 of the Souris basin is non-contributing. However, in extremely wet conditions, a non-contributing area could fill up to the lowest spot in its rim and then contribute flow. The speed of the flow down creeks and rivers relates mainly to the slope of the streambed. The Souris basin is quite flat. With a shallow river valley slope (0.3 m/km or 1.7 feet per mile) the travel time for flows is very slow, taking many days for floods to move the length of the river.

Flows and levels

The following table shows minimum, average, and maximum flow values for the main monitoring points of the ISRB. The locations of these and other flow and level monitoring stations are shown on a Map fact sheet.

Station Name	ID	Minimum*		Average*		Maximum*	
		m^3/s	cfs	m^3/s	cfs	m^3/s	cfs
Souris River Near Sherwood, ND	05114000	0.0	0.0	3.44	122	388	13700
Souris River Near Westhope	05NF012	-0.99 [t]	-35.0 [t]	7.64	270	351	12400
Long Creek At Western Crossing	05NA003	0.0	0.0	0.851	30.1	123	4340
		meters	feet	meters	feet	meters	feet
Rafferty Reservoir Near Estevan	05NB032	535.41	1756.58	545.961	1791.21	551.06	1807.94
Alameda Reservoir Near Alameda	05ND012	537.75	1764.27	554.951	1820.71	562.47	1845.38
Lake Darling Near Foxholm, ND	05115500	482.88	1584.24	485.973	1594.40	486.98	1597.69

* Of all of the daily averages for the period of available data to 2009

[t] water flowing upstream from downstream flooding.

cfs	Cubic feet per second
m^3/s	Cubic meters per second

Conversion factors

1 m^3/s = 35.31 cfs	1 cfs = 0.646 million gallons per day	1 cfs for a day = 1.9835 acre feet
1 foot = 0.3048 meter	1 m3/s = 86.4 million liters per day	1 m^3/s for a day = 86.4 cubic decameters (dam^3)
1 inch = 25.4 mm	1 hectare = 2.471 acres	1 acre foot = 1.233 cubic decameters

The **International Souris River Board** is a board of the **International Joint Commission**
of the **Boundary Waters Treaty**

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