Regulation of Water Levels on Lake Manitoba
and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues

A Report to the Manitoba Minister of Conservation

Volume 1
Summary Report
July 2003

The Lake Manitoba Regulation Review Advisory Committee

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Cover Photo:
Looking west along the Fairford River from the Fairford River Water Control Structure.

Executive Summary

The Lake Manitoba Regulation Review Advisory Committee was appointed in 2001, following complaints to the Minister of Conservation with respect to relatively high water levels on Lake Manitoba.

The Terms of Reference developed to guide the Lake Manitoba Regulation Review Advisory Committee are as follows:

- Determine the most acceptable and practicable range of regulation within which the levels of Lake Manitoba might be controlled;
- Decide if it is practicable and desirable to maintain the lake at certain levels during different seasons of the year, and from year to year, and if so recommend specific levels or range of levels;
- Determine the best course of action for water levels along the Fairford River, Lake Pineimuta, Lake St. Martin and the Dauphin River, including the best course of action with respect to the operation of the Fairford Dam; and,
- Examine existing data with respect to the present water quality of Lake Manitoba and compare to historical water quality.

Attempts have been made to regulate Lake Manitoba water levels for about 100 years. In 1961, following a period of very high lake levels, the present Fairford River Water Control Structure (FRWCS) and associated channel improvements were constructed. Since then, Lake Manitoba has been regulated to a target level of 812.17 feet above sea level (ft asl) with a range from 810.87 to 812.87 ft asl. This is a much narrower variation than the historical range of approximately 810.0 to 816.0 ft asl recorded since water level recording began in 1913.

Managing Lake Manitoba water levels within this narrower range has raised concerns from many groups with an interest in the land, shoreline and marshes bordering the lake. These include cottagers, tourist camp operators, First Nations, commercial fishers, ranchers and those concerned with the health of the marshlands and associated wildlife, and with water quality in Lake Manitoba and areas downstream.

Cottagers are divided on the issue of water levels. Those in the south at Twin Lakes Beach and Delta Beach feel that the target level of 812.17 ft asl is too high and contributes to erosion, particularly during storms. These cottagers would prefer a level of 811.5 ft asl, particularly as fall approaches. Due to their location on the lake, these properties are affected by the highest potential wind setup (wind tide) and wave heights on the lake. This is because they are located at the receiving end of the longest fetch, or distance of open water, on the lake.

South basin cottagers north of Twin Lakes Beach as well as those in the north basin want higher water levels. They prefer a target level of 812.17 ft asl or higher to provide easier access to the lake and deeper water for boating and to prevent the growth of weeds. These cottagers are not as affected by wind setup and erosion as those on the south shore.

The Lake Manitoba fishery is the third largest commercial fishery in the province. The opinion was offered that this fishery has not been affected by regulated water levels. However, commercial fishers are very concerned that the FRWCS inhibits the passage of fish into and from Lake Manitoba. They are also concerned, as are all interest groups, with the operation of the Portage Diversion and its perceived effect on lake levels and water quality.

Ranchers are an important part of the regional economy. They rely on the lands surrounding Lake Manitoba and in the Lake St. Martin area for the production of hay and forage. While recognizing that occasional high water levels are good for hay production, ranchers would prefer lake levels in the 811.5 ft asl range beginning in mid to late June, and through the summer to allow for the harvest of native hay.

Wildlife interests have indicated that maintaining a relatively constant water level on Lake Manitoba has resulted in a significant deterioration of the marshlands surrounding the lake. This has reduced the habitat quality to the point where the marshes do not support the waterfowl populations that gave Delta Marsh and the other coastal marshes their world-class designation. Water quality, plant diversity, fish spawning habitat and landforms within the marshes have all been adversely affected.

Marshlands require a water level management regime that reflects the natural wet and drought cycles of the prairies in order to maintain their biodiversity. While lake levels have fluctuated as much as six feet historically (from approximately 810.0 to 816.0 ft asl), most presenters agreed that a return to that amount of fluctuation would be impractical. They granted that a range of fluctuation in the order of three feet would likely be adequate to restore the health of the marshes over time.

All interested parties are concerned with the issue of water quality on Lake Manitoba and downstream, and in particular how the Portage Diversion may impact water quality. There is also a concern that the current water quality monitoring protocol may not be adequate to properly determine trends in water quality in Lake Manitoba. The present collection and analysis of water quality samples appears inadequate to address many of the questions posed to the Committee about spatial and temporal changes in water quality.

The attempts to maintain Lake Manitoba within the target range and the ability of the FRWCS to convey flows through the Fairford River both greater and lesser than they would be under natural conditions has significantly increased the variability of downstream flows and water levels. The variability in water levels has been transferred downstream to Pineimuta Lake, Lake St. Martin and the Dauphin River, increasing both the frequency and severity of flood and drought periods.

First Nations downstream of the FRWCS are affected most by the variability of water levels. High water levels on Lake St. Martin results in many adverse effects on these communities, including direct flooding of low-lying homes.

In the past, cattle ranching was an important part of the regional economy around Lake St. Martin, and remains so on lands located within the RM of Grahamdale. This was based to a large degree on the harvest of the marsh meadows for the production of hay and forage. After the loss of several hay crops in the 1960s due to unexpected high flows late in the season, the Province of Manitoba bought all the privately held land around Lake St. Martin. However, the Province was not able to purchase the land occupied by the three First Nations in this area. Residents state that cattle ranching in these communities has been affected by the reduction in native hay to the point where the industry is no longer a significant activity on First Nation's land.

Low water levels make access to Lake St. Martin difficult and results in damage to the fishery. Low flows along the Dauphin River prevent the upstream movement of whitefish and other fish species for their annual spawning run. Low water levels and reductions in water levels during the winter have caused commercial fishing nets to be frozen into the ice and lost.

The unnatural fluctuation in water levels along the Fairford River, Pineimuta Lake and Lake St. Martin has resulted in a marked deterioration in the marshlands and a loss of wildlife inhabiting these areas. In the early years of the operation of the FRWCS, flooding and drought conditions often occurred within a single year. Rapid changes in water levels during critical nesting periods dramatically decreased the success of waterfowl. These water level changes also decreased the number of muskrats along the rivers and in the marshes.

While Lake St. Martin water levels have varied between approximately 794.5 and 802.8 ft asl since the construction of the FRWCS, the First Nations have indicated that a more desirable range of Lake St. Martin levels is between 797.0 to 800.0 ft asl. One First Nation presenter advocated having minimum flows in the Fairford and Dauphin rivers of 1100 cubic feet per second (cfs).

In response to the majority of the interested parties, the objective of the Committee is to have water levels on Lake Manitoba managed so that levels at the high end of the range will be similar to those reached during the period of regulation, and low water levels similar to those reached under natural conditions before regulation. At the same time, the wide fluctuations in flows and water levels which have been transferred to downstream water bodies and have created severe problems for First Nations and downstream wildlife, fisheries and tourist operators will be reduced.

Therefore, the Lake Manitoba Regulation Review Advisory Committee recommends a water level management regime which should permit Lake Manitoba to fluctuate between 810.5 to 812.5 ft asl over a period of years insofar as this may be reasonably possible, with the expectation that as a result of water level variations, the lake will rise to 813.0 ft asl in some years and drop to 810.0 ft asl in others. Modeling conducted for the Committee by Manitoba Conservation (See Appendix D: Minimal Log Change Model) indicates that it should be possible to achieve this objective in most years while at the same time lowering Lake Manitoba water levels in the fall to reduce shoreline erosion concerns.

The water level on Lake St. Martin should be maintained between 797.0 ft to 800.0 ft asl insofar as reasonably possible. The minimum flow on the Fairford River and the Dauphin River should be 800-1000 cfs insofar as this may be reasonably possible. Modeling conducted by Manitoba Conservation indicated that significant improvements can be made to the downstream water levels both in reducing annual variation and reducing the frequency of both flood and drought periods. It is unlikely that flooding can be eliminated by operational means alone, especially due to extra flow volume added to Lake Manitoba through the Portage Diversion. Therefore, consideration should be given to the construction of additional works which would better enable the control of Lake St. Martin water levels between 797.0 ft asl and 800.0 ft asl.

The Committee recommends that the issue of water quality data collection and analysis be closely examined. Appropriate measures should be taken to collect and analyze water quality on all the lakes and rivers included in this study and steps taken to address and identify water quality issues.

The Committee strongly recommends that an on-going Lake Manitoba Advisory Committee be established to advise the Minister with respect to a wide range of issues regarding the management of Lake Manitoba and downstream interests.

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1.0 Introduction

Prior to human intervention, water levels on Lake Manitoba varied considerably over the long term with alternating cycles of high and low water. High water prevented farmers from harvesting hay from the marsh meadows. Low water reduced the suitability for boat traffic and affected the wildlife available for hunting and trapping. In addition, the effects of wind and waves on the shallow lake accentuated these variations in water levels. Attempts to control this natural regime began as early as the 1890s.

Starting in 1899, an additional channel was dredged at the outlet of Lake Manitoba into the Fairford River, the only outlet from the lake, in an effort to reduce maximum lake levels. This action proved ineffectual. In 1933, a control structure was built on the Fairford River to help prevent lake levels from falling too low, but this structure could do nothing to manage high lake levels and associated flooding.

In 1961, in response to a period of record high lake levels and shoreline flooding in the mid-1950s, the present Fairford River Water Control Structure (FRWCS) and associated channel improvements were constructed. This structure has been used to control both high and low water levels on Lake Manitoba. Since that date, the lake has been managed to a target level of 812.17 feet above sea level.

Managing Lake Manitoba within a reduced range of water levels has raised concerns from many groups with an interest in the land, shoreline and marshes bordering the lake. Some interest groups have expressed the view that the target level is appropriate while others have suggested that it be changed.

Regulating Lake Manitoba within a narrow range requires continually adjusting the outflow of the lake at the FRWCS on the Fairford River. These adjustments have had a pronounced negative impact downstream on Pineimuta Lake, Lake St. Martin and the Dauphin River where the variability in flows and water levels has increased significantly as a result of these adjustments.

Maintaining Lake Manitoba at a relatively constant level has resulted in the significant deterioration of the quality of the marshlands surrounding the lake and a corresponding reduction in wildlife.

1.1 The Lake Manitoba Regulation Review Advisory Committee

In 2001, the Manitoba Minister of Conservation appointed the Lake Manitoba Regulation Review Advisory Committee (the Committee) to review the current regulation of water levels on Lake Manitoba and areas downstream. Committee members were selected from a variety of groups having an interest in the management of Lake Manitoba (Table 1.1).

Table 1.1: Lake Manitoba Regulation Review Advisory Committee

David A. Farlinger, Chair	Winnipeg	Professional Engineer, Energy Consultants International
James Knight, Vice-Chair	Portage la Prairie	Reeve, RM of Portage la Prairie
Ed Anderson	Fairford	Pinaymootang First Nation
Eric Blais	Winnipeg	Hydrologist, UMA Engineering
Maurice Blanchard	Portage la Prairie	President, Lake Manitoba Commercial Fishing Association
Terry Eyjolfson	Steep Rock	Chair, Lake Manitoba Fish Enhancement Committee
Bill Finney	Eddystone	Manitoba Cattle Producers Association
Garry Grubert	St. Laurent	Twin Lakes Beach Cottage Association
Dr.Gordon Goldsborough	Winnipeg	Delta Marsh Field Station, University of Manitoba
James Richardson	Winnipeg	Institute of Wetland and Waterfowl Research, Ducks Unlimited
Myrle Traverse	Winnipeg	Lake St. Martin First Nation

1.2 Terms of Reference

Terms of Reference were developed to guide the Committee in its task. They are as follows:

- Determine the most acceptable and practicable range of regulation within which the levels of Lake Manitoba might be controlled;
- Decide if it is practicable and desirable to maintain the lake at certain levels during different seasons of the year, and from year to year, and if so recommend specific levels or range of levels;
- Determine the best course of action for water levels along the Fairford River, Lake Pineimuta, Lake St. Martin, and the Dauphin River, including the best course of action with respect to the operation of the Fairford Dam; and,
- Examine existing data with respect to the present water quality of Lake Manitoba and compare to historical water quality.

1.3 Overview of Committee Activities

The Committee held more than 20 regular meetings at which it reviewed and discussed the concerns and issues placed before it, heard presentations from a variety of agencies and organizations and evaluated the findings of studies and reports prepared on its behalf. The Committee also conducted a number of inspection tours to examine first-hand many of the issues it was expected to address.

During April 2002, the Committee held public meetings at five locations – St. Martin, Lundar, Eddystone, Amaranth and Portage la Prairie. More than 25 presentations were made to the Committee during these public forums. A complete description of the opinions and concerns presented by the public are included in Volume 2: Main Report.

In addition to the presentations made at the public meetings, a number of technical presentations were made to the Committee at its regular meetings. The general content of each presentation is summarized in Volume 2: Main Report in the sections to which they relate.

Recommendations and conclusions in this report have been based on information gathered at the public meetings, from subsequent communications with interested parties, from presentations made to and studies commissioned by the Committee, tours of the affected areas and from the knowledge and valuable input of the Committee members themselves.

Left: Committee tours Delta Beach

Below, left and right: Public meetings

2.0 Lake Manitoba Drainage Basin

2.1 General Description

Lake Manitoba is the 33rd largest freshwater lake in the world with a surface area of about 4,700 square kilometres (km^2). The lake is 225 kilometres (km) long from north to south and has about 915 km of shoreline. It is divided naturally into north and south basins at the Lake Manitoba Narrows, located approximately half way along its length near the community of Eddystone. Lake Manitoba has water depths averaging about five metres with a maximum depth of about seven metres.

The Lake Manitoba watershed is part of the Hudson Bay Drainage Basin and covers about 79,000 km^2 including much of west-central Manitoba and a portion of east-central Saskatchewan. The Lake Manitoba drainage area has also been referred to as the Dauphin River Drainage Basin, a reflection of the fact that the only outlet for Lake Manitoba is through the Fairford River/Dauphin River system into Lake Winnipeg. In effect, all of the water that enters Lake Manitoba must leave through the Fairford River, except for that portion lost to evaporation from the lake. See Figure 2.1: Lake Manitoba Drainage Basin

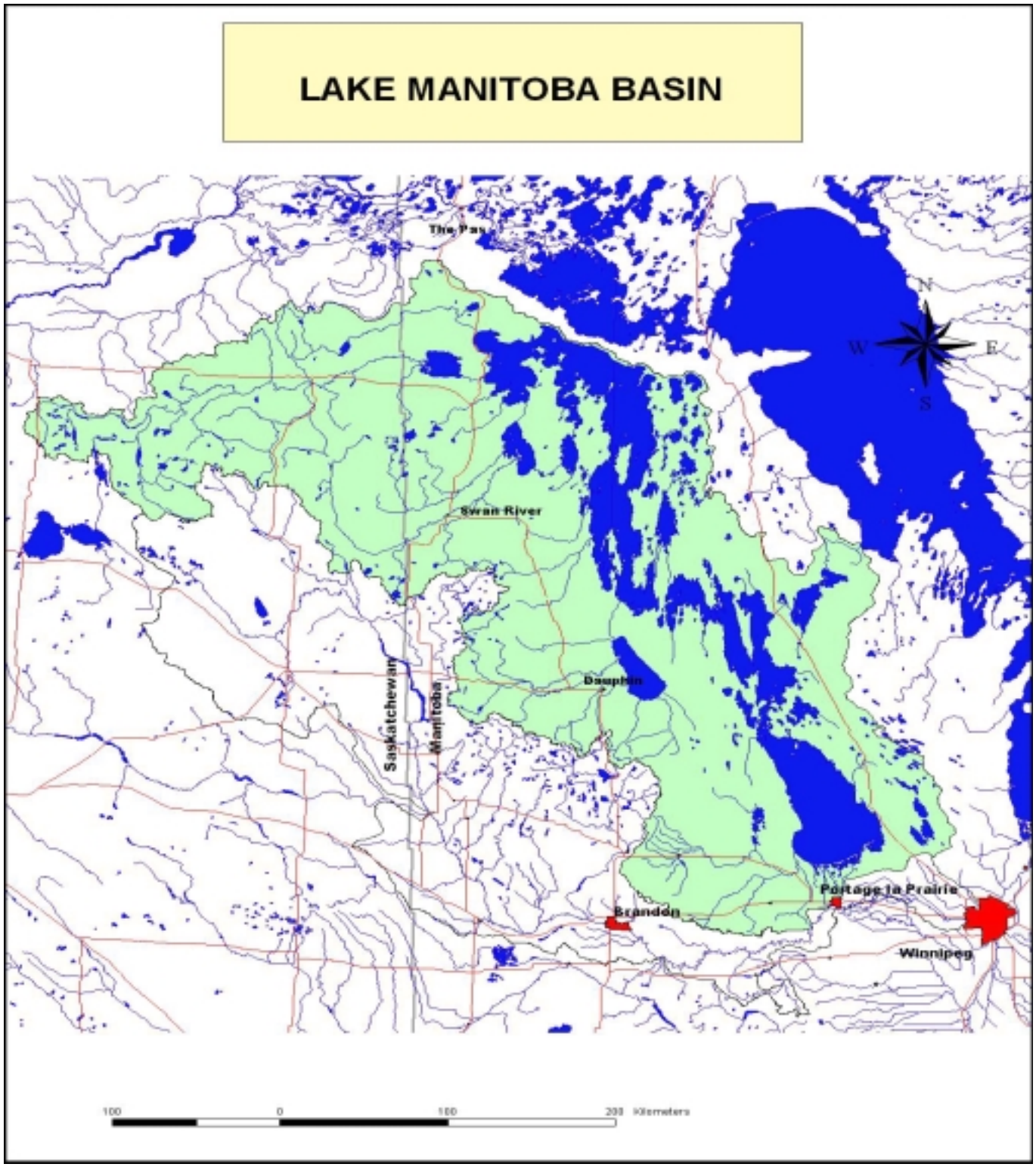
Lake Manitoba drains through the Fairford River at Pinaymootang (Fairford) First Nation, then through the south end of Pineimuta Lake into Lake St. Martin. Pineimuta Lake is a shallow, 39 km^2 wetland complex situated between Lake Manitoba and Lake St. Martin.

Lake St. Martin has a total surface area of approximately 345 km^2 with about 260 km of shoreline. It is comprised of two shallow basins – the larger having a maximum depth of 4.1 metres, the smaller 1.5 metres. Lake St. Martin drains northeastward through the Dauphin River. The Dauphin River is approximately 50 km long, emptying into Sturgeon Bay on Lake Winnipeg.

Land use in the southern and southwestern portions of the basin below the Manitoba Escarpment – from Duck Mountain south – is primarily agricultural with a combination of intense annual crop production and mixed farming. Nearer to the west shore of Lake Manitoba, the emphasis shifts to livestock production, primarily cow/calf operations. Agricultural land use in the Interlake region focuses on mixed farming with an emphasis on livestock, forage and forage seed production.

Throughout the northern portion of the basin – north and west of Lake Manitoba – the landscape is largely in its natural state, except for some mixed agriculture in the Swan River/Birch River area. Cow/calf production is the primary agricultural activity in isolated areas along the northern sections of Lake Manitoba. Forestry activity in the basin revolves around supplying hardwood timber for an oriented strand board plant located in Minitonas.

Figure 2.1: Lake Manitoba Drainage Basin



2.2 Lake Manitoba Regulation

2.2.1 History of Regulation

In the early 1880s, severe flooding around Lake Manitoba lead to a request from local landowners for the federal government to control the lake. This resulted in the excavation of a channel at the outlet of the lake between the years 1899 – 1901. The next major construction adjacent to the Fairford River at the outlet from the lake was instigated to increase water levels following successive dry years in the late 1920s and early 1930s. In 1933, the Province constructed a concrete control dam and timber bridge across the Fairford River immediately downstream of the 1899-1901 channel. This structure remained in place until construction of the current Fairford River Water Control Structure (FRWCS).

The FRWCS was completed in 1961 following a period of excessively high water on Lake Manitoba. The structure was able to control both excessively high and low water levels on Lake Manitoba and was designed to maintain the lake in the range of 810.87 ft asl to 812.87 ft asl (current datum), with a target level of 812.17 ft asl. The operating rules for the structure stated that the lake was to be brought to the target level as quickly as possible.

Below: Fairford River Water Control Structure

In recent years, the Manitoba Water Branch has operated the FRWCS such that the target level is reached over a longer period, resulting in less fluctuation in downstream water levels. The Branch has also been operating to a lower level on Lake Manitoba in the fall to reduce the risk of erosion at the south end of the lake while, at the same time, endeavouring to maintain a minimum flow of 500 cfs in the Fairford River to mitigate negative impacts on the downstream fishery.

Table 2.1: Lake Manitoba Water Levels in feet at Steep Rock.

See also Appendix B: Historic Lake Manitoba water levels

Period	Maxmum water level	Average water level	Minimum water level	Average annual range	Total range for period
Pre-1960	816.25	812.17	809.92	1.40	6.33
1960 - 1999	813.48	811.92	810.36	1.27	3.12
Differences between periods	2.77	0.25	-0.44	0.13	3.21

Table 2.2: Lake St. Martin Water Levels in feet

See also Appendix C, Historic Lake St. Martin water levels

Period	Maximum water level	Average water level	Minimum water level	Average annual range	Total range for period
1960-1998 Observed	802.82	799.01	794.54	3.07	8.28
1960-1998 Calculated Natural	800.29	798.08	795.15	1.65	5.14

Since construction of the FRWCS in 1961, the maximum variation in water levels on Lake Manitoba has been reduced to 3.12 ft between the highest and lowest levels compared to a variation of 6.33 ft prior to 1960 (Table 2.1). Conversely, the variability of Lake St. Martin water levels has increased from a calculated 5.14 ft under natural conditions for the period 1960-98 to a recorded 8.28 ft (Table 2.2).

2.2.2 The Portage Diversion

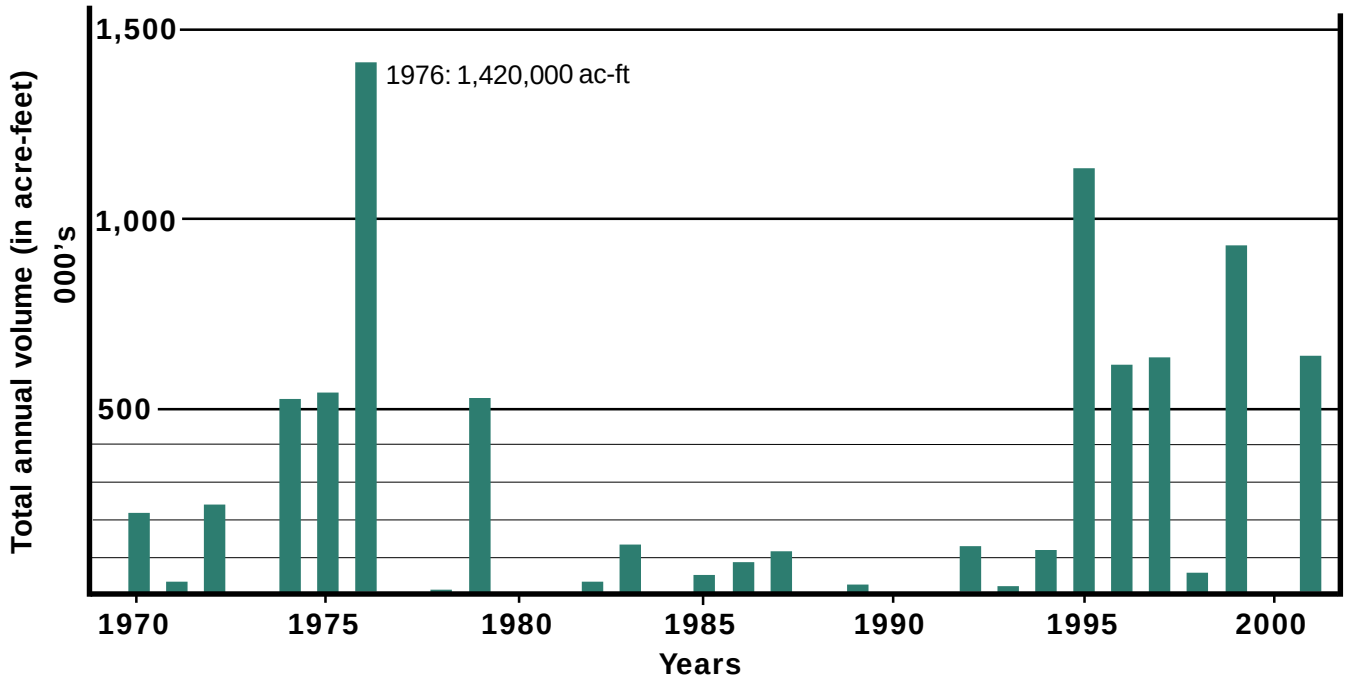
The Portage Diversion is an integral part of the flood control system for the city of Winnipeg. It is designed to convey excess flows on the Assiniboine River into Lake Manitoba near Delta. The Portage Diversion has been used 23 times since its completion in 1970. Concern was expressed at many of the public meetings about the perceived impact of the Diversion on water quality and lake levels.

Below: Portage Diversion at the Assiniboine River

The largest impact of the Diversion on Lake Manitoba occurred in 1976 when 1,420,000 acre-feet (ac-ft) of flow was diverted into the lake (Figure 2.2, page 8). This volume would correspond to a 1.22 ft increase in the water level on Lake Manitoba if all of the water had been retained in the lake. However, as the lake level rises, the outflow through the FRWCS increases, thereby allowing some of this volume to flow out of the lake. The Water Branch estimates that the net impact of the Diversion in 1976 was to add about 10 inches to the lake level.

The average annual volume of water directed into Lake Manitoba through the Diversion over the 33 years of its existence is 246,774 ac-ft. This amount of water would account for a rise in Lake Manitoba water levels of approximately 2.6 inches. This small increase would have little impact on the outflow through the FRWCS.

Figure 2.2: Portage Diversion - Years of Operation and Volumes



2.3 Summary of Previous Studies

2.3.1 Lakes Winnipeg and Manitoba Board - 1958

Following the high lake levels of the mid 1950s, the Lakes Winnipeg and Manitoba Board was established in 1956 as a joint Federal - Provincial Board. Its assignment was to determine what further developments and controls of the water resources would appear to be physically practicable with particular reference to flood control on Lake Manitoba and hydro-electric power generation.

In its 1958 report, the Board recommended construction of the Fairford River Water Control Structure (FRWCS), which was completed in 1961. The range selected for lake level management was from 811.0 ft asl to 813.0 ft asl with a target level of 812.3 ft asl (all in 1960s datum). Subsequently these levels were reduced by 0.13 ft as a result of a survey datum adjustment.

Under these operating rules, flows through the FRWCS were regularly adjusted to bring the level of Lake Manitoba either up or down to the target level as quickly as possible, maintaining a relatively stable level. However, the variability in water levels was transferred downstream to Pineimuta Lake, Lake St. Martin and the Dauphin River resulting in high water and flood damage in some years and extremely low water levels in other years, often accompanied by wide variations within the year itself.

2.3.2 Manitoba Water Commission, 1973

From the beginning of operation of the FRWCS, complaints and concerns were expressed by residents of the region about the regulation of Lake Manitoba within the 810.87 to 812.87 ft asl range (revised datum).

In December of 1968, the Province asked the Manitoba Water Commission to review and identify the most acceptable and practical range of levels within which to regulate Lake Manitoba. In so doing, the Commission was requested to consider the wish of ranchers around Lake Manitoba to regulate the lake to a level of 811.67 ft asl (revised datum).

In December 1973, the Commission released its report. The major focus was on the impact of the operation of the FRWCS downstream on the agricultural, wildlife and fisheries resources on Pineimuta Lake and Lake St. Martin and environs. The study concluded that lowering the target level on Lake Manitoba would reduce the social and economic values of the recreational, wildlife and fisheries resources on and around Lake Manitoba and that the only resource use to benefit from lower lake levels would be agriculture where additional native hay land would be made available.

The Commission recommended that Lake Manitoba continue to be regulated to target elevation 812.17 ft asl with the same range of 810.87 to 812.87 ft asl.

2.3.3 Manitoba Water Commission, 1978

Concerns about the wide fluctuations of water levels on Pineimuta Lake and Lake St. Martin continued and numerous complaints were directed to the Province. In 1977, the Province instructed the Manitoba Water Commission to examine alternatives for managing water levels and solving the related problems downstream of the FRWCS.

A variety of structural water management schemes were examined. While all of the options considered would have had a beneficial effect on water levels in Pineimuta Lake and Lake St. Martin, it was determined that the costs of implementing any of these schemes would out-weigh the benefits accrued.

As a result, the Commission in its 1978 report recommended that no structures should be built downstream from the FRWCS, and that the operation of the FRWCS should be re-examined to determine if marginal adjustments could be made to prevent large sudden changes in water levels downstream. The Commission also suggested it would not be unreasonable to consider mitigation of the financial problems of the users in the Lake St. Martin area affected by water level fluctuations.

Although not phrased as a recommendation, the Commission suggested that there should be an evaluation of a plan in which the entire watershed of Lake Winnipegosis, Lake Manitoba, Lake St. Martin and Pineimuta Lake leading into Lake Winnipeg be considered as one economic unit.

3.0 Findings

The Lake Manitoba Regulation Review Advisory Committee is the most recent government-appointed group to examine the regulation of Lake Manitoba and the impact on the land and water courses downstream of the Fairford River Water Control Structure. Through its investigations, consultations and deliberations, the Committee has become aware of a number of facts or findings related to Lake Manitoba and areas downstream.

Detailed discussion substantiating the development of these findings appears in Volume 2: Main Report.

3.1 Lake Manitoba

3.1.1 Water Levels

a) Attempts have been made since the late 1800s to control the level of Lake Manitoba. These attempts have been in response to events such as high lake levels in the early 1880s, low levels in the 1930s and high water levels again in the mid-1950s.

b) The majority of overland flow into Lake Manitoba is from Lake Winnipegosis through the Waterhen River. During the period 1972 to 2001, the average annual contribution of the Waterhen River to Lake Manitoba volumes was 1.9 million acre-feet (ac-ft). The Whitemud River and local overland flows combined, excluding the Portage Diversion, averaged 257,000 ac-ft. Precipitation contributes about 1.8 million ac-ft directly to Lake Manitoba annually.

c) The Portage Diversion has been operated 23 times since its completion in 1970. The largest contribution of water to Lake Manitoba by the Portage Diversion occurred in 1976, when 1,420,000 ac-ft entered the lake through the Diversion. This would have amounted to an increase in the lake level of 1.22 ft, assuming the Fairford River Water Control Structure had not been in operation. However, the net impact has been estimated to be the addition of about 10 inches to the lake level.

Below: Portage Diversion outlet at Lake Manitoba

Over the 33 years since it opened, the Diversion has contributed an average annual volume of 246,774 ac-ft to Lake Manitoba. This amount of water would equate to 2.6 inches in lake water level.

The Province has recently undertaken structural modifications to the Diversion to reduce any negative impacts that might occur as a result of using it as an irrigation supply channel.

d) The Fairford River is the only outlet from Lake Manitoba. The average annual discharge through the Fairford River (1972 to 2001) was about 2.0 million ac-ft. Water also leaves Lake Manitoba through evaporation, also averaging about 2.0 million ac-ft per year.

Above: Fairford River Water Control Structure

e) The Fairford River Water Control Structure, completed in 1961, was designed to regulate both high and low water levels on Lake Manitoba. Since that date, the lake has been regulated to a target level of 812.17 feet above sea level (ft asl), the long-term average level of the lake with a target range of 810.87 ft asl to 812.87 ft asl.

f) Lake Manitoba level records prior to 1961 may not precisely reflect natural conditions since lake level management efforts began with channel improvements to the Fairford River during the period 1899 to 1901, and the completion of a concrete control structure in December 1933.

g) According to water level records (record-keeping began in 1913), the long-term variability of water levels on Lake Manitoba has decreased since construction of the Fairford River Water Control Structure, while water level variations within the year have increased slightly. The long-term variability since regulation is 3.12 ft as compared to 6.33 ft prior to regulation.

h) Modeling carried out by the Water Branch of Manitoba Conservation (Appendix D: Minimal Log Change Model) indicates that, with relatively minor changes in the operation of the Fairford River Water Control Structure, the lake can be maintained for the most part, within a range of 810.5 to 812.5 ft asl, with the expectation levels will rise to 813.0 and drop to 810.0 ft asl in some years. Downstream problems with respect to low water levels as well as flooding should be mitigated at the same time.

3.1.2 Cottage Owners

a) Erosion damage in 1999 at Twin Lakes Beach has been estimated, by lakeshore property owners in the area, at approximately $1,000,000 to cottages, shoreline protection structures, outbuildings and other structures. While this figure has not been independently verified, it is recognized that substantial windstorm-related erosion damage has occurred to shoreline properties generally, and particularly in the southeast portion of the south basin.

b) Lake Manitoba cottagers are divided in their opinions as to the ideal lake level. Those located in southern-most portion of the south basin – Twin Lakes Beach and Delta Beach – want lower levels, ideally 811.5 ft asl, to reduce property damage from erosion and to provide wider beaches. Cottagers and other recreational interests located in the south basin, north of Twin Lakes Beach, as well as those located in the north basin prefer higher water levels (812.0 ft asl or higher) to provide better access for watercraft and to reduce weed growth.

Above: Erosion damage to Lake Manitoba cottages.

3.1.3 Shoreline Dynamics

a) The shorelines along the south basin of Lake Manitoba are primarily granular in composition. On granular shorelines, the shoreline can migrate both onshore and offshore in response to a change in water level or wave conditions. Any erosion or accretion is recoverable.

b) Conversely, cohesive shorelines – those made up of non-granular material such as clay or glacial till – do not accrete, they only erode. Cohesive shorelines may be characterized by low to steep bluffs along the beach. If the water level increases on a cohesive shoreline, erosion will occur by down-cutting of the foreshore or by undercutting shoreline bluffs. There will be a general, irreversible loss of the beach.

3.1.4 Fisheries

a) While the success of the commercial fishery in Lake Manitoba is not necessarily directly related to water levels, high water can strand fry in pools in streams flowing into the lake when lake water levels drop in late spring.

b) The predominate marketable fish species caught by commercial fishers on Lake Manitoba has changed from whitefish in the late 1800s to pickerel, sauger and perch today. The reason for this change is unclear to the Committee. There has been a large increase in rough fish such as mullet and carp present in the catch. Tulibee catch remains high, although it is not considered a commercial species at this time.

c) The total recorded catch of the commercial winter fishery on Lake Manitoba has decreased from more than six to eight million kilograms per year in the late 1940s to less than two million kilograms in 2002. There are widely varying opinions between commercial fishers and Manitoba Conservation's Fisheries Branch regarding the cause of this decline. The Committee is not in a position to determine the reasons for the decline.

Above: Fairford River Water Control Structure fish ladder, attraction flume.

d) Commercial fishers on Lake Manitoba blame the Fairford River Water Control Structure for negatively affecting the passage of fish and thus, the fishery on Lake Manitoba.

e) The Committee is not aware of an environmental impact study being conducted prior to the construction of the Fairford River Water Control Structure in 1961. It should be noted that such an assessment was not a requirement of Provincial regulations or legislation of the day.

f) Experts with the Department of Fisheries and Oceans, Freshwater Institute in Winnipeg maintain that the design of the fish ladder at the Fairford River Water Control Structure is a state-of-the-art structure. This does not necessarily mean that the same number of fish pass through the structure to Lake Manitoba as did prior to construction of the structure, but simply that the present fish ladder, properly operated and maintained, is the most effective fish passage structure available.

g) To the knowledge of the Committee, there are no operation and maintenance records for the fish ladder in the FRWCS. There is concern that the fish ladder is not being operated and maintained according to its original design.

Above: Many cattle producers rely on marshland hay.

3.1.5 Ranching

a) Ranchers generally prefer lower lake water levels, at or near the current target level of 812.17 ft asl in the spring, dropping to a level of 811.0 to 811.5 by late June to allow access to native haylands along the lakeshore. At the same time, ranchers acknowledge that periodic flooding is good for the land and the native grasses in the marshes surrounding the lake.

3.1.6 Wetlands

a) There are an estimated 236,700 hectares of marshland in the area surrounding Lake Manitoba, Lake St. Martin and Pineimuta Lake. Historically, these wetlands have been valuable to waterfowl as breeding, moulting and migration staging areas, for furbearers such as mink and muskrat and as spawning and nursery areas for fish. In addition, marshlands provide important habitat for songbirds, shorebirds and colonial water birds.

b) The productivity and biodiversity of the coastal marshlands bordering, and connected to Lake Manitoba (including Delta Marsh, officially designated as a "Wetland of International Significance" and a "Heritage Marsh") have deteriorated significantly since lake level regulation began in 1961.

Above: East Meadows Ranch - an example of a Lake Manitoba coastal marshland

c) Delta Marsh has undergone several marked changes since the 1960s. These include decreases in the area of shallow open water, increases in the amount of suspended sediment, decreases in submerged plants, disappearance of emergent plants that dampen the erosional force of wind and waves, proliferation of hybrid cattail and dramatic declines in waterfowl and muskrat populations. These changes are thought to have arisen due to the smaller range of water levels in the marsh due to regulation of Lake Manitoba, and invasion of the marsh by common carp, an introduced fish species.

d) There is consensus among interests concerned with these marshes that larger variations in water levels over the long term than those experienced since lake level regulation began, are required for the health of the marshes and associated wildlife. Water level fluctuations should be nearer to those that occurred under natural conditions prior to regulation – generally a three-foot fluctuation over time, while considerably less than natural, was considered acceptable.

3.1.7 Water Quality

a) Water quality in Lake Manitoba generally falls within the "fair" to "good" regulatory classes, although values for such parameters as total phosphorus and conductivity often exceed values desirable for drinking water, irrigation, or protection of aquatic life.

b) There is wide-spread concern over the operation of the Portage Diversion and its impact on water levels and water quality of Lake Manitoba. However, many of these concerns appear to be based on perceptions rather than factual evidence.

c) There is also concern with respect to the debris that enters the lake through the Diversion and gathers on Delta Beach, as well as the maintenance of the Diversion itself. Many presenters requested that the use of the Diversion be limited to as short a time period as possible.

d) Provincial government calculations indicate that during the years in which it is operated, the Portage Diversion can comprise over half the total phosphorus inputs to Lake Manitoba. While this may threaten lake water quality, the basis of these calculations is not clear and more data analysis may be required. Consequently, the Committee cannot, at this time, fully evaluate the importance of the Portage Diversion as a source of nutrients, sediments, pesticides, debris, and other materials to Lake Manitoba.

e) Water quality in Lake Manitoba has been studied since at least 1928 but more intensively since the 1960s, and especially since 1991. Samples have been collected from over 20 sites in Lake Manitoba, some in the north basin but most in the south basin. The current monitoring program consists of monthly measurements at a single site in the south basin of Lake Manitoba, monthly sampling of the Assiniboine River upstream of the Portage Diversion, and monthly sampling of the Whitemud and Waterhen Rivers.

f) The Committee has not been able to ascertain if the present provincial government water quality monitoring infrastructure on Lake Manitoba is adequate for determining lake-wide trends in water quality.

g) Evaluation of inter-decadal water quality trends is difficult due to improvements over time in methods of measurement, collection of water samples at different sites around the lake at different times, and different lengths of time during which measurements were taken. Therefore, the Committee believes the only data on which it is valid to examine trends over time are those collected year-round at monthly intervals since 1991.

Below: An example of organic debris gathered on Lundar Beach

3.2 Downstream of the Fairford River Water Control Structure

3.2.1 Water Levels

a) The Fairford River Water Control Structure (FRWCS), operated since 1961, has the ability to permit both higher and lower outflows from Lake Manitoba than under natural conditions. The operation of this structure has drastically increased the variation in flows and water levels downstream.

b) Modeling conducted by UMA Engineering for Indian and Northern Affairs Canada has demonstrated that compared to natural conditions:

- Fairford River peak flows have approximately doubled.
- On both Pineimuta Lake and Lake St. Martin, maximum lake levels have increased significantly since the construction of the FRWCS.
- Water levels below 797.0 ft asl occur on Lake St. Martin about twice as often as they would under natural conditions.
- With the present operation of the FRWCS, water levels on Lake St. Martin can be expected to exceed 800.0 ft asl significantly more often than under natural conditions.

Details are presented in Volume 2: Main Report.

c) Since 1960, there have been numerous annual peak water levels on Lake St. Martin that exceeded elevation 800.0 ft asl, the approximate level when flooding occurs. Many of these events exceeded this level by more than one foot and a few by approximately three feet. Under calculated natural conditions, only a few events would have exceeded 800.0 ft asl.

d) The increased variability in water levels is even greater on Pineimuta Lake than on Lake St. Martin. This has had an adverse on wildlife habitat.

e) There is no artificial control on the flow of water from Lake St. Martin into the Dauphin River and large variations of outflow from Lake Manitoba also affects the Dauphin River.

3.2.2 Communities

a) First Nations on the Fairford, Little Saskatchewan and Narrows Reserves, downstream of the FRWCS are affected most with the variability of water levels. As the privately held land affected by flooding was purchased by Manitoba in the 1960s, the First Nations are the only rights holders with shoreline land. High water levels adversely affect many activities in these communities including direct flooding of low-lying homes.

Below:
Lake St. Martin

b) Indian and Northern Affairs Canada indicates that the Federal government has incurred costs of approximately $20 million over the past ten years for short-term flood control and associated activities. This investment has been ineffective in providing a long-term solution to the flooding problem around Lake St. Martin.

c) Widely fluctuating flows through the FRWCS and associated changes in water levels on Lake St. Martin and Pineimuta Lake have resulted in impacts to economic and traditional activities including ranching, fishing and trapping.

3.2.3 Fisheries

a) Low water levels on Lake St. Martin create problems with the whitefish and walleye fishery, including the loss of fish in the winter due to low oxygen levels, and fish becoming trapped in pools in the Fairford and Dauphin rivers and being lost when the pools freeze to the bottom. Low water levels also create boating access problems for residents of the area during the open water season. Low flows in the Fairford and Dauphin rivers can inhibit the annual spawning run.

b) The fishery on Lake St. Martin requires lake levels of 797.0 ft asl or higher to be successful. According to Manitoba Conservation's Fisheries Branch and local fishers, the ideal level is about 799.0 ft asl. In addition, correspondance from the Director of Fisheries to the Deputy Minister of Natural Resources in 1981 indicated that minimum flows of 1000 cfs are also required on the Fairford River to permit successful spawning, particularly the fall whitefish spawn. Changing water levels on Lake St. Martin during the winter fishing season causes great difficulties for fishers such as nets freezing in the lake.

c) Low winter flows were also a contributing factor in the closing of the Dauphin River Fish Hatchery as low flows and dissolved oxygen resulted in several years when significant numbers of the fry in the hatchery perished.

3.2.4 Ranching

a) In the past, cattle ranching was an important part of the regional economy around Lake St. Martin, and remains so on land located within the RM of Grahamdale. This was based to a large degree on the harvest of the marsh meadows for the production of hay and forage. After the loss of several hay crops in the 1960s due to unexpected high flows late in the season, the provincial government bought all the patent land around the lake. The province was not able to purchase the land occupied by the three First Nations in this area.

Above:
Marshland hay

b) Residents state that cattle ranching by the First Nations communities has declined during the regulated period to the point where it is no longer a significant activity.

3.2.5 Wetlands

a) There have been no recent studies of the wetlands surrounding Pineimuta Lake and Lake St. Martin. However, it has been brought to the attention of the Committee that the large increase in annual variation in water levels on these lakes has resulted in significant deterioration in the health of the marshlands and indigenous wildlife.

b) Ducks Unlimited indicated in their submission to the 1978 Manitoba Water Commission that the waterfowl production on Pineimuta Lake had fallen to four per cent of its potential capability and that muskrat populations were also severely affected by the operation of the FRWCS. For example, in the winter of 1975-76, 70 per cent of the muskrat lodges were flooded out in a 30-acre sample area.

c) The problems encountered downstream of the FRWCS are not the same as those in the marshes surrounding Lake Manitoba where stable water levels have affected habitat. On the downstream marshes, wide variations in water levels have reduced the ability of waterfowl and fur-bearing animals to survive and reproduce.

Below:
Lower Fairford Bridge

3.2.6 Water Quality

a) Limited information exists for water quality in the Fairford and Dauphin rivers. No water quality monitoring is currently conducted on Pineimuta Lake and Lake St. Martin.

b) The First Nations blame increased flooding of their lands for problems with potable water quality.

4.0 Recommendations

The Lake Manitoba Regulation Review Advisory Committee respectfully submits the following recommendations to the Manitoba Minister of Conservation.

Lake Levels

1) Lake Manitoba should be managed in a more natural fashion based on the Minimal Log Change Model (Appendix D) developed for the Committee by the Manitoba Water Branch. Utilizing this model, or a refined version, the following operating rules for the Fairford River Water Control Structure (FRWCS) should be applied:

a) Water levels on Lake Manitoba should be permitted to fluctuate between 810.5 and 812.5 feet above sea level (ft asl) over a period of years, insofar as this may be reasonably possible, with the expectation that water levels on the lake may rise to 813.0 ft asl in some years and drop to 810.0 ft asl in others;

b) Any variance in the lake levels outside of the range shall be shared between Lake Manitoba and Lake St. Martin, insofar as this may be reasonably possible;

c) The level of Lake St. Martin should be maintained within a more natural range of 797.0 ft to 800.0 ft asl insofar as this may be reasonably possible, in order to reduce flooding, to provide better access for commercial fishing and recreational interests, to enhance the commercial and sport fisheries, to maintain marshlands in a natural state, to restore the natural aesthetics of the region and to provide for hayland for local ranchers;

d) The minimum flow in the Fairford River should be 800 cubic feet per second (cfs) with a desirable flow of 1,000 cfs insofar as the achievement of both of these flows may be reasonably possible; and,

e) An additional water level monitoring station should be installed on Lake St. Martin nearer the existing communities along the north shore.

FRWCS; Fish Ladder

2) Fairford River Water Control Structure (FRWCS) and Fish Ladder.

a) Operating and maintenance records for the FRWCS and the associated fish ladder should be maintained and made available to the public.

b) Monitoring the condition, and maintenance of, the FRWCS should be conducted on a regular basis.

c) The fish ladder associated with the FRWCS should be operated as per the original design and intent.

d) Maintenance of the FRWCS fish ladder should be carried out on a regular basis.

e) Consideration should be given, in consultation with the Lake Manitoba Commercial Fishing Association, Lake Manitoba Fish Enhancement Committees and Manitoba Conservation Fisheries officials, to the construction of additional fish ladders at such time as the FRWCS is reconstructed, or as deemed appropriate.

Public Initiatives

3) Public Initiatives

a) The Province should work with cottage owners, tourist operators, rural municipalities and First Nations to facilitate and enhance access to Lake Manitoba and Lake St. Martin for swimming and boating and to maintain or enhance the quality of the lakeshore for associated activities.

b) An information delivery system such an Internet website should be developed to provide all stakeholders with historic lake level data and current lake level data on a real-time basis. The site could also provide information related to inflows and outflows including those through the FRWCS, water quality, Portage Diversion operation and other relevant information.

c) Man-made obstructions in outlets connecting marshlands to Lake Manitoba should be removed, where deemed advisable by wildlife experts, to permit the natural flushing action provided by the flow of water between the coastal marshes and their adjoining lakes.

Studies

4) In conjunction with the appropriate partners, the Province of Manitoba should carry out, or cause to be carried out, the studies itemized below. In so doing, due consideration should be given to the insight, Traditional Ecological Knowledge and oral evidence provided by First Nations people and others in regards to the history and management of the lands and resources in the area.

a) Initiate, in concert with the appropriate First Nations, studies to examine means to regulate the outflow of Lake St. Martin and/or Pineimuta Lake into the Dauphin River. The purpose of these studies would be to determine methods of mitigating extreme high and low water levels. Such studies should fully take into account all issues deemed relevant, including the environment, wildlife, fisheries, haylands, downstream and community impacts and social and economic issues.

b) A multi-year scientific study should be carried out to ascertain whether the proposed water level management regime for Lake Manitoba, Fairford River, and Lake St. Martin is successful at reversing the degradation of the lakeshores, coastal marshlands and beaches.

c) Studies should be carried out, in conjunction with the Lake Manitoba Fish Enhancement Committees, to better determine the ability of the current FRWCS fish ladder to pass fish, and to determine methods in which its effectiveness may be improved.

d) An investigation should be conducted into potential methods of reducing the amount of debris being produced and carried in the Portage Diversion channel into Lake Manitoba, and to determine more efficient methods of cleanup along the shore.

e) More thorough analysis of existing water quality data, focusing on trends from 1991 to present, should be carried out. All available sources of data, including remote sensing information from aerial photography and satellite imagery, should be used in this assessment.

f) Thorough mass balance calculations should be conducted to ascertain the relative contributions of the three major channels (Whitemud River, Waterhen River and Portage Diversion) on Lake Manitoba water quality. This may require more data than are presently available. If so, collection of such data should be a priority of a short-term, intensive monitoring program.

g) A critical evaluation of the present water quality monitoring infrastructure on Lake Manitoba and connected waterways should be conducted, with the objectives of determining: how many sites are needed to adequately assess lake-wide differences in water quality; how frequently samples should be collected; whether samples collected in the Assiniboine River are representative of water quality conditions in the Portage Diversion during periods of high flow; and whether Lake Manitoba water quality measurements adequately represent those in downstream areas, including the Fairford and Dauphin Rivers, and Pineimuta Lake and Lake St. Martin. This evaluation should involve an intensive water quality monitoring study, with samples collected at numerous sites at regular intervals over a period of at least two years.

5) Portage Diversion

Portage Diversion

a) The use of the Portage Diversion should be restricted to those periods of time and flows which are absolutely necessary to protect downstream interests along the Assiniboine River and in Winnipeg. The operating rules of the Portage Diversion should be re-examined, with the objective of asserting its primary function as a short-term flood protection work, and to minimizing its discharge of nutrients, sediments, debris, and other materials into Lake Manitoba.

b) Clean-up of debris deposited from the Portage Diversion onto Delta Beach and other affected areas each spring the Diversion is operated should be carried out in a timely fashion.

Lake Manitoba Advisory Committee

6) The Lake Manitoba Regulation Review Advisory Committee is of the opinion that the best decisions are reached when all those impacted are involved in the consensus-building process. In that regard, the Committee recommends the establishment of an on-going Lake Manitoba Advisory Committee with representation from all interest groups associated with the Lake Manitoba basin, as well as interests downstream of the Fairford River Water Control Structure. This Committee should be financially supported by the Province of Manitoba and include representation from agriculture, fisheries, First Nations, cottage owners from both basins, other recreation interests, wildlife proponents and other rights holders as the Province deems appropriate.

The Committee's terms of reference should include, but not necessarily be limited to the following:

a) To establish and maintain an on-going dialogue with local interests, municipalities and the Province regarding the management of Lake Manitoba, Pineimuta Lake, Lake St. Martin and the Fairford and Dauphin rivers, to solicit, as required, public input related to these concerns, and to communicate with the public on a regular basis;

b) Communicate with the Minister on an on-going basis with regard to water levels on Lake Manitoba, Pineimuta Lake and Lake St. Martin, including the operation and maintenance of the Fairford River Water Control Structure and the associated fish ladder, and to recommend appropriate seasonal flows to be maintained in the Fairford and Dauphin rivers insofar as this is reasonably possible;

c) Advocate long-term monitoring and research on water levels and the health of Lake Manitoba, Pineimuta Lake and Lake St. Martin, including coastal marshlands along these water bodies, to be carried out by the appropriate agencies and report on the results annually to the Minister. This should include all aspects of water quality, fisheries, wildlife, agriculture, recreation, shoreline erosion, marshland rejuvenation, impacts on First Nations and other communities, and such other matters as deemed advisable by the Committee or by the Minister;

d) Investigate, and if considered advisable, recommend remedial projects to enhance all aspects of the general health of the lakes, associated marshlands and associated resources and resource uses, as outlined in section (c) above. In this regard, the Committee shall actively encourage jointly funded private sector/government projects;

e) To appoint a member of the Lake Manitoba Advisory Committee to the Portage Diversion Advisory Committee to ensure that Lake Manitoba interests are taken into consideration in the operation of the Diversion, and

f) To provide other guidance to the Minister as may be deemed appropriate.

g) To facilitate the work of the proposed Lake Manitoba Advisory Committee, all documents collected and commissioned by the Lake Manitoba Regulation Review Advisory Committee should be collected and maintained on file as a source of information and reference.

h) In order to accomplish the above, the Province and the Lake Manitoba Advisory Committee should work in concert, taking full advantage of the knowledge and expertise developed in the existing Lake Manitoba Regulation Review Advisory Committee.

Appendices

A: Imperial/Metric Conversions
B: Historic Lake Manitoba Water Levels
C: Historic Lake St. Martin Water Levels
D: Minimal Log Change Model

Appendix A: Imperial/Metric Conversions

Distance

1 inch (in.)= 2.54 centimetres (cm)	1 cm = 0.39 in.
1 foot (ft) = 0.3048 metre (m)	1 m = 3.2808 ft
1 mile (mi.) = 1.62 kilometre (km)	1 km = 0.621 mi.

Area

1 acre (ac) = 0.405 hectare (ha)	1 ha = 2.471 ac
1 square mile ($mi.^2$) = 2.59 square kilometre km^2	1 km^2 = 0.386 $mi.^2$

Volume

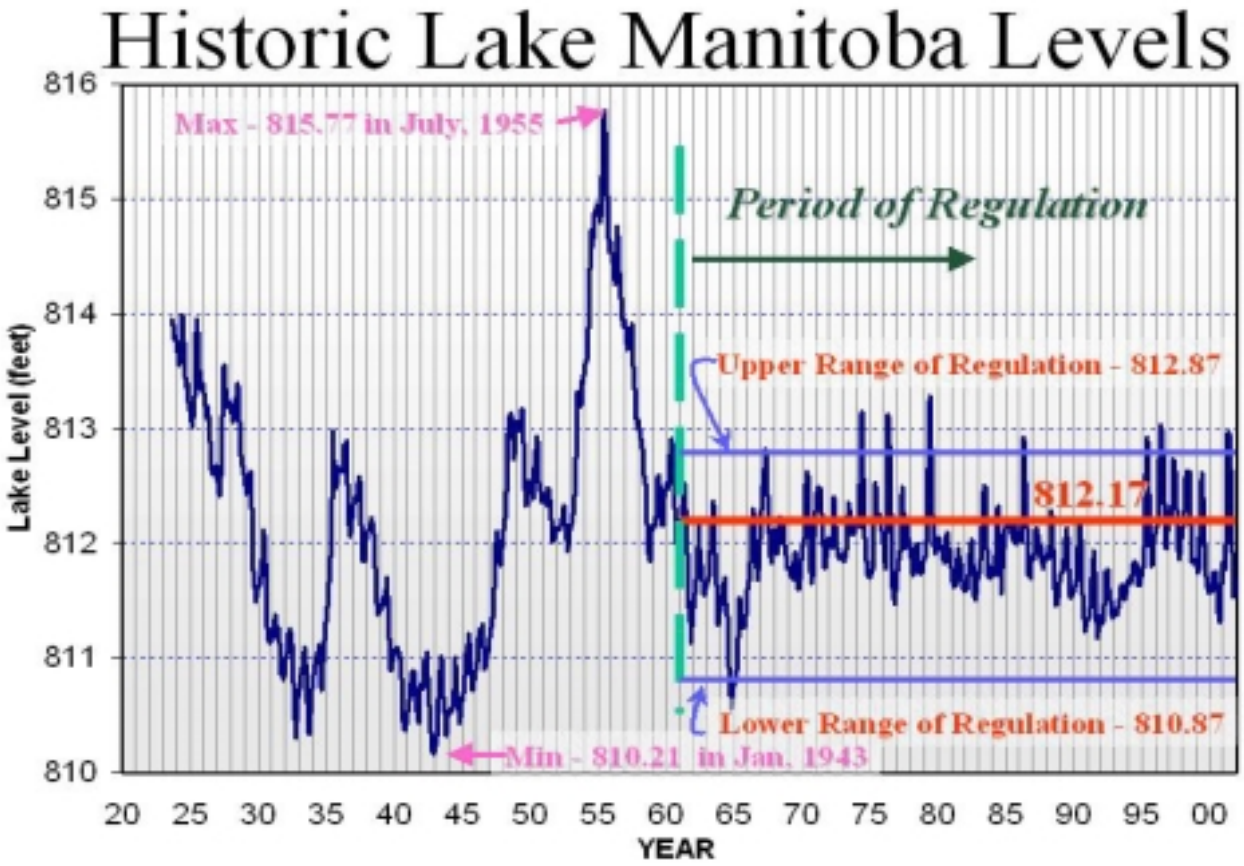
1 acre-foot (ac-ft) = 1.2335 cubic decametres (dam^3) 1 dam^3 = 0.8107 ac-ft

Flow Rate

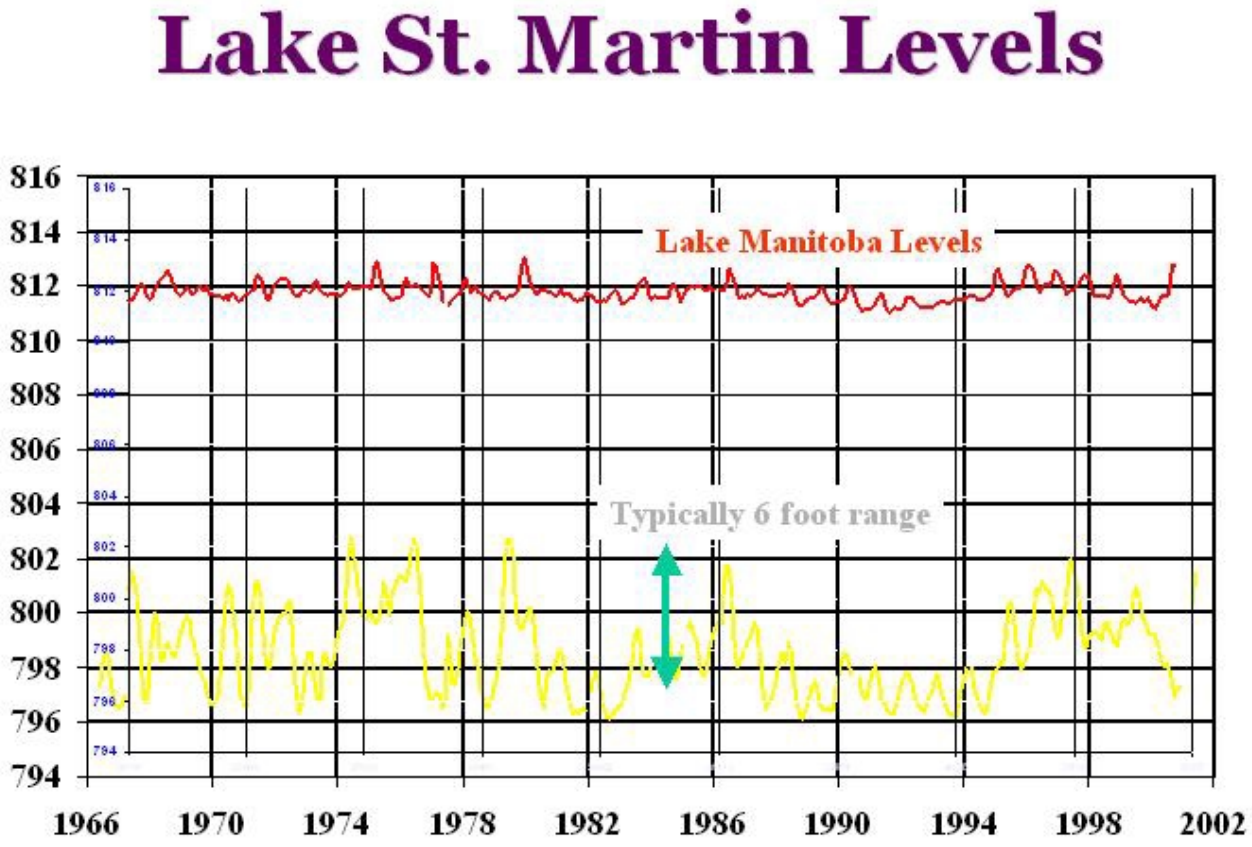
1 cubic foot per second (cfs) = .0283 cubic metres per second (m^3/s)
1 m^3/s = 35.315 cfs

Appendix B: Historic Lake Manitoba Water Levels

(Steeprock)



Appendix C: Historic Lake St. Martin Water Levels



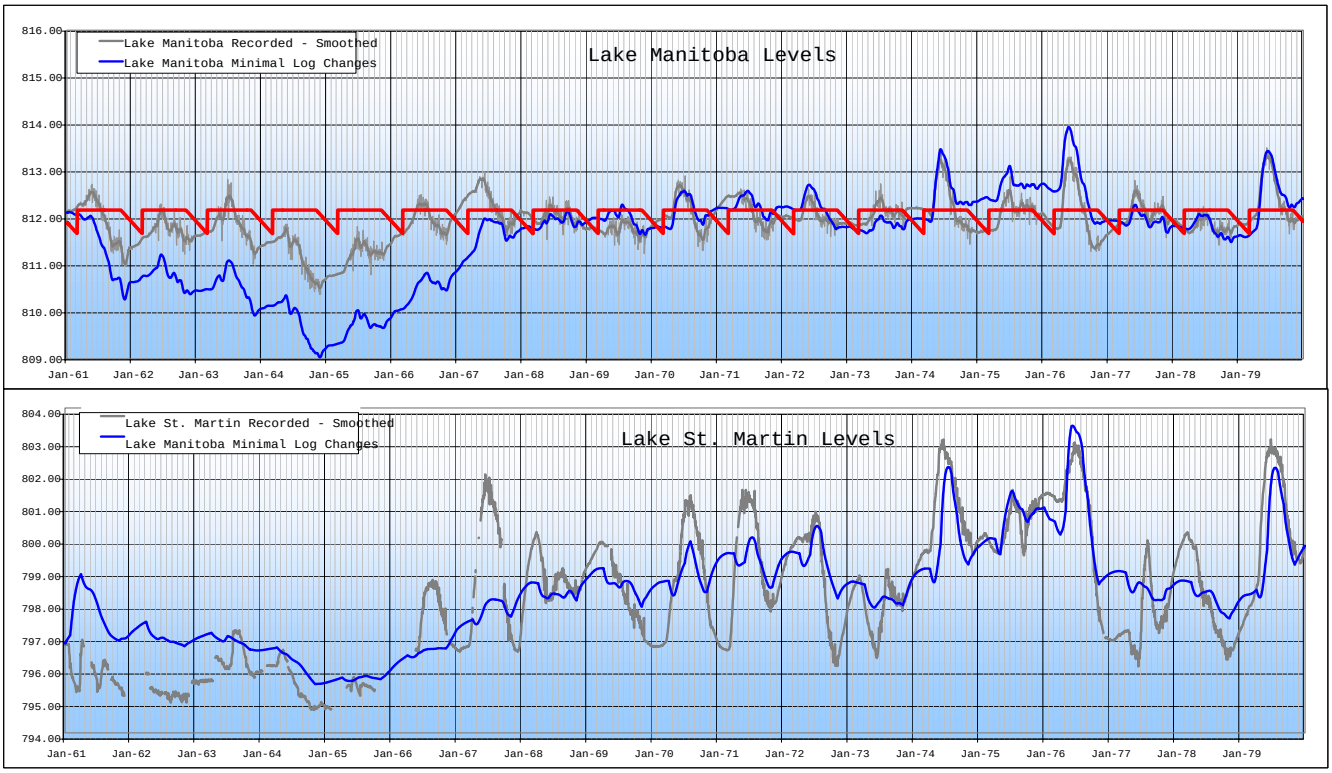
Appendix D: Minimal Log Change Model

Manitoba Conservation's Water Branch conducted a series of water level modeling simulations on behalf of the Lake Manitoba Regulation Review Advisory Committee. Graphs displaying the results of the Minimal Log Change Model for Lake Manitoba and Lake St. Martin are presented on the following pages.

Under the Minimal Log Change regime, there are no target levels for water levels on Lake Manitoba and Lake St. Martin. Rather, water levels are generally maintained between 810.5 to 812.5 feet above sea level (ft asl) on Lake Manitoba with the expectation that water levels will occasionally reach 810.0 ft asl or lower on the low side, and 813.0 ft asl or higher on the high side. Water levels on Lake St. Martin will generally be managed between 797.0 and 800.0 ft asl. When both lake levels are within the specified ranges, flow through the Fairford River Water Control Structure (FRWCS) would be maintained at 50 per cent of capacity.

If Lake Manitoba is below its range (below 810.5 ft asl) or if Lake St. Martin is above its range (above 800 ft asl), flows through the FRWCS would be set to the specified minimum. If Lake Manitoba is above its range (above 812.5 ft asl) or if Lake St. Martin is below its range (below 797.0 ft asl) flows through the FRWCS would be increased based on the current procedure.

The minimum outflow through the FRWCS is 800 cubic feet per second, except when Lake Manitoba water levels are too low to produce that amount of outflow.


Lake Manitoba Recorded - Smoothed
Lake Manitoba Minimal Log Changes
Lake Manitoba Levels
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Lake St. Martin Recorded - Smoothed
Lake Manitoba Minimal Log Changes
Lake St. Martin Levels
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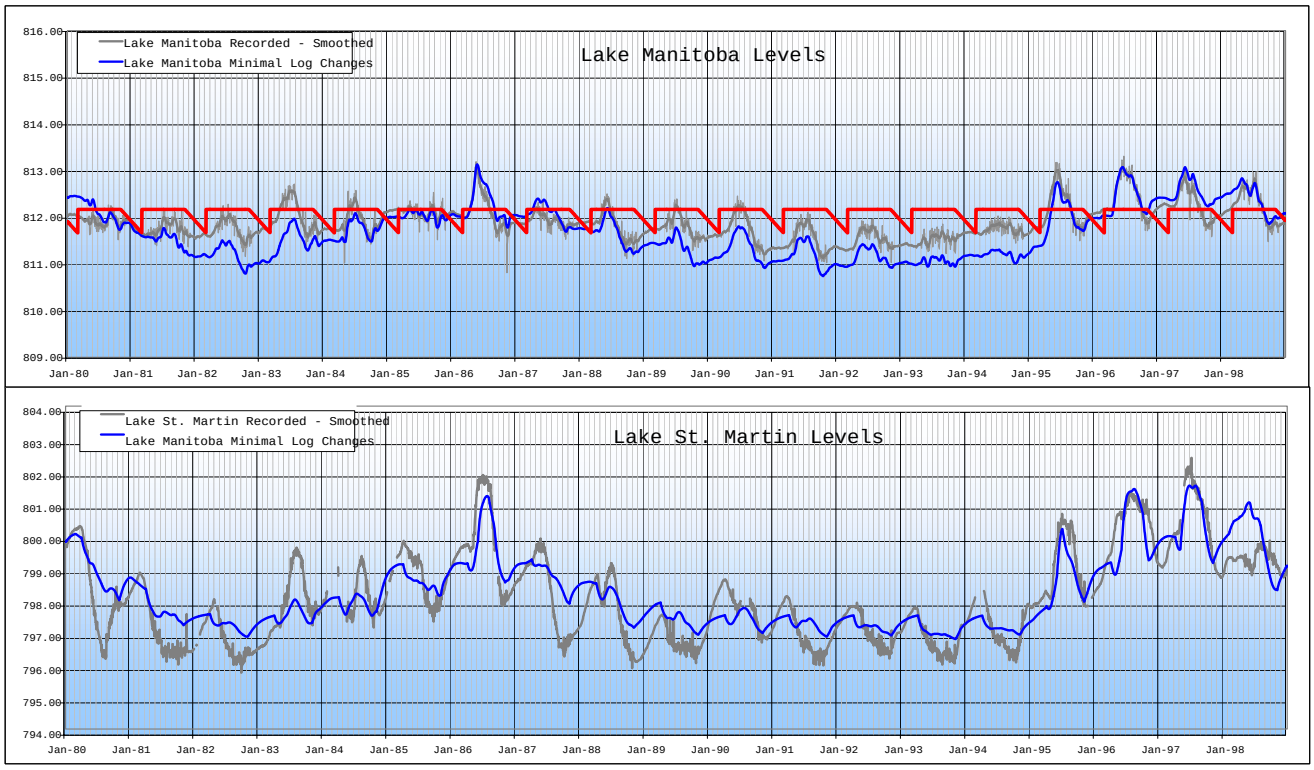
Lake Manitoba Recorded - Smoothed
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Lake St. Martin Recorded - Smoothed
Lake Manitoba Minimal Log Changes
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