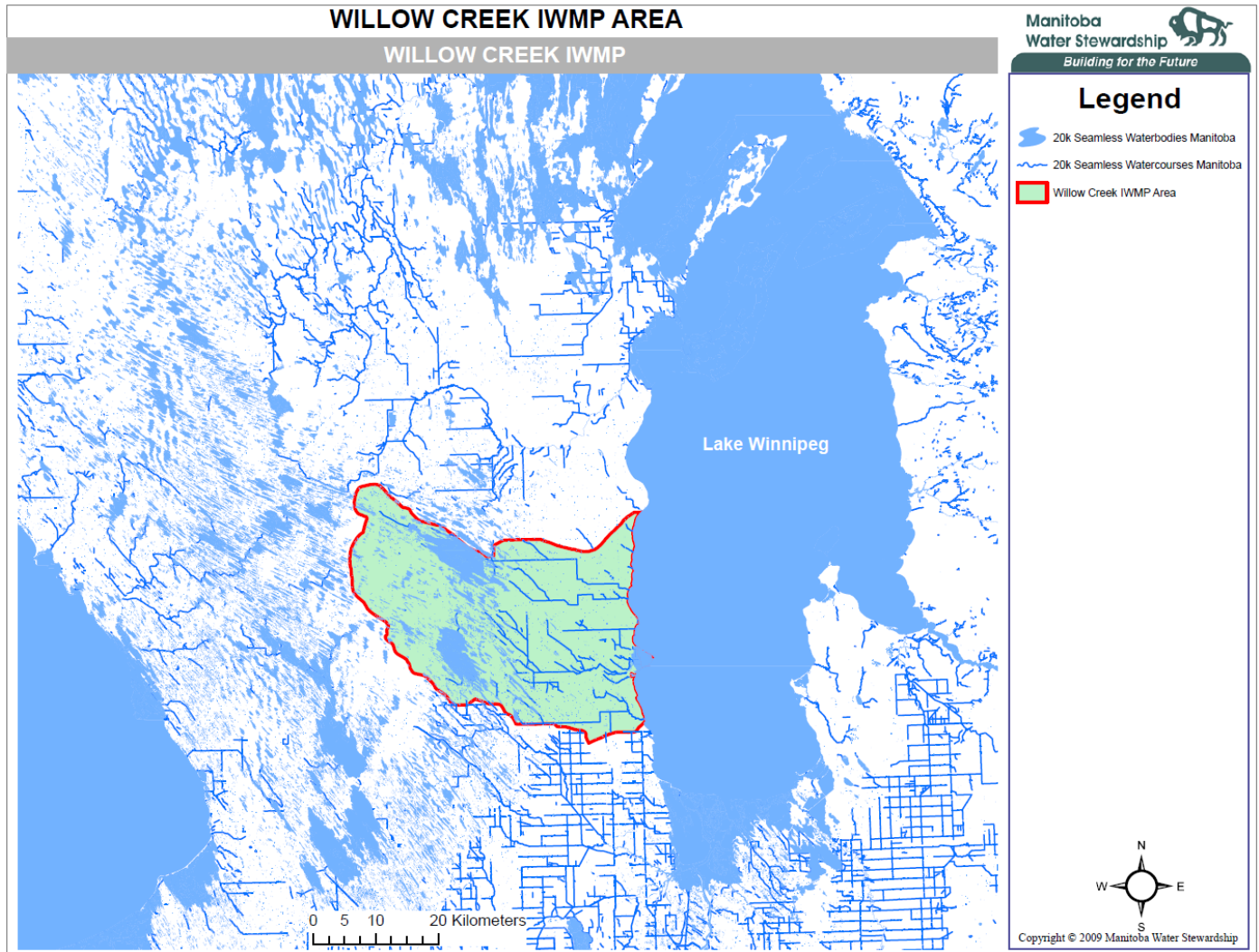


# WILLOW CREEK INTEGRATED WATERSHED MANAGEMENT PLAN

## SURFACE WATER HYDROLOGY REPORT

### Planning Area Boundary:

The Willow Creek planning area extends west from Lake Winnipeg to include the area draining into Fish Lake and Dennis Lake. The Willow Creek planning area is shown on Figure 1.



**Figure 1: Willow Creek IWMP Area**

The planning area in this case is a watershed, but is made up of a number of sub-watersheds including Willow Creek, Fish Lake Drain and others. 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 kilometers. A larger watershed can contain many smaller sub-watersheds which are defined in the same manner as a watershed. 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 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 Willow Creek planning area boundaries were established using this system of watersheds.

### Climate:

Climate data was extracted from Environment Canada's data base for Gimli, MB.

From 1971 to 2000, Gimli received an annual average of 532 mm of precipitation. Precipitation varies from year to year as shown in Figure 2. The average annual temperature at Gimli is 1.8°C. The Willow Creek planning area receives the largest portion of its annual precipitation in the spring and summer months. The monthly mean precipitation and temperature are shown in Figure 3 and Figure 4. Data for Winnipeg are also shown in the figures for reference.

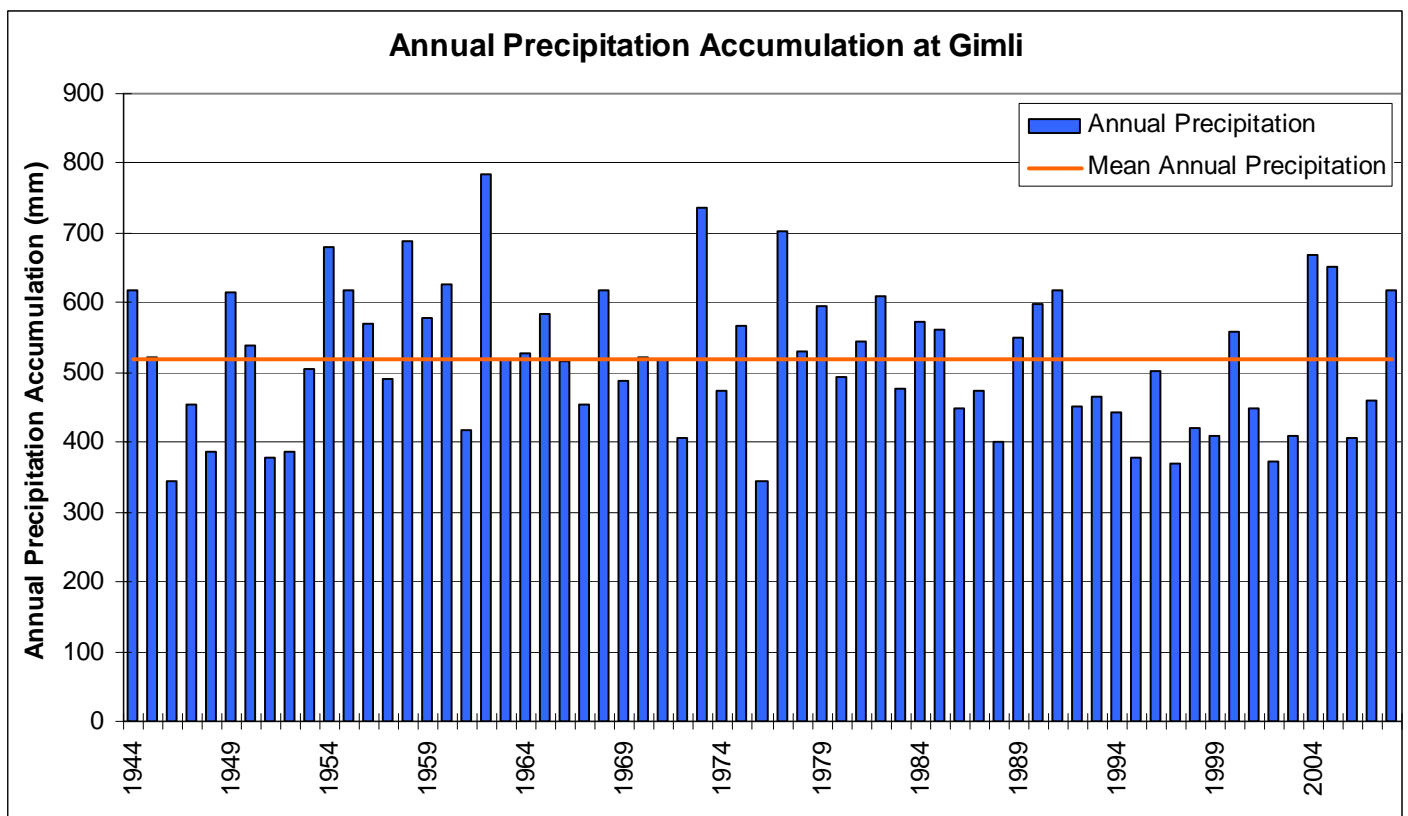
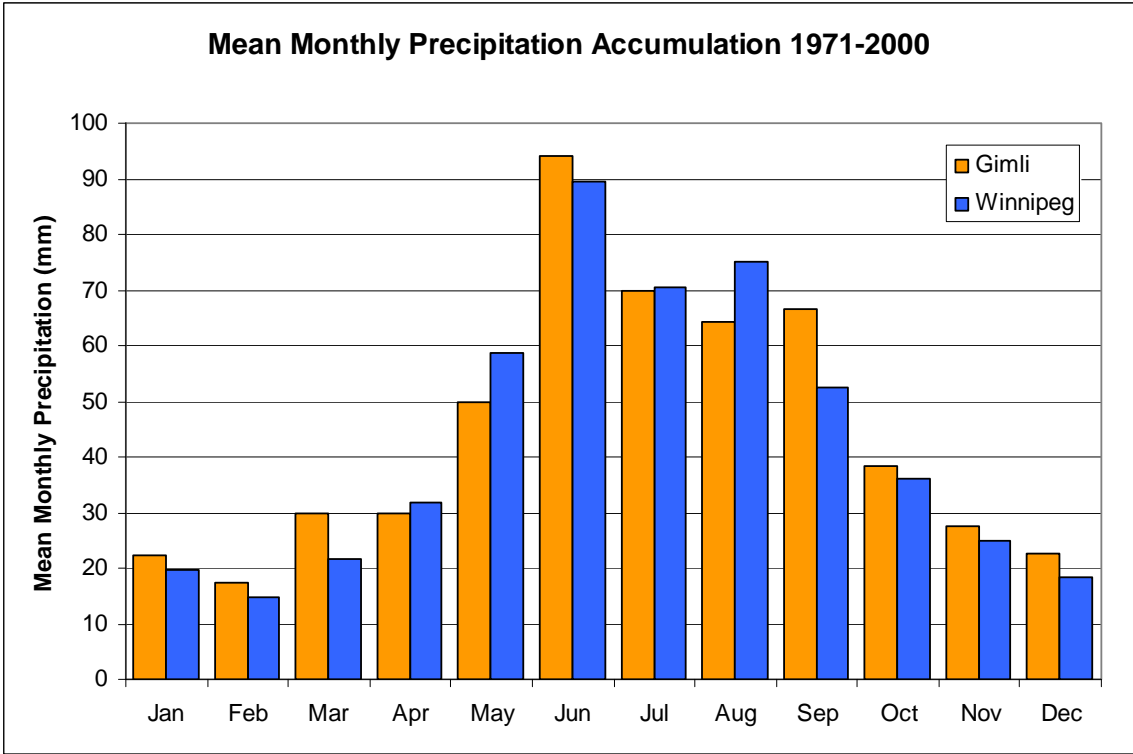
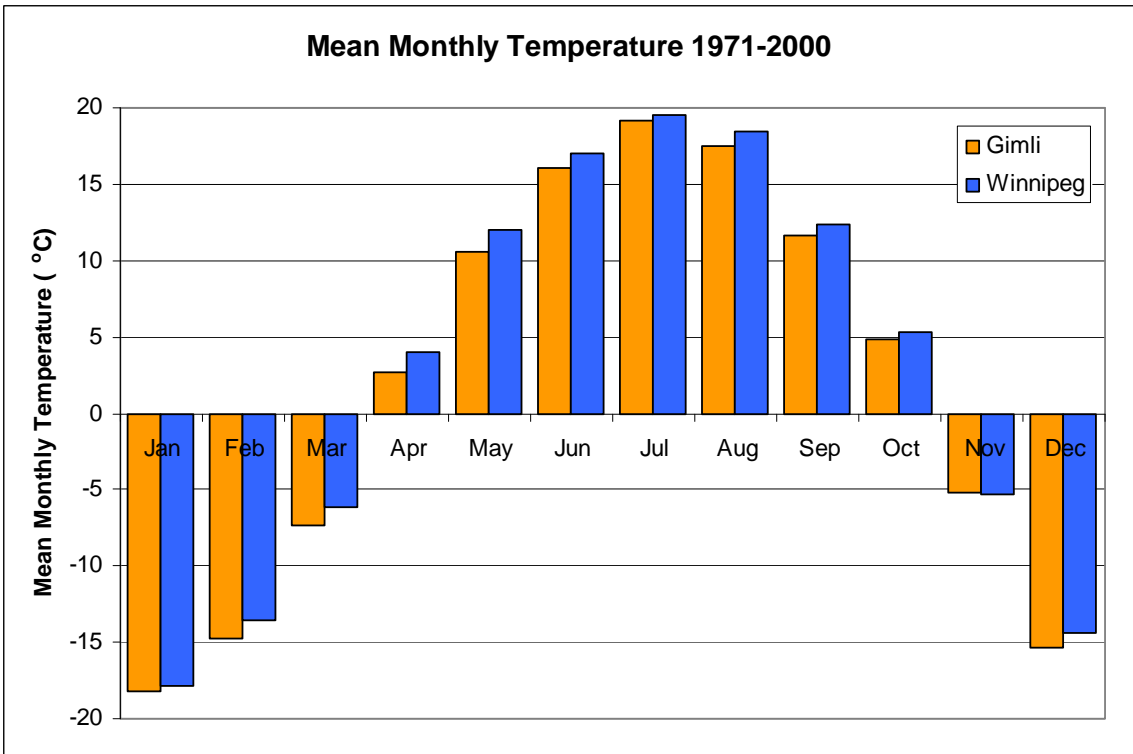


Figure 2: Annual Precipitation at Gimli



**Figure 3: Average monthly precipitation at Gimli and Winnipeg**

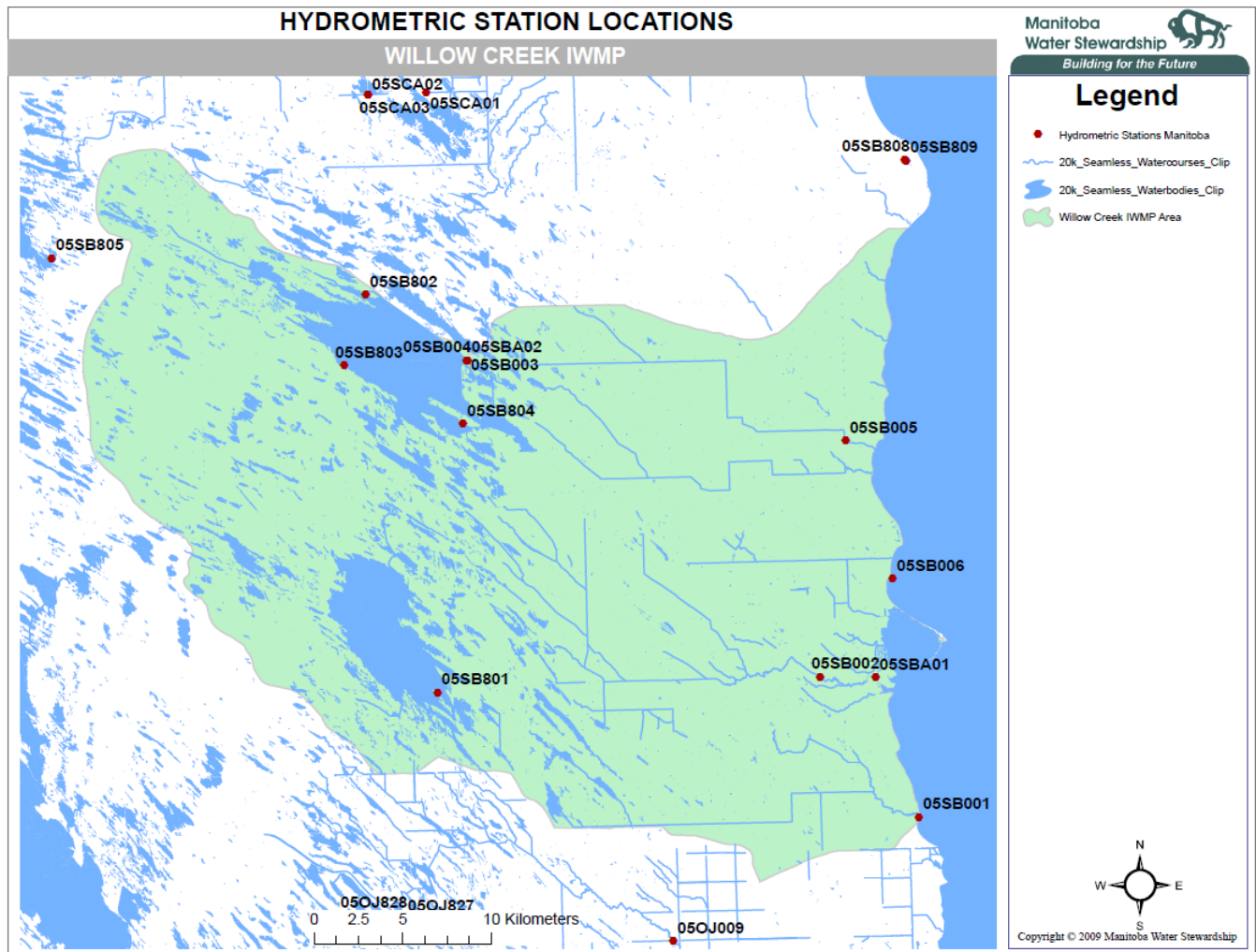


**Figure 4: Average monthly temperature at Gimli and Winnipeg**

## Hydrometric Data:

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, which is part of a National Hydrometric Program, supports activities such as policy development, operation of water control works, flow forecasting, water rights licensing, water management investigations and hydrologic studies, ecosystem protection and scientific studies. Environment Canada, the Province of Manitoba and Manitoba Hydro operate 143 discharge and 133 water-level gauging stations under this Agreement.

Streamflow or water level data have been collected at ten hydrometric gauging stations within the Willow Creek planning area for varying time periods since the 1960s, with some data for levels on Lake Winnipeg dating back to 1913. The locations of the ten stations are shown on Figure 5. Table 1 provides information relating to the station ID number, name, location, effective and gross drainage area, type of data collected, and the years of operation.



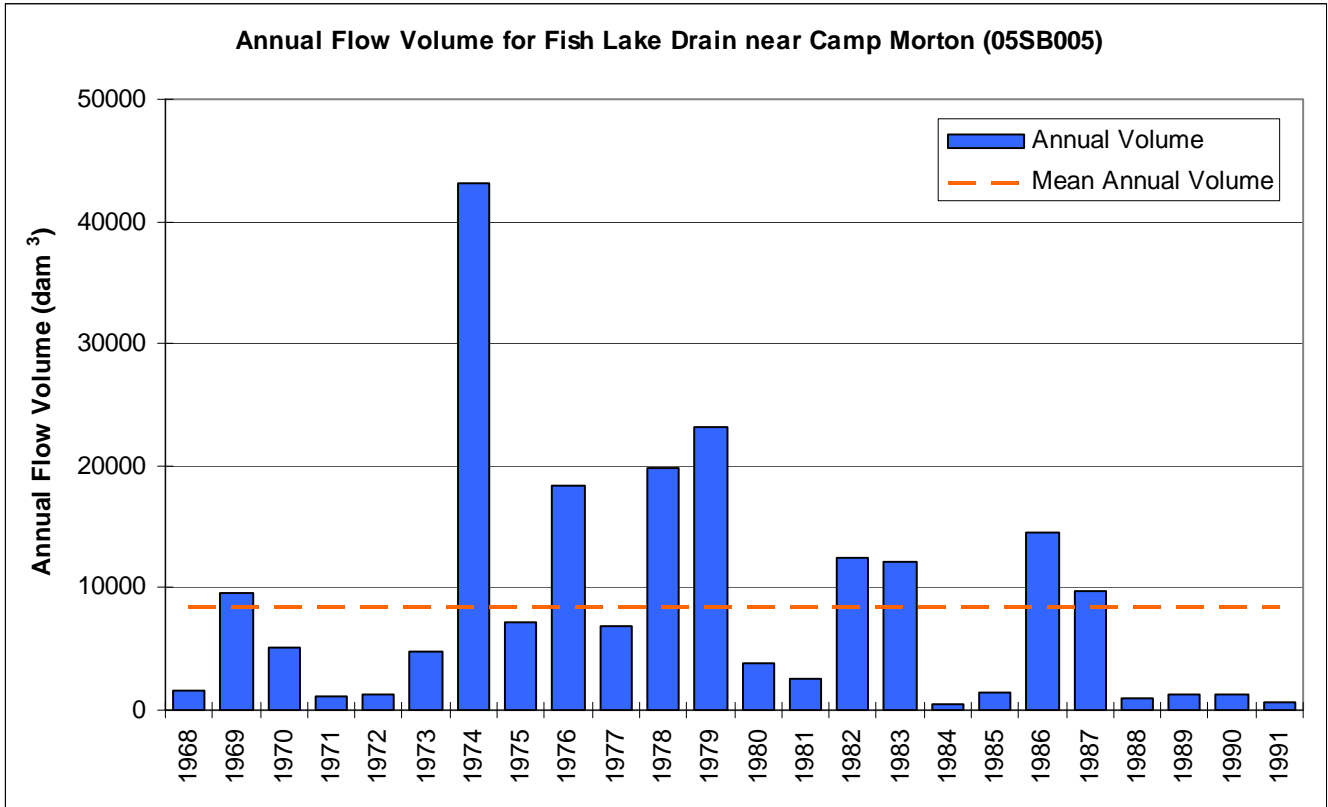
**Figure 5: Hydrometric Station Locations**

**Table 1: Hydrometric station information**

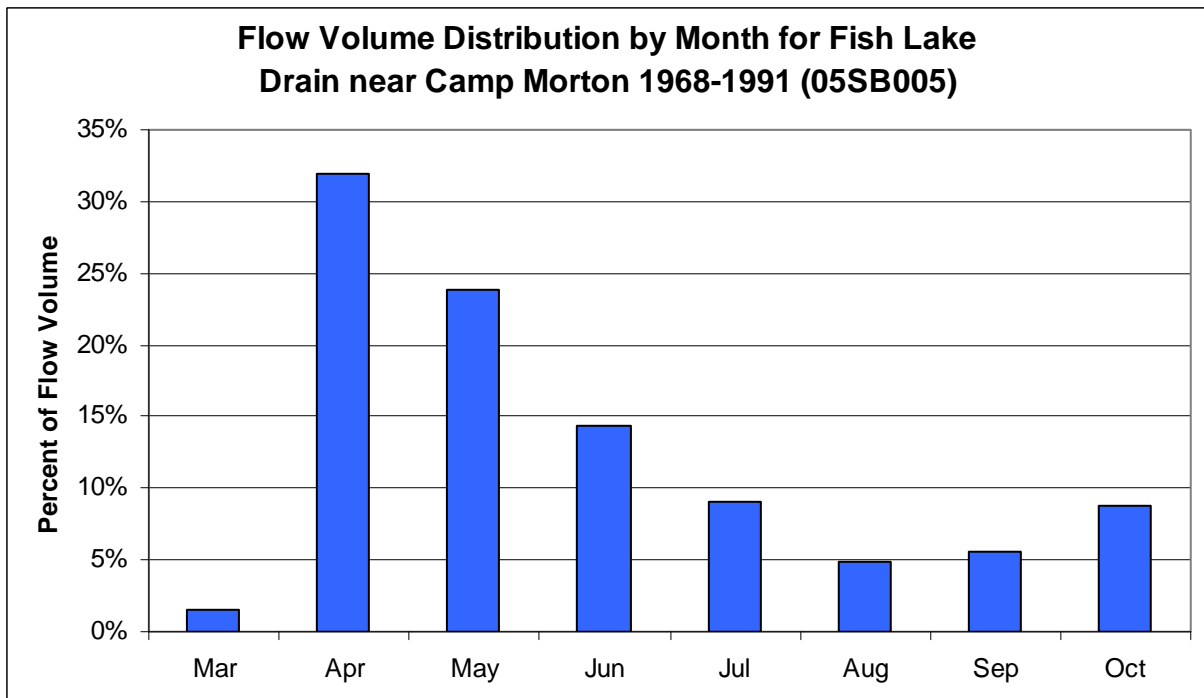
Station ID	Station Name	Station Location	Gross Drainage Area (km <sup>2</sup> )	Effective Drainage Area (km <sup>2</sup> )	Period of Record F – Flow Data L – Level Data
05SB001	Lake Winnipeg at Winnipeg Beach	NW 34-17-04E1	1,020,300	679,300	1913-1966 L
05SB002	Willow Creek near Gimli	NW 30-18-04E1	236	236	1960-1991 F 1985-1991 L
05SB003	Fish Lake at Outlet Control Structure	SW 30-20-02E1	180	180	1967-2008 L
05SB004	Fish Lake Drain near Meleb	SW 30-20-02E1	180	180	1969-1970 F
05SB005	Fish Lake Drain near Camp Morton	SW 8-20-04E1	272	272	1968-1991 F 1985-1991 L
05SB006	Lake Winnipeg at Gimli	SE 16-19-04E1	1,020,300	679,300	1966-2009 L
05SB801	Dennis Lake near Malonton	NE 26-18-01E1	277	277	1965-2008 L
05SB802	Fish Lake at North Lake	NW 4-21-01E1	180	180	1984-2008 L
05SB803	Fish Lake at Singbiels	NW 28-20-01E1	180	180	1984-2008 L
05SB804	Fish Lake at Simmenk's	NE 12-20-01E1	180	180	1984-2008 L

**Streamflow Characteristics:***Fish Lake Drain*

The daily discharge data for Fish Lake Drain were statistically analyzed. Data are available from 1968 to 1991. Data have not been recorded since 1991. Annual flow data are shown on Figure 6. The monthly distribution of flow from March to October is shown on Figure 7. The recorded data exhibit a large inter-annual variability as large flow years can have ten times the volume of the low flow years. The flow distribution is similar to other streams on the Canadian Prairies. Stream flow is concentrated in the spring months as the melting snowpack contributes large volumes of water.



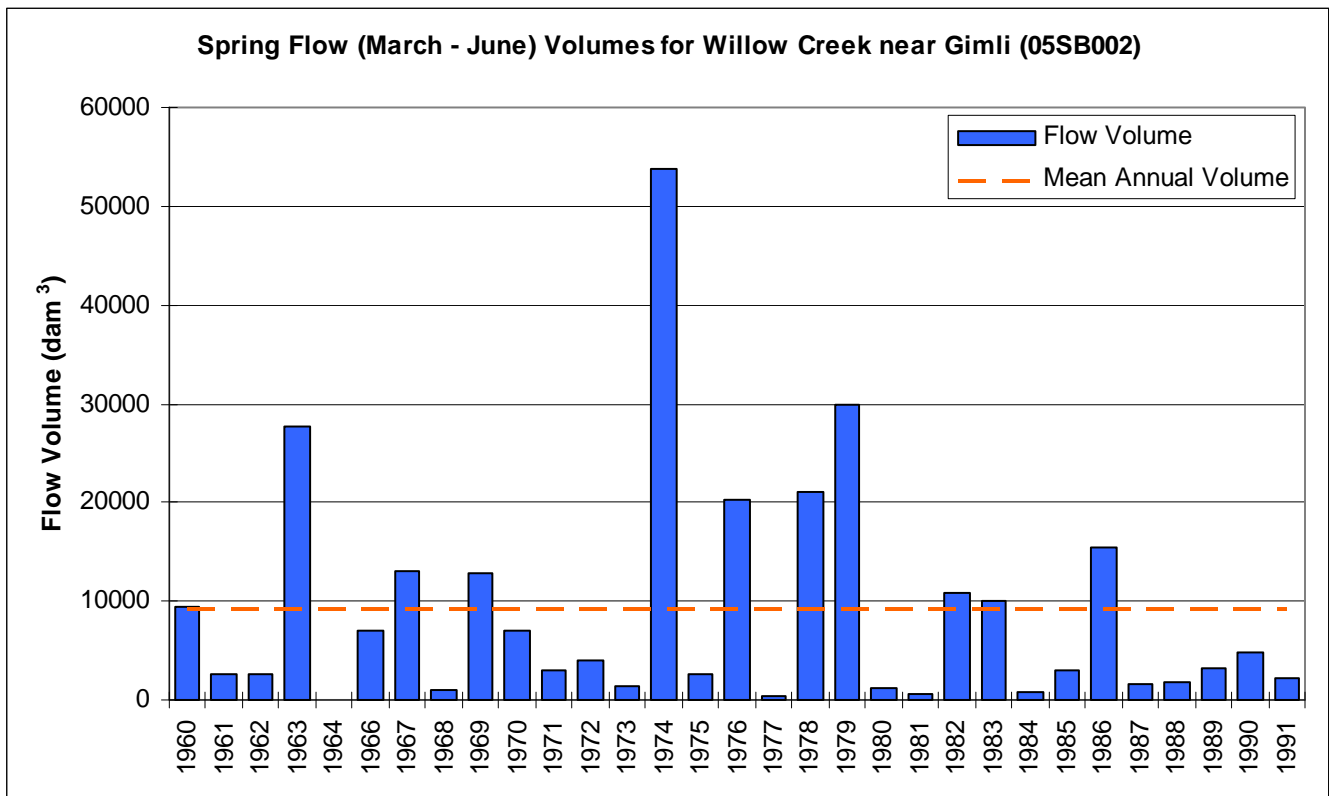
**Figure 6: Annual Flow Data for Fish Lake Drain near Camp Morton (05SB005)**



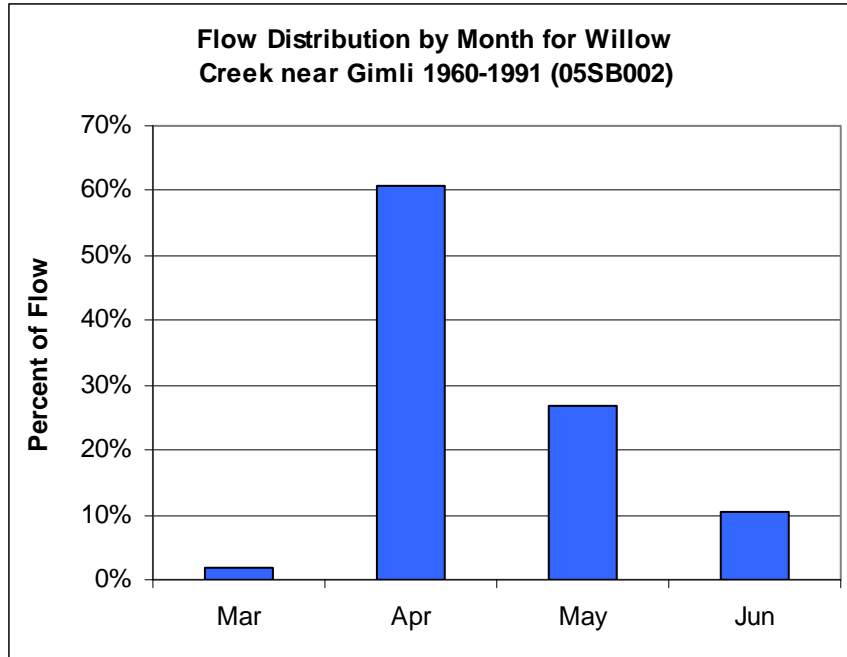
**Figure 7: Monthly distribution of flow between March and October for Fish Lake Drain**

*Willow Creek*

The daily discharge data for Willow Creek were also statistically analyzed. Daily discharge data are available for March to October from 1960 to 1972 and for March to June from 1973 to 1991. Data have not been recorded since 1991. Annual flow data are shown on Figure 8. The monthly distribution of flow from March to June is shown in Figure 7. Although not shown in Figure 7, in the years where summer flows were recorded, approximately 6.5% of the annual flow occurred from July to October.



**Figure 8: Annual Flow Data for Willow Creek near Gimli (05SB002)**



**Figure 9: Monthly distribution of flow between March and June for Willow Creek**

**Lake Level Data:**

*Fish Lake*

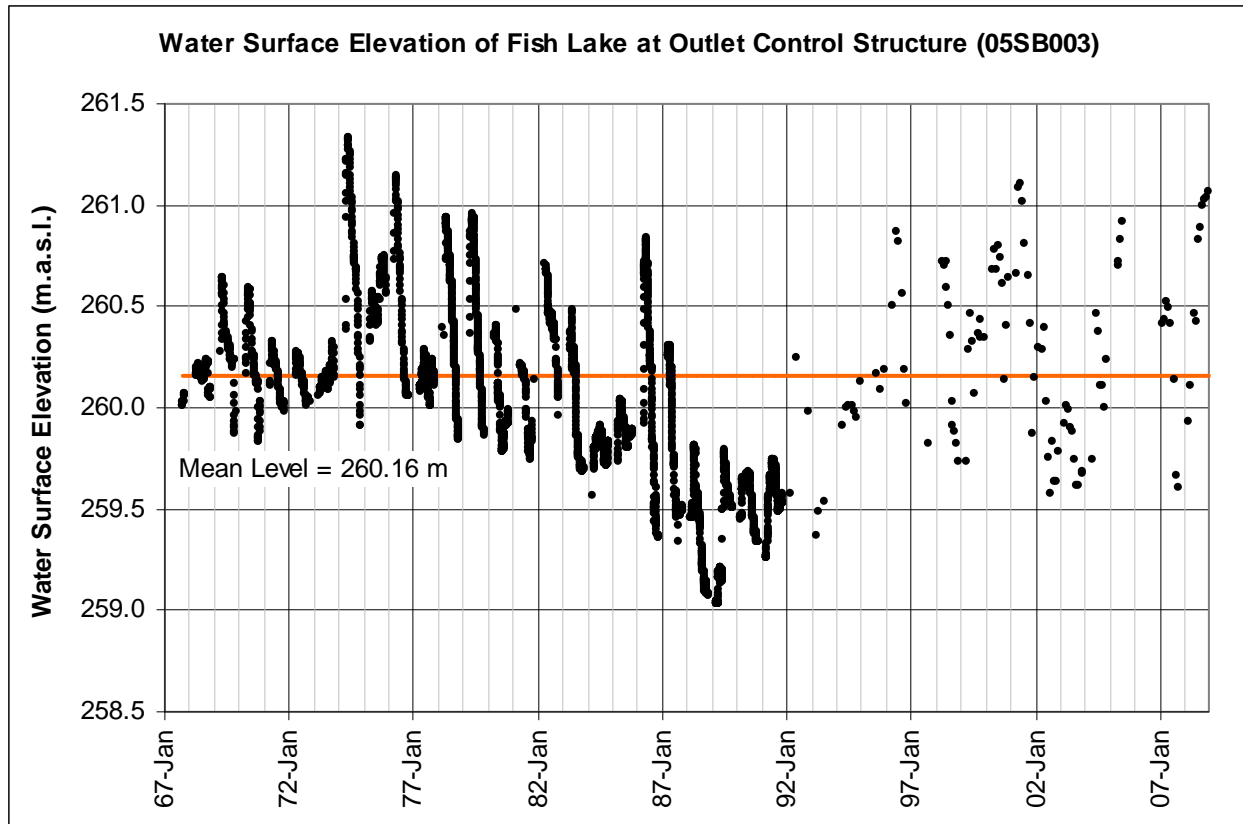
Fish Lake is located in the northwest area of the Willow Creek planning area.

Fish Lake is controlled by an earth filled structure at the northeast corner of the lake. The dam was constructed in 1965 by the Province of Manitoba to reduce spring flooding. The top of the dam has an elevation of 262.280 m.

There are one uncontrolled and two controlled outlets from the lake. The main control structure consists of a 1220 mm (48 in) gated corrugated metal pipe with an invert elevation of 259.171 m. Beside the gated pipe there is an uncontrolled conduit 1473 mm by 914 mm (58 in by 36 in) at an elevation of 260.186 m. These outlets discharge to Fish Lake Drain. The other outlet is a 450 mm (18 in) gated corrugated metal pipe located in a secondary control structure and discharges into a channel connected to the Rembrandt Drain. At the full supply level of 260.186 m, the lake has an area of approximately 1000 ha (2500 acres).

Fish Lake levels have been recorded since 1967. Since 1992, levels have been recorded periodically. A plot of the lake levels is provided in Figure 10.





**Figure 10: Fish Lake Water Levels**

### *Dennis Lake*

Dennis Lake is located in the southwest area of the Willow Creek planning area.

According to the Dennis Lake Regulation Study (Water Resources Branch, 1983), Dennis Lake has no natural outlet below 267.16 m (876.5 ft). Below this level the lake acts as a closed basin, where water can only leave the lake by evaporation or seepage. Above 267.16 m the lake overflows to adjacent watersheds. In addition to overland flow from Dennis Lake into the Willow Creek drainage system, overflows to Netley creek watershed to the south of Dennis Lake were documented in 2001.

A study was carried out on Dennis Lake in the early 1980s by the Water Resources Branch and resulted in the report titled the Dennis Lake Regulation Study, 1983. The report focuses on cost benefit analysis of various multi-purpose operating schemes. The recommendation of the report was that the optimum cost-benefit ratio was achieved with an outlet at an elevation of 266.40 m (874.0 ft). The proposed outlet would discharge to Willow Creek via South Malonton Drain.

The Dennis Lake Regulation Study identified a local concern regarding a drain leading to Dennis Lake which was constructed in 1953 in association with Provincial Road 231. The claim is that this construction caused additional water to drain into Dennis Lake. The report acknowledged that the drain would have contributed additional flow to the lake, however there was no evidence as to how significant the flow contribution from this additional drainage area was to the rise in lake levels.

Dennis Lake levels have been recorded since 1965. A plot of the lake levels are shown on Figure 11. Key water elevations have been displayed on the figure.

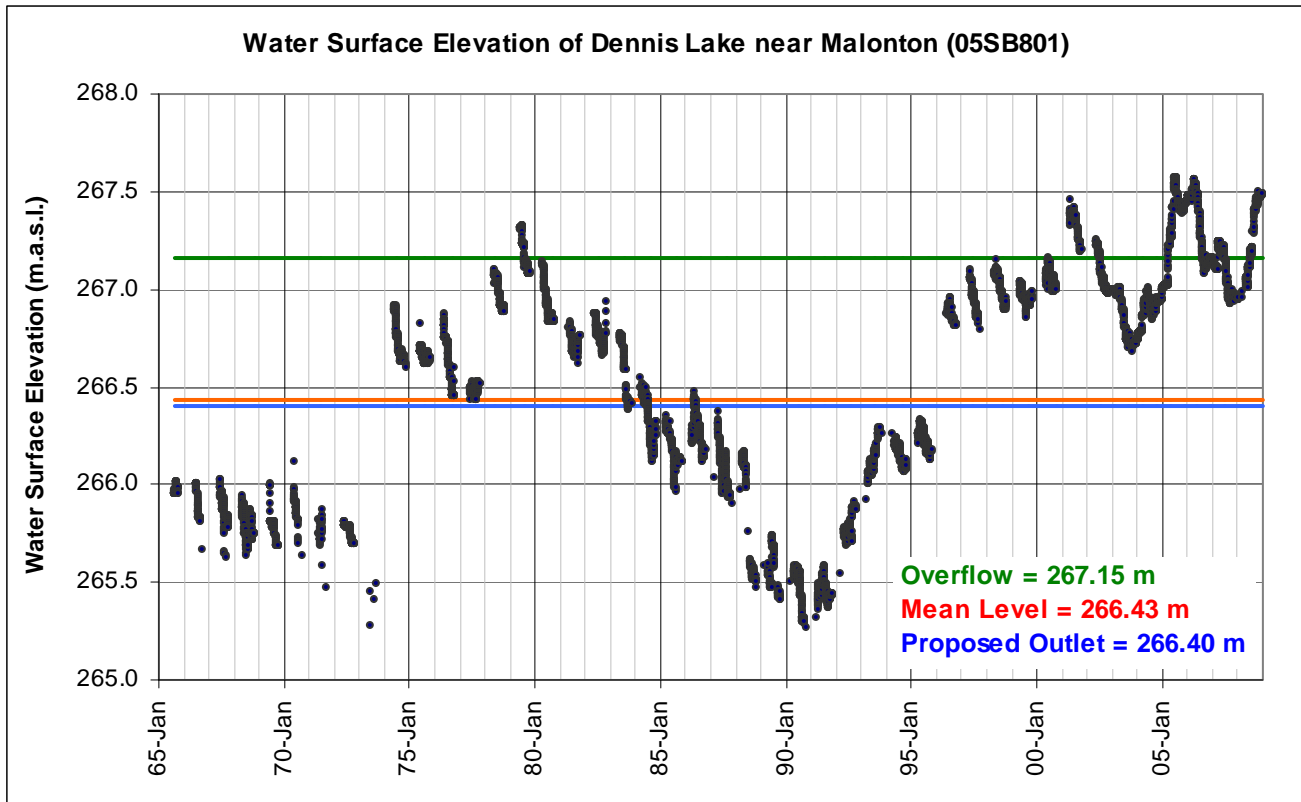


Figure 11: Dennis Lake Water Levels