

2011
Flood

Flood Fighting in Manitoba

A History and Background of
Manitoba's Flood Protection Works

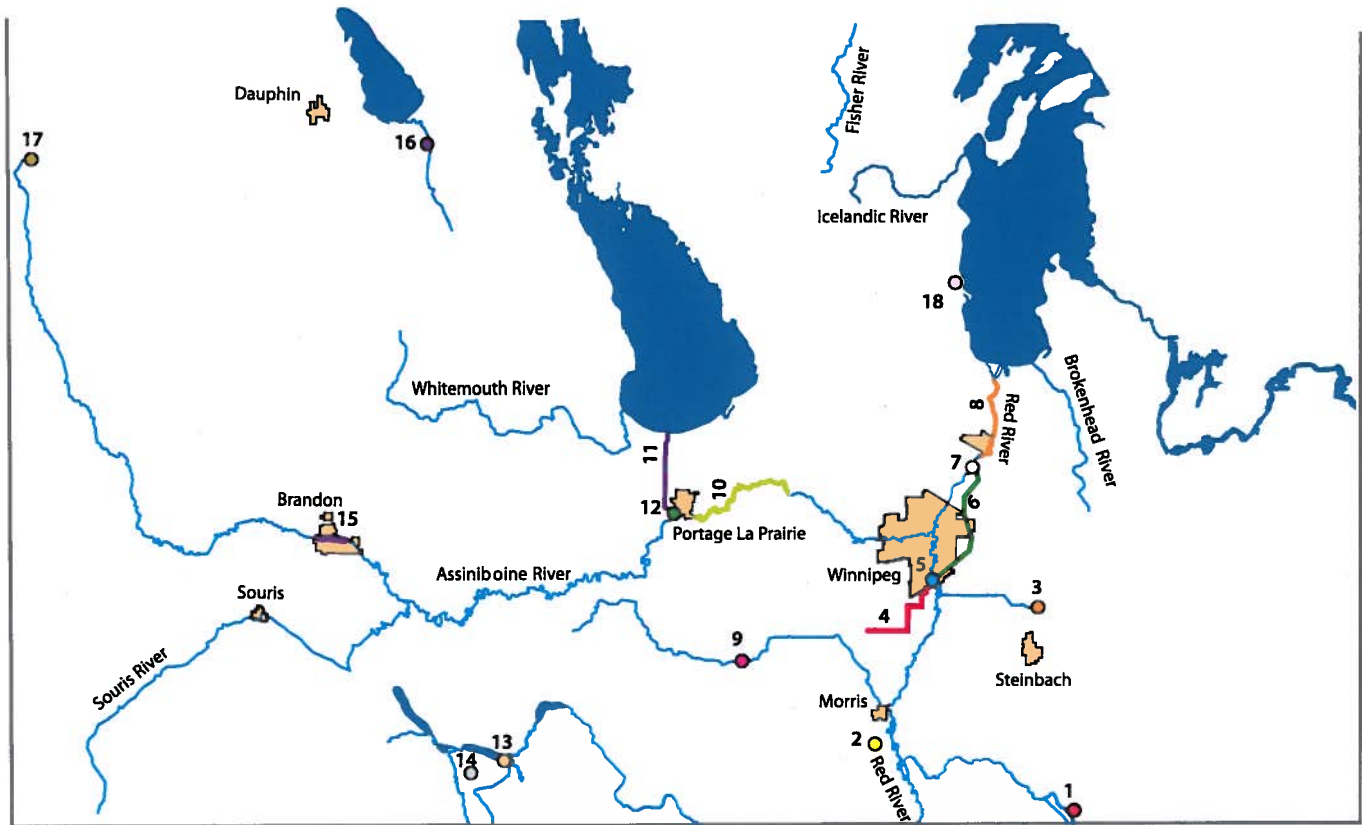
Flood Fighting in Manitoba

Southern Manitoba has extensive flood control measures in place, particularly in the Red River Valley, from Winnipeg, south to the US border. Flood controls were built after the devastating flood of 1950, which flooded the Red River Valley and the City of Winnipeg. Construction of the Red River Floodway was completed in 1968. Additional flood control improvements, including an expansion of the floodway, were made after the Flood of the Century in 1997. This flood was substantially larger

than the 1950 flood, but resulted in far less property damage because of the flood control measures in place. There are also flood control measures along the Assiniboine River.

Flood protection work has prevented property damage and reduced the potential impact of flooding on families and communities. Since the 1997 flood, more than \$1 billion has been invested in flood mitigation efforts in Manitoba.

Southern Manitoba with Flood Protection Works

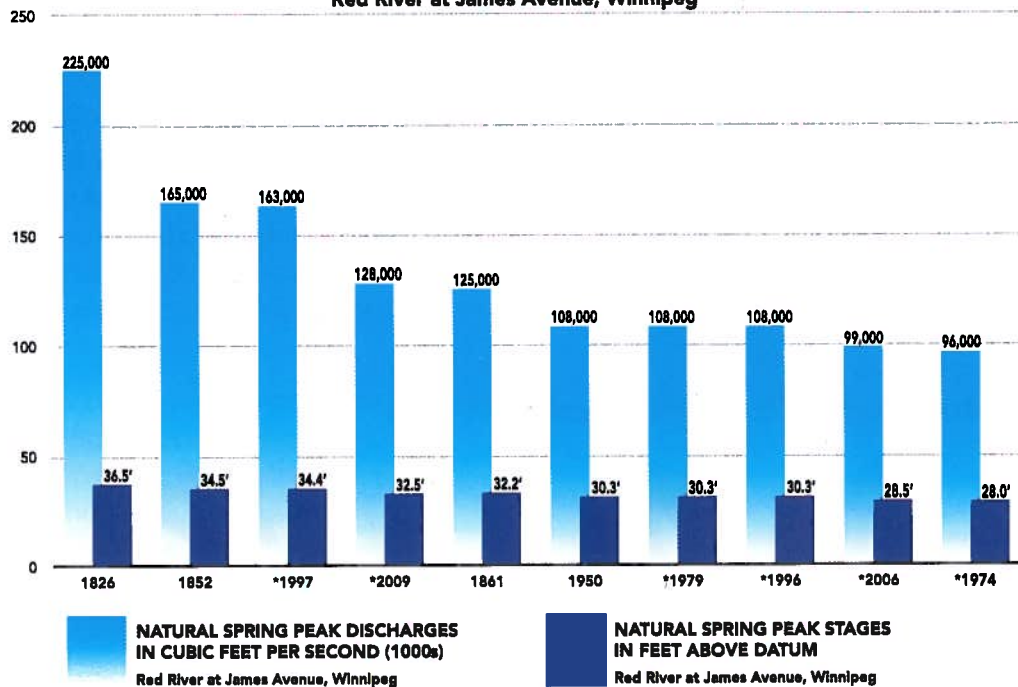


Control Structures

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|-----------------------------|--|--------------------------------|---------------------------------------|
| ● 1 - Gardenton Floodway | ● 5 - Red River Floodway Inlet Control Structure | ● 9 - Carman Diversion | ○ 14 - Pelican Lake Control Structure |
| ● 2 - Community Ring Dikes | — 6 - Red River Floodway | — 10 - Assiniboine River Dikes | — 15 - Brandon Dikes |
| ● 3 - Seine River Diversion | ○ 7 - St. Andrews Lock and Dam | — 11 - Portage Diversion | ● 16 - Ste. Rose du Lac Dikes |
| — 4 - West Dike | — 8 - Red River Ice Cutting | ● 12 - Portage Diversion Inlet | ● 17 - Shellmouth Dam |
| | | ○ 13 - Rock Lake Dam | ○ 18 - Gimli Diversion |

Top 10 Manitoba Floods Since 1800

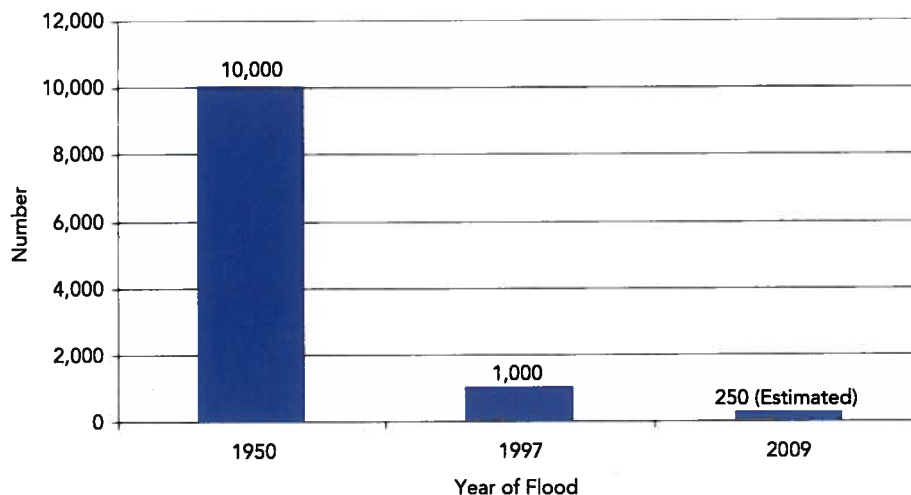
Red River at James Avenue, Winnipeg



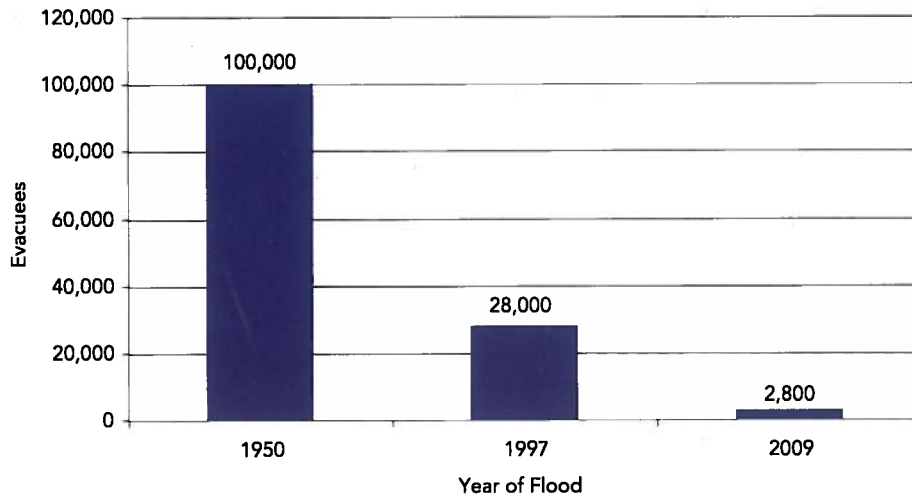
* Computed Natural Discharge Without Use Of Red River Floodway, Portage Diversion, Shellmouth Dam
 Compiled by Manitoba Water Stewardship



Number of Homes Damaged During Spring Floods



Number of People Evacuated During Spring Floods

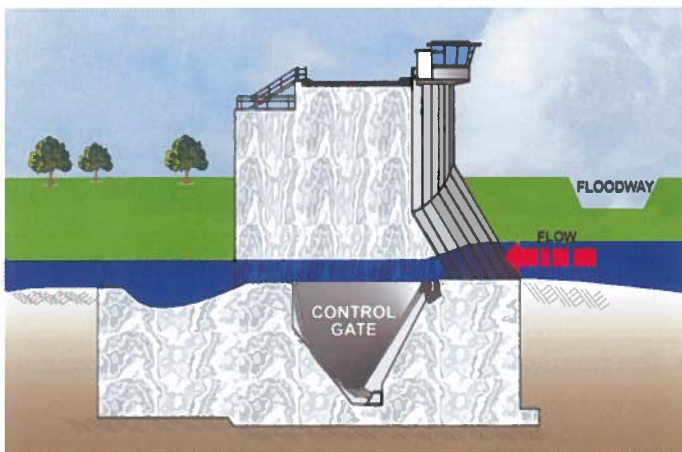


Red River Floodway

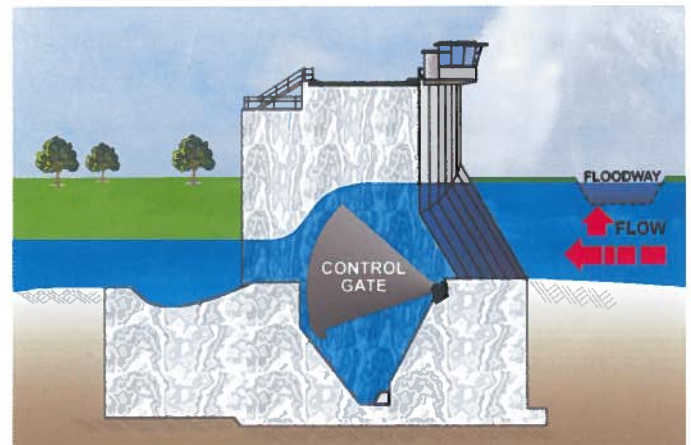
One of the most significant flood protection measures in Manitoba is the Red River Floodway, which protects the City of Winnipeg. Starting in 2005, Canada and Manitoba invested \$665 million to further expand the Red River Floodway.

- The original floodway was built between 1962 and 1968 and cost \$63 million.
- At the time, excavation of the floodway channel was the second largest earth moving project in the world (second only to the Panama Canal and larger than the Suez Canal project).

- Since 1968, it has prevented more than \$30 billion (in 2009 dollars) in flood damage in Winnipeg.
- It is often referred to as Duff's Ditch in recognition of then-Premier Duff Roblin, who spearheaded the development the floodway.
- The expansion of the current floodway system (including the West Dike and channel outlet) began after the 1997 flood, to protect the City of Winnipeg from a one-in-700-year flood. It increased the floodway's capacity – from 90,000 cfs (cubic feet per second) to 140,000 cfs. The floodway operates by diverting a portion of the Red River flow around Winnipeg through the floodway channel. During flooding, as the river naturally



Floodway gates during normal summer conditions



Floodway gates raised to regulate water levels

rises, it spills over the floodway channel entrance and flows down the floodway channel. When this happens, the river water flows through two routes – through the city and through the floodway. At the same time, it drops below its natural level, south of the floodway inlet.

- When the floodway gates are raised, the water level south of the floodway inlet is restored to its natural level which, in turn, allows more water to spill into the floodway. As Red River flows continue to increase, the level south of the inlet drops below natural again and the gates are raised further. This process continues as long as the flow in the Red River continues to increase.
- During the majority of floods, the floodway is operated to ensure that the water level south of the city is maintained at the natural level – that is the level that would occur if the flood control works did not exist.
- In a major flood, even larger than 1997, the flow through the city will be controlled with the guidance of three spring floodway operating rules. These rules are designed to ensure Winnipeg's primary diking system is not overwhelmed. When these rules are implemented to protect the city, there may be instances when additional water going through the floodway causes artificial flooding of land and roads south of the floodway inlet. In recognition of this possibility, the Manitoba government has legislation in place which provides compensation to individuals impacted by this artificial flooding.
- A fourth floodway operating rule is also in place, but is only applied during the summer when high water levels affect Winnipeg's storm sewer and combined sewer systems. The combination of high water and a high intensity rain storm can overwhelm the sewer systems causing basement flooding. If this occurs, operation of the floodway can lower water levels in the city, reducing the damages and potential health risk caused by basement flooding.



Floodway inlet control structure south of Winnipeg



Floodway outlet structure north of Winnipeg

- The floodway is recognized as a National Historic Civil Engineering Site and is considered one of the world's 16 engineering marvels. For more information, see www.floodwayauthority.mb.ca.

City of Winnipeg Flood Protection

- The main protection for the city is the Red River Floodway, the Portage Diversion and the Shellmouth Reservoir.
- Within the city there is a primary dike system that protects land along the Red and Assiniboine rivers. There are also secondary dikes to protect low-lying areas on the river side of the primary dikes, including Kingston Row, Lord Avenue, North Drive and Kilkenny Drive North. For more information about Winnipeg's flood protection see: www.winnipeg.ca/emergweb/.
- After the 1997 flood, \$10.8 million was invested to protect homes and condominium complexes. As well, the secondary dikes in the city were further strengthened.
- The \$130 million under the 1997 Canada-Manitoba Partnership Agreement on Red River Valley Flood Protection funded these improvements.

West Dike

- The 45 km (28 miles) West Dike is located south of Winnipeg and also provides flood protection for the city. It prevents Red River floodwaters from flowing into the La Salle River and entering Winnipeg. The dike is high enough to handle wind and waves during major floods. It was substantially and quickly reinforced in 1997.
- As part of the Red River Floodway expansion, the dike was extended approximately 11 km (7 miles) and raised in various areas up to 1.5 m (5 ft).

Red River Valley Ring Dike Communities and Properties

- There are 18 ring dike communities in the Red River Valley providing protection up to 1997 levels, plus 0.6 m (2 ft). The dikes protect the communities and can be partially or fully closed during a flood. During the 2009 flood, the ring dikes prevented about \$700 million in flood damages to these communities.



Ring dike community of St. Jean Baptiste



Ring dike community of Morris

Spring Flood Peaks

(feet above sea level; Winnipeg is based on James Ave.)

RED RIVER:				
	Emerson	Morris	Winnipeg	Selkirk
1979	791.3	781.3	19.2	---
1997	792.5	783.3	24.5	729.5
2009	790.8	781.9	22.5	728.8

- The communities in the Red River Valley with ring dikes are: Emerson, Gretna, Letellier, Rosenfeld, Dominion City, St. Jean Baptiste, Riverside, Rosenort, St. Pierre-Jolys, Aubigny, Morris, Roseau River, Lowe Farm, Ste. Agathe, Brunkild, St. Adolphe, Niverville and Grande Pointe.
- Over 1,800 sites in the valley have been flood-protected – homes, business, farms – preventing another \$100 million in damages during the 2009 flood.
- Ring dikes and other forms of flood works protect 95 per cent of the homes, business and farms in the valley.
- The 1997 Canada-Manitoba Partnership Agreement on Red River Valley Flood Protection funded \$130 million in enhancements to eight ring dike communities that already had ring dikes; provided for the construction of 10 additional ring dikes; and supported flood protection for homes, farms and businesses.

St. Andrews Lock and Dam

- Built in 1910, the federally operated structure helps regulate low-flow water levels on the Red River. Its primary function is to raise the water level over Lister Rapids to allow river navigation.

North of Winnipeg to Lake Winnipeg

- Approximately \$4 million has been invested in the ice mitigation program for this area. It includes seven ice cutters, three Amphibex icebreakers and support units for the equipment. One Amphibex is owned by the North Red Community Water Maintenance and two are owned by the Manitoba government.
- Following the severe ice jams in 2009, the 63 most flood-prone homes and cottages in the Breezy Point and St. Peters Road areas were purchased by the government so the homeowners could relocate.



One of seven ice-cutting machines.



One of three Amphibex icebreakers.

Assiniboine River Watershed

- The Assiniboine River runs from southern Saskatchewan and ends when it meets the Red River in the City of Winnipeg. The river twists and turns for approximately 1,070 km (665 miles).
- A community ring dike protects St. Lazare which is south of the Shellmouth Dam.
- The flood-prone section of the Town of Melita is located along the Souris River, which feeds into the Assiniboine River. It is protected by dikes and a raised portion of Hwy 3, including the intersection of Hwy 3 and PTH 83. This project was funded by the Manitoba government in 2009.
- The last major floods along the Assiniboine River were in 1976 and 1995.

Spring Flood Peaks

(feet above sea level)

ASSINIBOINE RIVER				
	St. Lazare	Brandon	Portage	Headingley
1976	1287.1	1179.5	854.2	770.5
1995	1288.8	1178.8	847.8	765.8
2009	---	1173.8	844.1	767.1

Shellmouth Dam

- The Shellmouth Dam (which helps protect Brandon, Portage la Prairie and Winnipeg from high flows on the Assiniboine River) is located about 24 km (15 miles) northwest of Russell. The reservoir created by the dam is approximately 56.3 km (35 miles) long. The reservoir is known as Lake of the Prairies.
- There is a reinforced-concrete, horseshoe-shaped conduit that allows a controlled release of water from the reservoir. During flooding, a portion of flood water is stored in the reservoir. When reservoir levels are very high, uncontrolled flows can spill over the concrete chute spillway and affect agricultural land.
- Construction on this project began in 1964 and was completed in 1972, at a cost of \$10.8 million.
- Canada and Manitoba have jointly committed to a \$14 million project to look at improvements to the dam, including installing gates on the concrete spillway. These gates would allow higher reservoir water levels, providing more flood protection and a larger water supply for domestic, commercial and irrigation use.



Shellmouth Dam structure and reservoir (Lake of the Prairies)

City of Brandon

- The Assiniboine River flows through the northern end of the City of Brandon. Most of the developed areas of the city are located on the higher elevations outside of the Assiniboine River Valley floodplain. However, some industrial, commercial, residential and recreational properties and facilities exist within the floodplain, most notably the Brandon Flats area, located south of the river between First Street and 26th Street.
- The flood-prone properties are protected by dikes to varying degrees, but in general they are not high enough to protect against a 100-year flood.
- To address this issue, the City of Brandon raised approximately 5 km (3.1 miles) of dike by about 0.6 m (2 ft), to a level about 0.3 m (1 ft) above the unfavourable predictions from the January and February flood outlooks for the 2011 spring flood. The Manitoba government is providing \$781,000 to support the \$1.07 million the city is investing in this project.



Portage Diversion structure



Portage Diversion channel

Portage Diversion

- This 29 km (18 miles) channel diverts water from the Assiniboine River into Lake Manitoba, just west of Portage la Prairie.
- The removal of up to 25,000 cfs of flood water provides flood protection for the City of Winnipeg and areas along the Assiniboine River and also supports flood protection along the Red River north of Winnipeg.
- The project was built from 1965 to 1970 and cost \$20.5 million.

Assiniboine River Dikes

- On each side of the Assiniboine River east of Portage la Prairie there are approximately 67 km (41.6 miles) of dikes – a total of 134 km (83.2 miles) – from Portage la Prairie to just east of Baie St. Paul.
- The dikes were first constructed by the federal government in 1912, reinforced in 1950 and again improved in the years following the 1997 flood. Responsibility for the dikes is now with the Manitoba government, but was a federal responsibility until 1996.
- The dikes protect farmland, farms and residences as well as the communities of Elie, La Salle, Sanford and Starbuck which would be affected if the Assiniboine River flows overtopped the dikes.
- The Manitoba government is strengthening this diking system again this year in preparation for a potential spring flood.

Other Flood Protection

Manitoba's flood potential is affected by a combination of many factors such as river flow, soil moisture conditions at freeze-up, snow-water content in the snowpack and weather conditions. Manitoba has many natural water sources that require numerous flood control measures across the province.

- **Fairford Dam** – A new dam, built in 1961, replaced an old structure first built in 1934. It regulates water levels of Lake Manitoba and flows into Lake St. Martin and the Dauphin River.
- **Gardenton Floodway** – Completed in 1930 by the provincial and federal governments, it diverts flood waters from the Roseau River into a relief channel that is protected by two dikes on either side of the channel banks. It prevents flooding of local communities such as Vita and farms and agricultural lands.
- **Carman Diversion** – Completed in 1991, the \$6 million diversion was funded by the federal and provincial governments and the Town of Carman. It diverts flood water from the Boyne River west of the town through a 9.8 km (6 miles) channel that exits into the Norquay Channel northeast of the town, providing protection for the Town of Carman. Before the diversion was built, Carman experienced major floods in 1893, 1923, 1970, 1974 and 1979. The 1979 flood caused damages of over \$3 million.
- **Pelican Lake Controls** – Completed in 1991 by the federal and provincial governments, the project includes a diversion channel from the Pembina River to Pelican Lake, along with outflow capacity improvements to allow better regulation of water levels.
- **Rock Lake** – In 1993, a weir and an outlet channel to the Pembina River were built, along with dikes on the west side of the lake, to protect flood-prone farmland.
- **The Pas area** – A series of dikes along the Saskatchewan River at The Pas protects agricultural and residential land. Funds have been invested in minor upgrades to the system in the past five years. Included in the dike system:
 - The Carrot River dikes run for approximately 39 km (24 miles), from The Pas to the Saskatchewan border.
 - The 34.6 km (21.5 miles) Salt Channel dikes protect the western boundary of the Carrot Valley area.
 - These dikes and the Pasquia River dikes protect about 57,061 hectares (141,000 acres) of residential and farm land, including the Carrot Valley. A temporary, 11 km (6.8 miles) dike was built at Ralls Island in 2005. It was removed after the water receded.

- **Seine River Diversion** – Completed in 1960, the channel diverts flood water from the Seine River into the Red River in the vicinity of St. Adolphe. It significantly reduces the risk of flooding for communities like Ste. Anne and Lorette, as well as residences and farms located along the Seine River.
- **Ste. Rose du Lac** – A diking system was built to protect the town following damage from the 1975 flood. The 1986 flood overtopped these dikes so the federal, provincial and local governments upgraded the existing structures. New dikes and other infrastructure were also built. All the works cost \$2.75 million. They protect against a 100-year flood on the Turtle River.
- The massive storm (also known as a weather bomb) on October 27, 2010 significantly damaged parts of these dikes and caused some flooding and property damage along the south basin of Lake Winnipeg. A Disaster Financial Assistance (DFA) program has been established to help with the repair costs of storm damage to residential properties and municipal structures.
- Additional flood protection along the lake includes the Gimli diversion, which was completed in 1995. The diversion channels take spring melt waters away from the Town of Gimli and the residential and industrial park in the RM of Gimli, including Loni and South Beaches.
- The lake also serves as a reservoir for Manitoba Hydro. The outlet from the lake into the Nelson River and hydro-generating dams has been wide open since July of 2010 to help manage lake levels. Manitoba Hydro has improved the outlet channel capacity by 50 per cent, building 13 km (8 miles) and 3.2 km (2 miles) channel to reduce flood damage to properties around Lake Winnipeg. For more information see www.gov.mb.ca/waterstewardship/licensing/lake_wpg_regulation.html.

Lake Winnipeg

- The lake is the 11th largest fresh water lake in the world. There are numerous seasonal and permanent cottage and beach communities along the south basin and it supports a \$40 million annual fishery.
- In the summer of 1974, approximately 100 km (62 miles) of dikes were built by the Manitoba government and local communities in response to the threat of high Lake Winnipeg levels.
- In 2005, in response to lake levels that were the highest since 1974, several local governments declared states of local emergency. They asked the Manitoba government to help finance the construction of dikes along Lake Winnipeg, to protect against high lake levels and windstorms. Between 2005 and 2007, the Manitoba government invested \$12 million to build 50 km (31 miles) of dikes.

The province works closely with Manitoba municipalities to plan and prepare for potential spring flooding and provided a \$1 million fund to help municipalities with early preparation for 2011 such as cleaning ditches, steaming culverts or building temporary dikes. A \$21 million commitment was also made for the purchase of new and enhanced provincial flood equipment and technology for 2011.

Flood Fighting Equipment for 2011

Manitoba has invested in a variety of flood fighting equipment, ranging from heavy equipment to specialized dikes and water barriers:

- three Amphibex icebreakers
- seven ice-cutting machines
- three Argo amphibious ATVs and six trailers to transport all equipment
- three million sandbags
- three new sandbagging units, making a total of six available sandbagging machines, several municipalities also have their own sandbagging machines
- 30,000 super sandbags
- 43 km (26 miles) of rapid-deployment cage barriers
- 24 additional heavy-duty steamers have been ordered, for a total of 61
- 21 new mobile pumps capable of pumping large volumes of water, bringing the provincial total to 36 units
- 72 km (44 miles) of water filled barriers of which 30 km (18 miles) will be in rapid-response trailers

Manitoba's Emergency Management System

Manitoba has a strong emergency response plan that includes all municipalities and has been well-tested and implemented in previous flood emergencies.

- Manitoba Emergency Measures Organization (EMO) is the provincial government agency responsible to ensure the province has emergency plans, programs and systems that can be applied to identified risks and hazards. These plans and programs are contained within the Manitoba Emergency Plan (MEP).
 - o local and regional training programs
 - o local and regional emergency exercises that test plans for continuous improvement
 - o local emergency operation centres to co-ordinate with the provincial emergency co-ordination centre
- Under *The Emergency Measures Act*, municipalities must have an emergency plan that is approved by EMO. All municipalities now have approved emergency plans and EMO works with all municipalities to ensure they are maintained.
- Manitoba's legislation provides for Emergency Prevention Orders which allow for a more limited set of powers than a State of Emergency Order. They can be used when there is a real possibility that the impact of an emergency or disaster could be reduced or averted.
- EMO, in co-operation with other government departments, has a current Manitoba Emergency Plan (MEP) that covers the co-ordination of all responses to emergencies or hazards in the province. The plan is assessed and updated on an ongoing basis.
- Municipalities are well-prepared to manage emergencies using:
 - o dedicated emergency co-ordinators who work closely with EMO's regional emergency managers
 - o current, effective, provincially-approved emergency plans