FISHER RIVER INTEGRATED WATERSHED MANAGEMENT PLAN
STATE OF THE WATERSHED REPORT CONTRIBUTION

SURFACE WATER HYDROLOGY REPORT

Disclaimer: The hydrologic conditions presented in this report are estimates to indicate the health of the watersheds as of 2013. They should not be used for licensing or design purposes. The trends are based on historical records and are subject to change as more hydrological information becomes available. Factors such as climate change or land use changes could impact the values in the future. Utilization of this information on a specific case by case basis requires detailed analysis by trained professionals and is intended for demonstration purposes only.

Planning Area Boundary:

The Fisher River planning area (FRPA) is south of the north basin of Lake Manitoba in the Interlake Region. The area extends from south of Otter Lake to West Doghead Point and from east of Ashern to the shore of Lake Winnipeg. THE FRPA covers an area of 3151.6 km^2. The Fisher River planning area is shown in Figure 1.

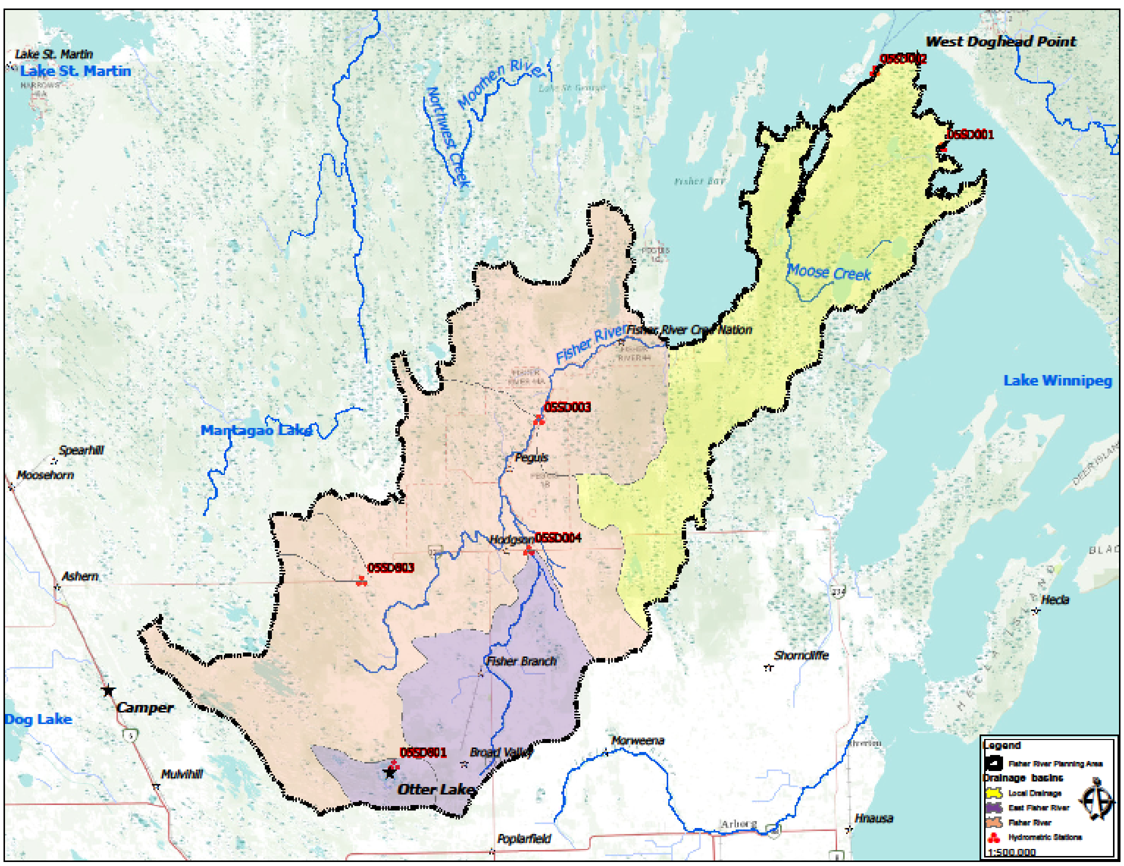

Figure 1: Fisher River Planning Area and Hydrometric Station Locations

The planning area is made up of a number of individual watersheds. By definition, a watershed is the land area that contributes surface water runoff to a common point. It is separated from adjacent watersheds by a land ridge or divide. Watersheds can vary in size from a few acres to thousands of square kilometres. A larger watershed can contain many smaller sub-watersheds. On a larger scale, a basin is defined as a collection of watersheds that feed into a common main tributary or large body of water (e.g. the Red River Basin). A sub basin is a division of a basin and will be made up of multiple watersheds.

Watershed and basin boundaries form a prime ecological unit for:

- Information and knowledge management and analysis, and
- Water and land use planning and management.

Watershed and basin boundaries are defined through the application of the best available science and modified with documented and verifiable local input. Agriculture and Agri-Food Canada through the efforts of the Prairie Farm Rehabilitation Administration (AAFC-PFRA) and Manitoba Conservation and Water Stewardship have delineated a system of watershed and basin boundaries for Manitoba. These boundaries have been designed to extend to the mouths of some rivers and streams and along large bodies of water. The FRPA boundaries were established using this system of watersheds.

Climate:

The FRPA is considered to be within the Boreal Plain ecozone and stretches across to two ecoregions and three ecodistricts. Ecozones consist of a distinctive assemblage of physical and biological characteristics and possess environmental characteristics that tend to cohere and endure over the long term. Ecoregions form part of an ecozone and are characterized by a unique combination of landscape physiography and ecoclimate. Ecoregion boundaries are guided by distinctive features of both climate and physiography. Ecodistricts are subdivisions of an ecoregion and are characterized by relatively homogenous physical landscape and climatic conditions[1].

[1] Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, page 11.

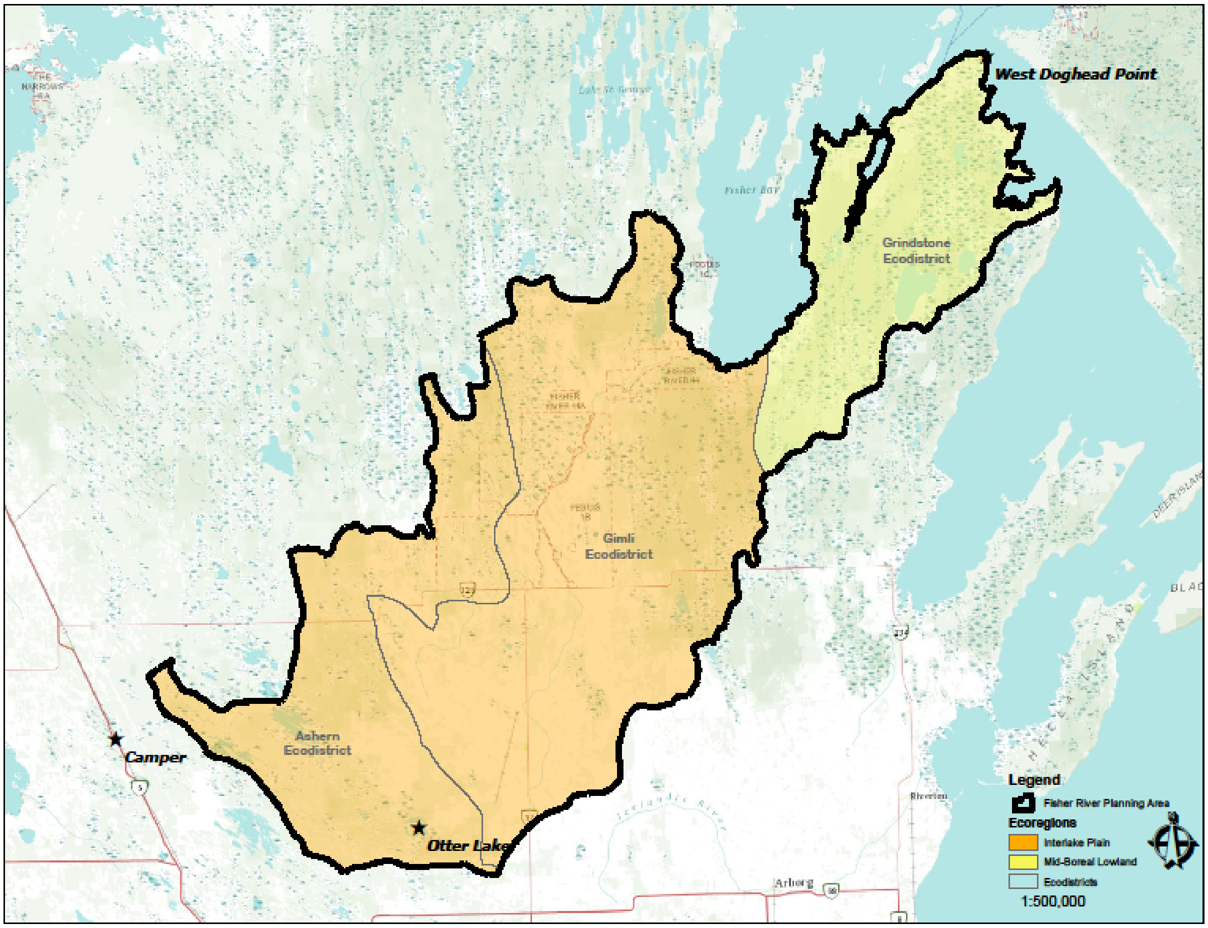

Figure 2: Fisher River Planning Area - Ecoregions and Ecodistricts

Mid-Boreal Lowland Ecoregion

This ecoregion is classified as having a subhumid mid-boreal ecoclimate. This ecogion's surface is generally level with a distinct, north to south trending drumlinoid or ridged topographic pattern with slopes ranging from 1 to 5 percent[2].

Grindstone Ecodistrict

This ecodistrict is characterized by short, warm summers and long, cold winters. Climate is moderated by proximity to Lake Winnipeg. The mean annual temperature is 0.9°C. The mean annual precipitation is approximately 580mm, of which one quarter falls as snow. Precipitation varies greatly from year to year and is highest from late spring through summer[3].

Interlake Plain Ecoregion

[2] Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, page 149.
[3] Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, page 176.

This ecoregion is classified as having a subhmid low boreal ecoclimate. This ecoregion's general surface form is that of a level to ridged lake terrace complex. Much of the Interlake/Westlake section has a distinct, low relief, north to south trending drumlinoid or ridge and swale topographic pattern with slopes ranging from 1 to 3 percent[4].

Ashern Ecodistrict

This ecodistrict is characterized by short, warm summers and cold winters. The mean annual temperature is 1.2°C. The mean annual precipitation is approximately 510mm, of which nearly one quarter falls as snow. Precipitation varies greatly from year to year and is highest from spring through early summer[5].

Gimli Ecodistrict

This ecodistrict is characterized by short, warm summers and cold winters. The mean annual temperature is 1.4°C. The mean annual precipitation is approximately 520mm, of which about one quarter falls as snow. Precipitation varies greatly from year to year and is highest from late spring through summer[6].

Water Courses:

The FRPA has two main watercourses; the Fisher River (81.6 km in length) and the East Fisher River (42.6 km in length). Numerous drains act as tributaries and empty into these two watercourses. The area has a moderate north-south trending ridge and swale topographic pattern.

The Fisher River watershed has a gross drainage area of approximately 918.9 km^2 and drains in a north-easterly direction from its head waters near Sleeve Lake, southeast of Ashern, Manitoba to its outlet into Fisher Bay of Lake Manitoba.

The East Fisher River watershed has a gross drainage area of approximately 465.0 km^2 and drains in northerly direction from its headwaters near Broad Valley to its outlet into Fisher River.

Drainage of the remainder of the FRPA is accommodated by local drains which do not empty into either one of the two main watercourses and has a gross drainage area of approximately 1767.7 km^2.

Hydrometric Data:

[4] Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, page 191.
[5] Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, page 198.
[6] Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, page 200.

The collection of hydrometric data is critical to the understanding of the availability, variability and distribution of water resources and provides the basis for responsible decision making on the management of this resource. Historic hydrometric data provides the basis for understanding the potential extent and limitation of the resource.

Water level and stream flow data collected under the Canada-Manitoba Hydrometric Agreement supports activities such as policy development, operation of water control works, flow forecasting, water rights licensing, water management investigations, hydrologic studies, water quality modeling, ecosystem protection and scientific studies.

Stream flow and lake level data has been recorder at six locations within the FRPA for varying time periods since the late 1950's. The locations of the six stations are shown in Figure 1. Table 1 provides information related to these six stations.

Table 1: FRPA Hydrometric Gauging Station Data

Station Number	Station Name	Years of Operation	Operational Schedule	Type of Data	Gross Drainage Area in km^2	Real Time Data Available
05SD001	Lake Winnipeg at Pine Dock	1958-1959	Continuous	Level	1,020,000	Yes
		1960-2013	Continuous	Level		
05SD002	Lake Winnipeg at Matheson Island Landing	1957-1959	Seasonal	Level	1,020,000	Yes
		1960-1978	Continuous	Level		
		1979-1996	Seasonal	Level		
		1997-2013	Continuous	Level		
05SD003	Fisher River near Dallas	1961-1972	Continuous	Flow	1,720	Yes
		1973-1996	Continuous	Flow		
		1997-2001	Seasonal	Flow		
		2002-2013	Continuous	Flow & Level		
05SD004	East Fisher River near Hodgson	1961-1979	Seasonal	Flow	390	Yes
		1980-1997	Seasonal	Flow		
		2012-2013	Seasonal	Flow & Level		
05SD801	Otter Lake near Broad Valley	1983-2013	Seasonal	Level	72.6	No
05SD803	Switzer Creek near Hodgson	1999-2011	Seasonal	Level	985	No

Archived hydrometric data can be found at:

http://www.wsc.ec.gc.ca/applications/H2O/index-eng.cfm

Real time hydrometric data can be found at:

http://www.wateroffice.ec.gc.ca/index_e.html

Streamflow Characteristics:

The collection of hydrometric data is critical to the understanding of the availability, variability and distribution of water resources and provides the basis for responsible decision making on the management of this resource. Historic hydrometric data provides the basis for understanding the potential extent and limitation of the resource.

The gross drainage area boundary is defined as the area at a specific location, enclosed by its drainage divide, which might be expected to entirely contribute runoff to that specific location under extremely wet conditions. The effective drainage area is that portion of a drainage area which might be expected to entirely contribute runoff to the main stem during a median (1:2 year event) runoff year under natural conditions. This area excludes marsh and slough areas and other natural storage areas which would prevent runoff from reaching the main stem in a year of average runoff. The effective to gross drainage area ratio is an indication of how well an area is drained. A perfectly drained area has a ratio of one.

The daily discharges for Fisher River gauging station (05SD003) and East Fisher River gauging station (05SD004) were statistically analyzed to determine runoff characteristics of the FRPA. The results of the analysis are presented as follows:

A. *Fisher River*

The gross drainage area of station 05SD003 is 1706 km^2. The station has an effective to gross drainage area ratio equal to 0.63 (PFRA drainage area database).

The mean monthly discharge data for the Fisher River is shown in Table 2. Based on available data, the average runoff during the period 1962 to 1996 is equal to 57,421 dam^3 or an equivalent depth of 33.4 mm over the gross drainage area for station 05SD003. The annual runoff depths for the Fisher River from 1961 to 2011 are shown in Figure 3. The values range from a minimum of 4.2 mm in 2003 to a maximum of 148.9 mm in 2011. This figure also illustrates the variability in runoff from year to year, as well as the years above and below the average runoff.

Table 2: Fisher River near Dallas (05SD003)

	Monthly Mean Discharge (m^3/s)												Annual Volume
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	dam^3
1961				1.58	0.92	0.39	0.22	0.16	0.19	0.26	0.24	0.13	10,745
1962	0.06	0.06	0.06	3.88	0.79	0.76	0.35	0.39	0.36	0.42	0.37	0.26	20,287
1963	0.07	0.02	0.38	17.90	4.10	18.90	3.06	1.31	0.89	0.50	0.42	0.29	124,823
1964	0.24	0.21	0.23	4.00	4.15	1.02	0.77	0.71	0.62	0.65	0.56	0.35	35,613
1965	0.28	0.16	0.16	8.10	1.85	2.38	1.02	0.50	0.49	0.48	0.44	0.39	42,467
1966	0.32	0.28	0.31	7.59	5.57	1.06	0.51	0.31	0.24	0.28	0.25	0.24	44,525
1967	0.22	0.19	0.24	9.18	2.50	0.80	0.49	0.39	0.23	0.36	0.32	0.27	39,724
1968	0.16	0.18	0.64	4.07	1.84	1.80	0.97	0.60	0.89	0.66	0.54	0.31	33,232
1969	0.26	0.30	0.30	8.17	1.10	1.30	0.63	4.61	1.48	2.39	1.01	0.47	57,849
1970	0.36	0.32	0.29	12.30	7.98	1.93	0.75	0.33	0.35	0.33	0.32	0.22	66,844
1971	0.15	0.09	0.17	5.93	0.84	0.46	0.34	0.23	0.24	0.29	0.26	0.22	24,079
1972	0.14	0.10	0.14	11.20	1.73	0.55	0.34	0.30	0.22	0.24	0.19	0.11	39,780
1973	0.06	0.07	1.03	0.52	0.35	3.14	0.41	0.29	0.53	1.72	0.71	0.43	24,335
1974	0.31	0.37	0.37	32.10	28.10	6.32	0.89	0.39	0.39	0.37	0.36	0.27	184,653
1975	0.20	0.19	0.23	5.59	1.11	0.78	0.55	14.10	16.10	6.35	2.34	0.89	127,510
1976	0.65	0.54	0.48	46.80	6.01	1.27	0.59	0.34	0.24	0.25	0.24	0.11	149,741
1977	0.08	0.08	0.24	0.72	0.55	0.66	0.78	0.28	0.50	0.60	0.47	0.32	13,882
1978	0.24	0.21	0.26	12.50	1.87	1.48	0.94	0.43	0.46	0.35	0.35	0.30	50,634
1979	0.20	0.19	0.23	28.90	19.10	4.46	0.82	0.49	0.42	0.42	0.39	0.27	146,679
1980	0.21	0.25	0.22	5.12	0.49	0.25	0.25	0.91	1.13	0.94	0.77	0.50	28,882
1981	0.38	0.47	1.94	1.75	1.09	2.23	0.55	0.77	1.24	2.92	3.86	0.71	47,090
1982	0.40	0.31	0.60	16.70	3.68	1.68	1.52	0.70	0.48	0.82	0.82	0.58	73,975
1983	0.28	0.24	0.27	12.70	1.27	2.97	0.78	0.34	0.24	0.32	0.32	0.16	51,802
1984	0.09	0.12	0.37	1.90	0.81	12.20	1.57	0.25	0.21	0.39	0.51	0.52	49,453
1985	0.45	0.34	2.11	8.29	1.04	1.14	0.58	3.41	1.65	2.88	1.72	0.50	63,379
1986	0.34	0.25	2.37	30.60	16.90	1.25	0.71	0.34	0.31	0.32	0.25	0.22	141,417
1987	0.18	0.16	0.32	9.66	0.69	0.38	0.37	0.36	0.23	0.35	0.34	0.28	34,660
1988	0.10	0.10	0.19	3.64	3.41	0.43	0.23	0.16	0.18	0.15	0.18	0.11	23,339
1989	0.10	0.07	0.07	0.76	0.24	1.13	0.30	0.15	0.14	0.15	0.23	0.09	8,948
1990	0.07	0.09	0.42	6.81	1.28	0.94	0.53	0.22	0.15	0.17	0.21	0.14	28,845
1991	0.06	0.07	0.24	1.83	1.38	0.34	0.24	0.10	0.19	0.25	0.23	0.18	13,401
1992	0.16	0.20	0.35	13.80	3.41	0.57	0.70	0.34	0.66	0.41	0.40	0.26	55,539
1993	0.17	0.16	1.38	2.35	2.66	4.96	1.40	0.71	1.38	1.03	0.66	0.28	45,068
1994	0.16	0.11	0.45	1.62	0.83	0.40	0.95	0.21	0.22	0.26	0.28	0.21	14,977
1995	0.22	0.18	7.13	3.01	1.25	0.53	0.24	0.35	0.15	0.24	0.27	0.18	36,408
1996	0.18	0.13	0.17	11.70	6.84	2.99	1.36	0.53	0.32	0.36	0.33	0.21	65,904
1997			0.19	11.00	2.64								36,089
1998			0.72	28.60	3.71								85,983
1999			1.79	3.29	3.26								22,054
2000			14.20	8.14	3.45								68,373
2001			0.57	35.70	21.30								151,108
2002			0.18	3.68	0.75								12,029
2003			1.46	0.97	0.28								7,156
2004													
2005			0.26	20.90	7.98								76,235
2006			0.43	17.70	8.64								70,163
2007			4.54	6.88	8.27								52,143
2008			0.33	12.50	2.90								41,038
2009			0.65	36.80	14.90								137,027
2010			2.93	3.99	4.94	13.80	29.70	5.99	12.50	16.80			240,180
2011			1.18	42.90	27.70	20.70	3.22	0.90	0.55	0.53			256,070
Mean	0.22	0.19	1.10	11.73	4.97	3.11	1.57	1.13	1.23	1.22	0.59	0.31	65,523
Max	0.65	0.54	14.20	46.80	28.10	20.70	29.70	14.10	16.10	16.80	3.86	0.89	256,070
Min	0.06	0.02	0.06	0.52	0.24	0.25	0.22	0.10	0.14	0.15	0.18	0.09	7,156

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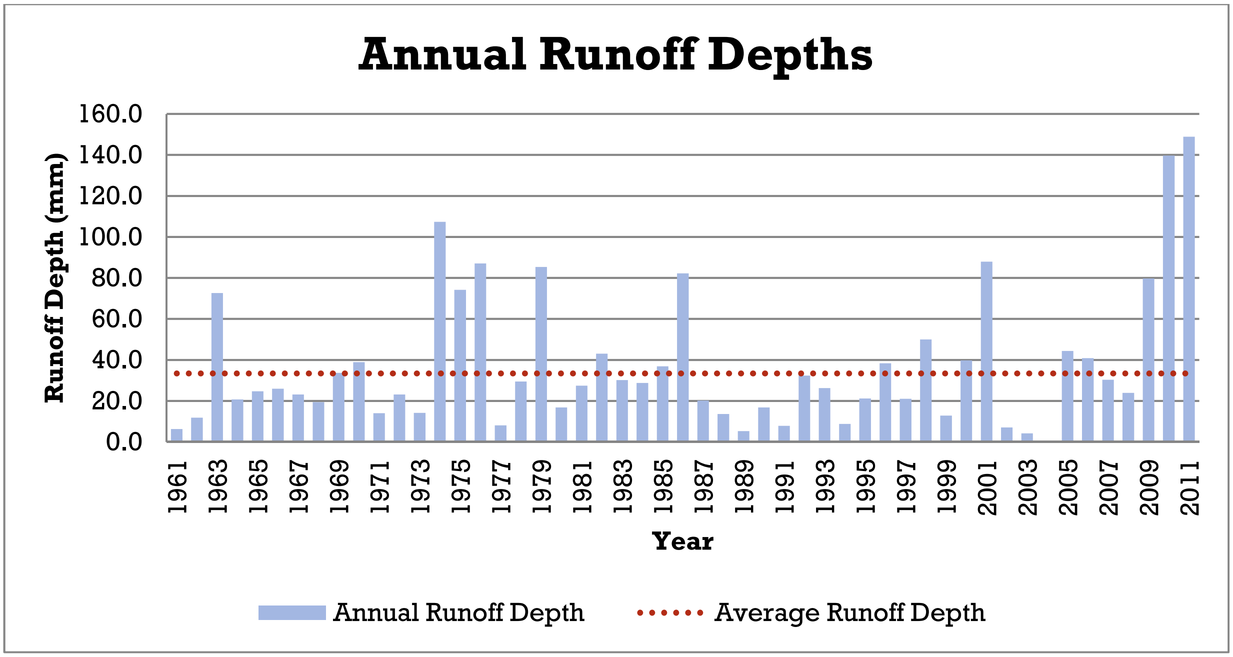

Figure 3: Equivalent Annual Runoff Depth for the Fisher River (05SD003)

The Bar graph in Figure 4 illustrates the distribution of annual runoff for the Fisher River. On average the majority of the runoff, 42%, occurs in April as a result of snowmelt and early spring rains. The maximum daily discharge of each year, as well as the date it occurred, was reviewed. In 37 of the 47 years of data, maximum daily discharge occurred during the spring runoff, in 9 out of 47 years the peak flow occurred during the summer growing period, and in 2010 the peak flow occurred in October.

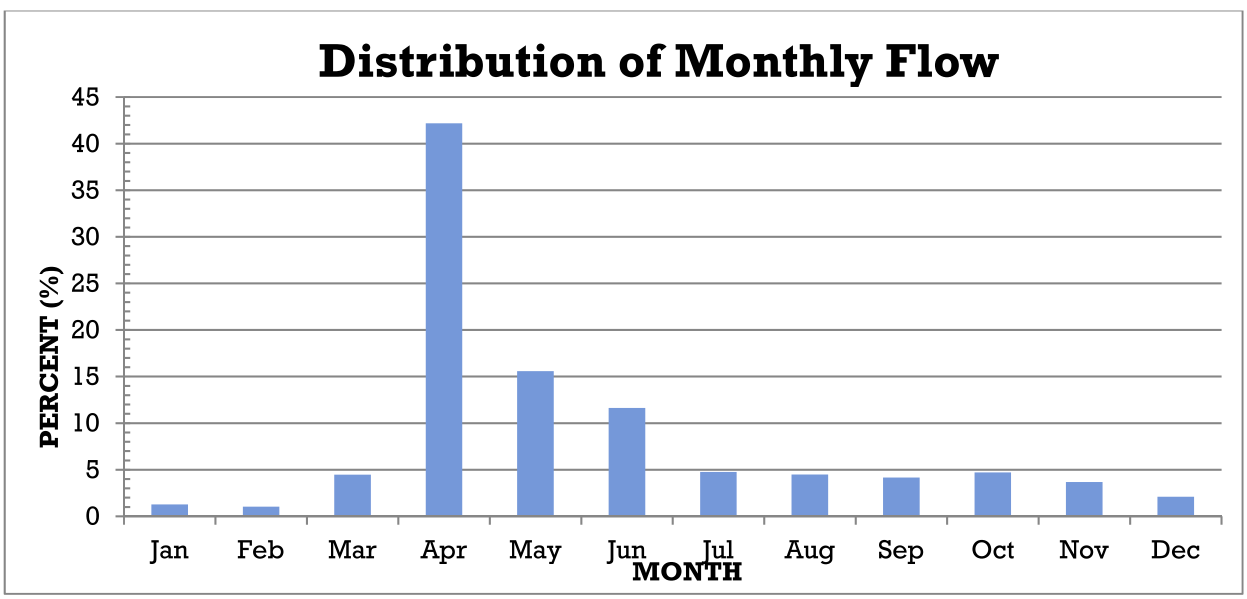

Figure 4: Distribution of Annual Runoff for the Fisher River (05SD003)

Table 3 lists the results of frequency analyses of flow data at the Fisher River at gauging station 05SD003 is shown in Table 3. The expected annual peak discharge, runoff volume and corresponding unit depth for selected frequencies is given.

Table 3: Frequency of Flood Flows for the Fisher River (05SD003)

Flood Frequency	Annual Peak Discharge (m^3/s)	Annual Runoff Volume (dam^3)	Unit Runoff (dam^3/km^2)
1%	133.3	199,372	115.9
2%	122.6	183,040	106.4
5%	105.3	156,635	91.1
10%	89.2	132,062	76.8
50%	37.8	53,610	31.2
80%	16.4	20,947	12.2
90%	9.7	10,721	6.2

Fisher River recorded flow hydrographs for years representative of the 2%, 5%, 10%, and 50% floods are plotted in Figure 5. The runoff hydrographs show minimal variability from the date the peak discharge occurs. In general, the initial peak occurs between April 1 and May 1.

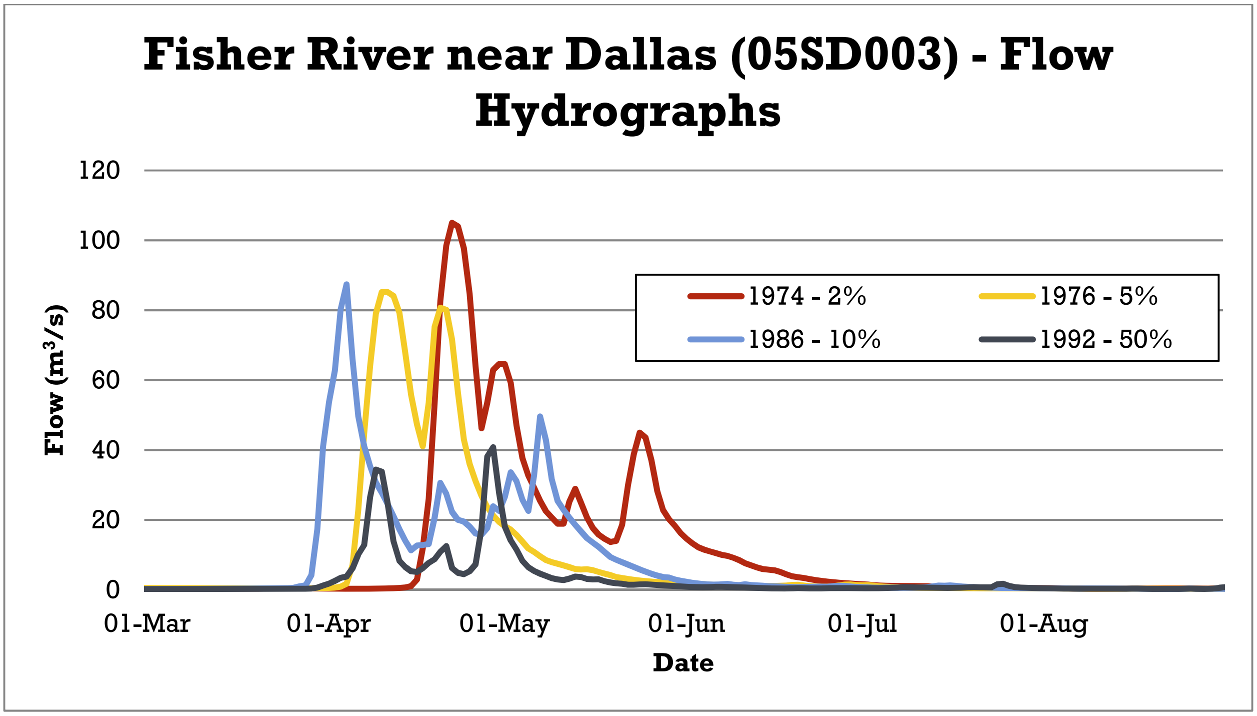

Figure 5: Fisher River near Dallas (05SD003) - Runoff Hydrographs

B. *East Fisher River*

The gross drainage area of station 05SD004 is 390 km^2. The station has an effective to gross drainage area ratio equal to one.

The mean monthly discharge data for the Fisher River is shown in Table 4. Based on available data, the average runoff during the period 1961 to 1997 is equal to 17,640 dam^3 or an equivalent depth of 45.2 mm over the gross drainage area for station 05SD004. The annual runoff depths for the Fisher River at gauging station 05SD004 from 1961 to 1997 are shown in Figure 6. The values range from a minimum of 8.7 mm in 1997 to a maximum of 167.4 mm in 1974. This figure also illustrates the variability in runoff from year to year, as well as the years above and below the average runoff.

Table 4: East Fisher River near Hodgson (05SD004)

	Monthly Mean Discharge (m^3/s)												Annual Volume dam^3
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1961			0.23	0.87	0.26	0.19	0.19	0.12	0.11	0.18			5,047
1962				1.86	0.38	0.35	0.24	0.21	0.12	0.28			9,020
1963			0.58	6.96	0.99	3.87	0.54	0.53	0.51	0.38			37,450
1964			0.17	1.92	1.02	0.54	0.45	0.42	0.32	0.43			13,878
1965			0.06	3.29	1.05	0.99	0.70	0.38	0.35	0.28			18,611
1966			0.15	2.13	1.38	0.38	0.36	0.21	0.18	0.21			13,159
1967			0.07	4.05	0.92	0.35	0.30	0.24	0.15	0.20			16,398
1968			0.50	1.71	0.76	0.57	0.59	0.36	0.52	0.28			13,932
1969			0.11	3.68	0.46	0.46	0.29	0.87	0.42	0.50			17,782
1970			0.13	4.36	1.22	0.51	0.39	0.25	0.19	0.18			18,968
1971			0.07	2.24	0.24	0.24	0.26	0.17	0.12	0.14			9,075
1972			0.09	4.69	0.55	0.24	0.23	0.22	0.16	0.14			16,482
1973			0.55	0.36	0.29	0.49							4,427
1974			0.21	14.66	9.07	0.91							65,301
1975			0.15	2.66	0.61	0.42							10,021
1976			0.23	17.88	0.77	0.44							50,213
1977			0.15	0.45	0.30	0.41							3,398
1978			0.05	6.77	0.63	0.48							20,624
1979			0.10	13.01	4.23	1.01							47,903
1980			0.09	2.83	0.31	0.21							8,983
1981			0.56	0.51	0.36	0.62							5,388
1982			0.18	3.81	0.57	0.48							13,134
1983			0.17	6.67	1.68	0.90							24,587
1984			0.23	0.80	0.34	4.44	0.92						15,119
1985			1.20	3.61	0.44	0.53	0.34						15,119
1986			1.70	8.01	3.90	0.60	0.49						37,306
1987			0.14	4.25	0.39	0.30							13,227
1988			0.10	1.70	0.59	0.30							7,037
1989			0.03	0.40	0.18	0.91							3,929
1990			0.35	3.35	0.57	0.53							12,505
1991			0.09	0.93	0.76	0.36							5,615
1992			0.26	8.58	1.53	0.60							28,597
1993			0.58	1.45	0.99	0.99							10,545
1994			0.22	0.95	0.30	0.15							4,244
1995			3.64	1.38	0.46	0.28							15,276
1996			0.05	5.98	2.68	0.93							25,220
1997			0.03	4.93	0.86								15,149
1998			0.38	15.01	1.95								45,140
1999			0.94	1.72	1.71								11,569
2000			7.43	4.27	1.81								35,841
2001			0.30	18.72	11.20								79,332
2002			0.09	1.93	0.39								6,317
2003			0.77	0.51	0.14								3,752
2004				19.37	1.54								54,340
2005			0.13	10.98	4.19								40,041
2006			0.22	9.30	4.53								36,846
2007			2.38	3.61	4.34								27,362
2008			0.17	6.54	1.52								21,468
2009			0.34	19.34	7.83								72,018
2010			1.54	2.10	2.59	7.23	15.60	3.15	6.59	8.83			77,000
2011			0.62	22.32	14.46	10.84	1.70	0.46					130,859
Mean			0.58	5.68	1.97	1.16	1.39	0.54	0.75	0.92			17,640
Max			7.43	22.32	14.46	10.84	15.60	3.15	6.59	8.83			130,859
Min			0.03	0.36	0.14	0.15	0.19	0.12	0.11	0.14			3,398

Note: For the years 1998 to 2011, the data was extended using correlation analysis with Station 05SD003: missing data left blank

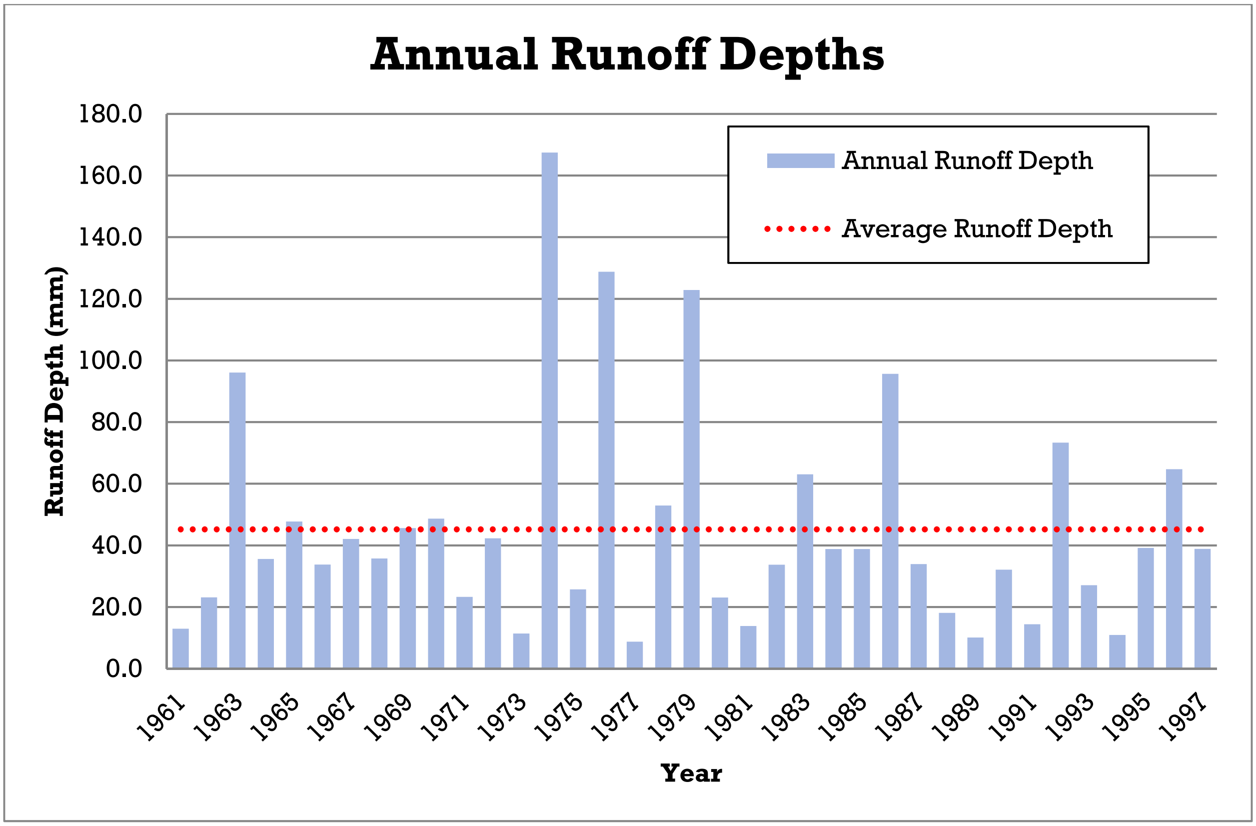

Figure 6: Equivalent Annual Runoff Depths for the East Fisher River (05SD004)

The Bar graph in Figure 7 depicts the distribution of annual runoff for the East Fisher River. On average the majority of the runoff, 55%, occurs in April as a result of snowmelt and early spring rains when the watershed is still saturated. The maximum daily discharge of each year, as well as the date it occurred, was reviewed. Between 1990 and 1995 the maximum daily discharge was 21.3 m^3/s which occurred April 27, 1992. From the available data, all peaks occurred between March 27 and May 11.

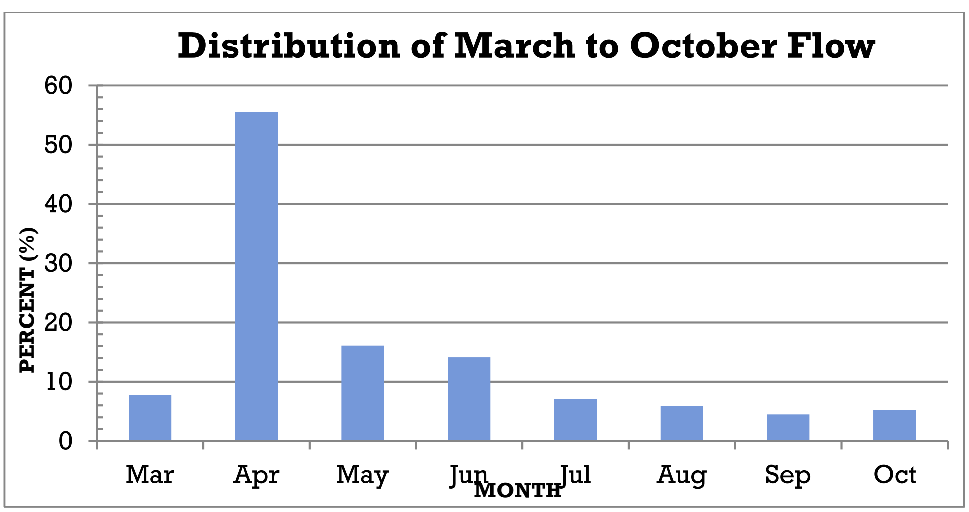

Figure 7: Distribution of Annual Runoff for East Fisher River (05SD004)

The result of a statistical analysis of the Fisher River is shown in Table 5. The expected annual peak discharge, runoff volume and corresponding unit depth for selected frequencies is given.

Table 5: Frequency of Flood Flows for the East Fisher River (05SD004)

Flood Frequency	Annual Peak Discharge (m^3/s)	Annual Runoff Volume (dam^3)	Unit Runoff (dam^3/km^2)
1%	78	60,788	155.9
2%	71	55,581	142.5
5%	59	46,654	119.6
10%	49	39,216	100.6
50%	19	16,899	43.3
80%	8	8,717	22.4
90%	5	6,485	16.6

East Fisher River recorded flow hydrographs for years representative of the 2%, 5%, 10%, and 50% floods are plotted in Figure 8. The runoff hydrographs show that the date of the peak flow occurred between March 29 and April 28.

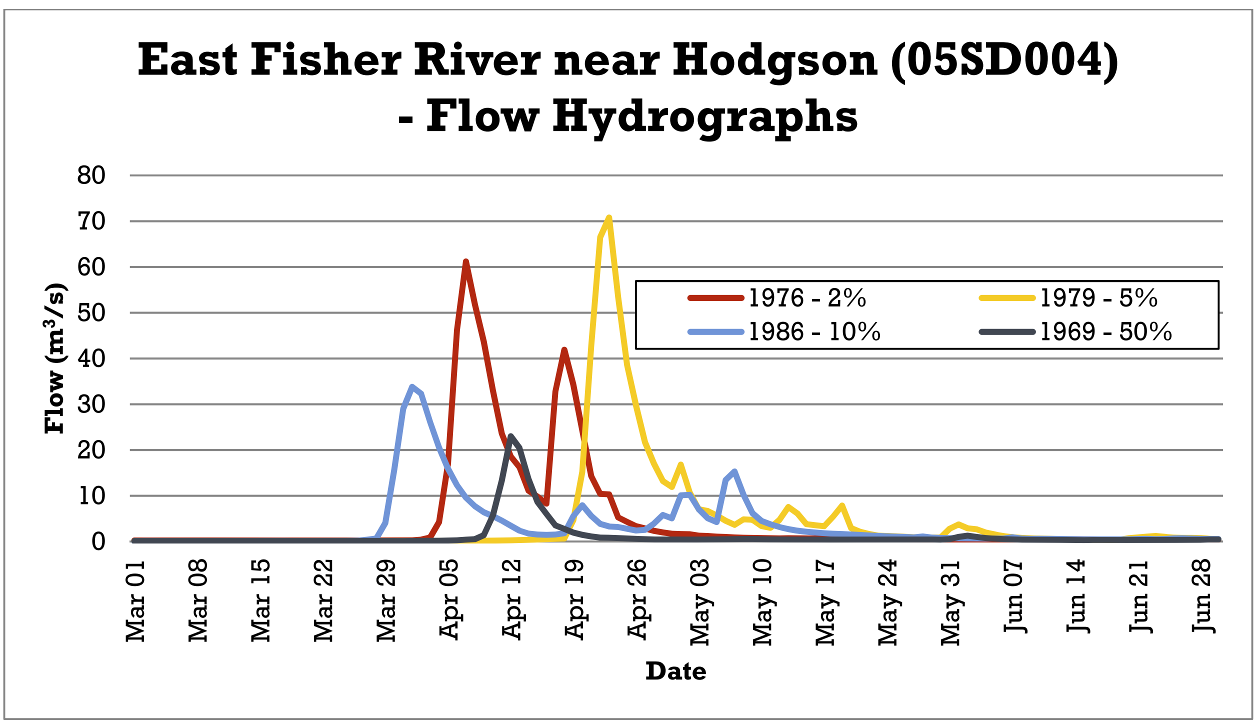

Figure 8: East Fisher River near Hodgson (05SD004) - Spring Runoff Hydrographs

C. *Summary of Findings*

Analysis of the available stream flow data in the FRPA indicates the following:

- Stream flow varies considerably over the months and years.
- Annual stream flow usually peaks between April and May.
- On average, between 75 and 80% of the annual runoff volume occurs between March and May of a given year.
- On major watercourses, spring flooding is more significant than flooding from summer precipitation events. Smaller drainage areas (< 30km^2) are more sensitive to rainfall events. Localized flooding can occur in the smaller poorly drained areas from excessive rainfall events.
- Although different in size, Fisher River and East Fisher River watersheds should exhibit similar general runoff characteristics.

Water Allocation:

The issuance of a water use licence requires the determination of the availability of water for human use allocation and the determination of instream flow needs (IFN). The IFN is a specified minimum instantaneous flow that determines when a user may pump from the stream. The allocation procedure depends on whether the stream is considered to be perennial or intermittent.

Intermittent:

The total spring volume (March to May) of water available for allocation on intermittent streams is based on the eight out of ten-year (80%) risk level based on daily discharge frequency. This would apply to smaller tributary streams.

On intermittent streams, one half of the spring volume of water is available for human use in eight out of ten years. The other half is allocated to IFN for maintenance of stream health and to maintain the ecological integrity of the stream system. Only when the flow in the stream is greater than the IFN can pumping occur.

Perennial:

The Tessman Method has been adopted in Manitoba for determination of the IFN on perennial streams. This method establishes a range of instream flow recommendations for each month based on the following criteria:

1. For months where the average recorded flow for the period of record is less than 40% of the overall mean annual flow, the minimum instream flow is equal to the average monthly flow.
2. If the mean monthly flow is between 40% and 100% of the overall mean annual flow then the minimum instream flow is equal to 40% of the mean annual flow.
3. For months where the mean monthly flow is greater than the mean annual flow, then the minimum instream flow is equal to 40% of that month's overall mean flow.

Under the 80% risk level, the volume of water available for human use allocation is the 80th percentile value from a duration curve of available volumes after the IFN requirements have been satisfied.

The Fisher River and East Fisher River are both considered to be perennial streams. The Tessman method was applied in determining an allocable volume of water at the two streams respective hydrometric stations, 05SD003 and 05SD004. The instream flow recommendations on a monthly basis for both streams are shown in Figures 9 and 10.

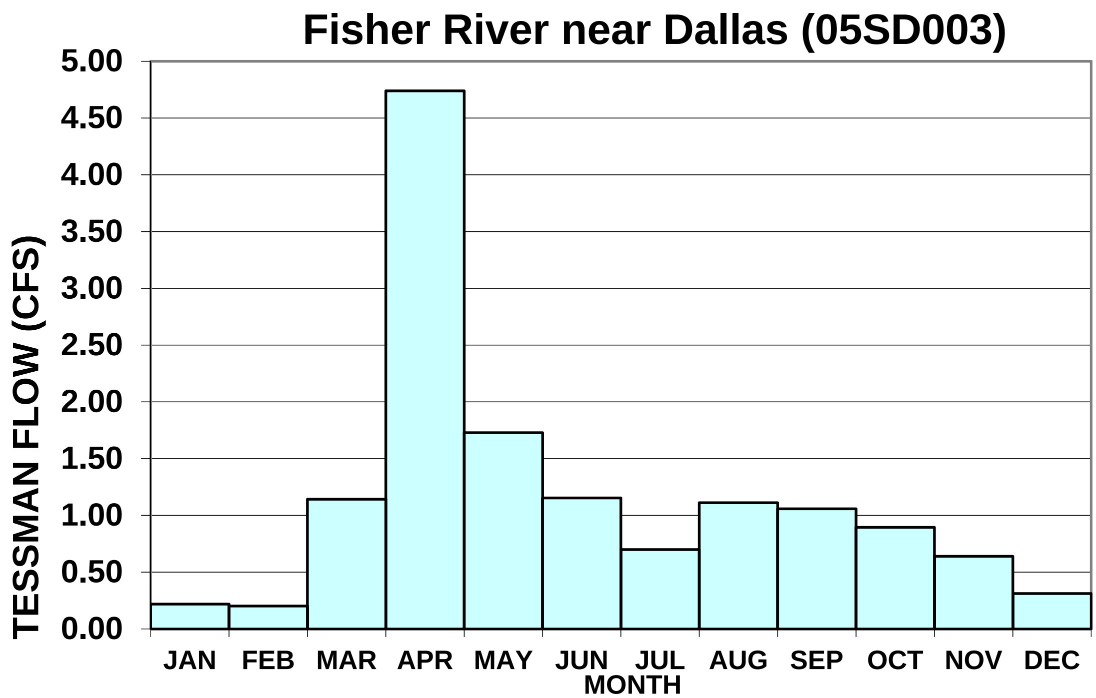

Figure 9: Tessman Flow plots for Fisher River

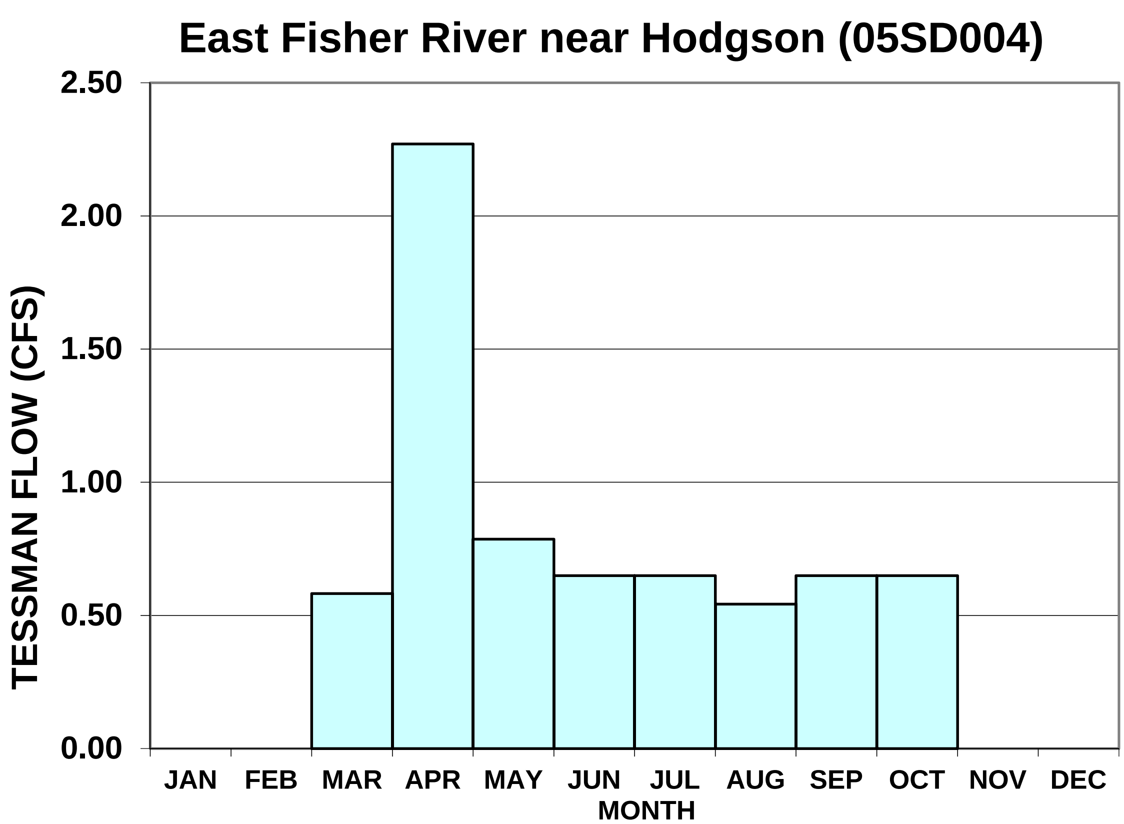

Figure 10: Tessman Flow plots for East Fisher River

Flood Risk Mapping Program:

Flooding is a serious concern to many residents of Manitoba. Although the public is probably more aware of flooding in the Red River Valley, flooding also occurs along numerous other rivers, streams and lakes including the Fisher River. Damages and hardships resulting from flooding have resulted in large costs to the public. Controlling the use of areas prone to flooding is one effective way or reducing these damages, as are certain structural works such as dykes or diversions.

In an attempt to reduce flood damages, Canada and Manitoba signed a General Agreement respecting Flood Damage Reduction on December 20, 1976. One aspect of the Agreement provided the formal delineation and mapping of a communities' flood risk area which are areas inundated by a design flood. The flood risk area was divided into two zones for most of the mapped communities: the floodway and the floodway fringe. The floodway is not a manmade structure, but in this case refers to the portion of the flood risk area where the water is the deepest and most destructive. The floodway is the area into which the flow could be confined, while causing only a moderate rise in water levels upstream, and where the water is one metre or more deep. Floodway areas were designated to indicate where any type of new construction should not be permitted. The remaining portion of the flood risk area is called the floodway fringe. In this outer zone, water tends to move more slowly and is shallower. The floodway fringe could be completely filled in or developed without significantly influencing upstream levels. Each of the two zones is treated differently regarding development restrictions.

Under the terms of the General Agreement, Canada and Manitoba agreed to discourage any new development from occurring in any designated floodway area. Within a floodway area, the two governments agreed not to finance or engage in any further projects. They agreed to withhold flood assistance payments for flood damages to any structures after the official designation of the floodway area. At the same time, they agreed to encourage suitable land use, such as recreational and agricultural uses, and appropriate zoning aimed at restricting development in those areas. With respect to the floodway fringe area, it was greed that restrictions concerning financial assistance or concerning development were not to be applied to undertakings that were adequately flood proofed. If the new development did not meet proper flood proofing requirements, financial support from government sources would not be available and assistance payments would not be made in the future.