Provincial Flood Control Infrastructure

REVIEW OF OPERATING GUIDELINES

A REPORT TO THE MINISTER OF MANITOBA INFRASTRUCTURE AND TRANSPORTATION

August 2015


DUCK MOUNTAIN
FOREST RESERVE
LAKE WINNIPEGOSIS
ELEV. 830
CONTROL (PROPOSED)
FAIRFORD CONTROL WORKS
LAKE DAUPHIN CONTROL
SHELLMOUTH RESERVOIR (PROPOSED)
RIDING MOUNTAIN NATIONAL PARK
LAKE MANITOBA
ELEV. 812
ELEV. 713
LAKE WINNIPEG
BELAIR FOREST RESERVE
DIVERSION FROM SOUTH SASKATCHEWAN (PROPOSED)
POTENTIAL IRRIGATION
PORTAGE FLOODWAY
LAKE MANITOBA SUPPLY CANAL
LOCKPORT
RED R.
WHITESHELL FOREST RESERVE
RIVERS RESERVOIR
GRAVITY SUPPLY CANAL (ASSINIBOINE)
BRANDON
PORTAGE
WINNIPEG
RED RIVER FLOODWAY (PROPOSED)
ASSINIBOINE R.
CROMER RESERVOIR (PROPOSED)
AK LAKE CONTROL (PROPOSED)
PUMPING STATION (PROPOSED)
GRAVITY SUPPLY ASSINIBOINE
SEINE RIVER DIVERSION
STEPHENFIELD RESERVOIR (PROPOSED)
POTENTIAL IRRIGATION
CANAL
RED RIVER
SPRUCE WOODS FOREST RESERVE
LAKE STORAGE (PROPOSED)
GRAVITY CANAL
ST. MALO RESERVOIR
NORTH-WESTANGLE FOREST RESERVE
ANTLER RESERVOIR (PROPOSED)
DELORAINE RESERVOIR (UNDER CONSTRUCTION)
TURTLE MTN. RES.
MORDEN RESERVOIR
PEMBINA RESERVOIR (PROPOSED)
SUPPLY PEMBINA
U. S. A.
PEMBILIER RESERVOIR (PROPOSED)
U. S. A.

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ACKNOWLEDGEMENTS

While much of the work in this report is technical in nature, that work can only be guided and have meaning within a human context. In this respect the Panel is deeply grateful to the large numbers of people who freely gave their time and provided the Panel with the benefit of their experience and knowledge. The Panel would like to acknowledge the work of David Faurschou and Marr Consulting, the participation of municipal governments, First Nations, producer associations, provincial staff, those people who provided excellent advice at the Panel's roundtable sessions and the many members of the public who took the time to attend open house sessions. The Panel also thanks the staff of the department for providing access to historical documents and technical support, and for attending the open house sessions.

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APPENDICES

1 FLOOD CONTROL INFRASTRUCTURE MATTERS

Manitoba sits at the bottom one of the world's great water basins. It extends from the Rocky Mountains on the west, approaches the Great Lakes on the east, and stretches 500 kilometres to the south – an area nearly the size of Western Europe.

It is not surprising, therefore, that some of Canada's most severe floods have occurred in southern Manitoba. Literally in our backyards and forming part of our collective history.

We would all be better off a little higher and further back from danger. But people love to live near water. And our pattern of settlement and land use means that flood control/flood management is a continuing and essential part of our common environment. We can't stop floods but we can take measures to reduce risk and to reduce property damage.

The flood control system of southern Manitoba encompasses a system of major flood control structures, hundreds of kilometers of dikes, community ring dikes and flood protection for individual homes raising them to safe flood protection levels. While not without controversy this flood control system has served Manitoba well.

In some respects we have been very successful. For people in Winnipeg, flooding can be mostly a media event thanks to the Red River Floodway. Most Winnipeg residents read about it but no longer experience the devastating effects. In the 2011 "flood without precedent", there was very little property damage in the Red River Valley where measures have been taken since the "flood of the century" (1997) to build higher and protect with dikes. Other parts of the province were not so fortunate. Thousands of acres of farmland went under water, bridges and highways were destroyed and people's cottages and homes around Dauphin Lake, Lake Manitoba and Lake St. Martin were severely damaged and in many cases destroyed. People are still dislocated from that event and many are deeply scarred. And just when we thought we wouldn't have to worry about events like 2011 for years to come, the 2014 flood set new records for peak flows, damaging agricultural interests in western Manitoba and the Lake Manitoba basin, and damaging structures and infrastructure.

By some measures, floods are nature's most destructive force; moreover these are recurring events. We need to find a way to live with them because we will experience more.

We have engaged in land use planning with a better understanding of flooding and we have moved dwellings to higher flood protection levels. To complement those measures we still need flood control infrastructure – major capital works that keep floodwaters within banks and/or diverted to where it will do the least damage.

Major works – including the Red River Floodway, Portage Diversion and Fairford River Water Control Structure – were all built in the 20 years following the 1950 flood. They were designed using hydrological information collected in the period post-1910 and supplemented by anecdotal evidence (a 40- to 50-year record). Our current hydrological database and the availability of computer models has grown by an order of magnitude since these structures were designed. We have also come to understand through practice that a balance of interests must be achieved in the operation of these

structures. We have experienced several major floods in the last 10 years and acquired a greatly enhanced analytical ability. The operating rules, however, have been in place with minor modifications since these structures were built. The Panel to conduct the Review of Operating Guidelines was put in place by the government of Manitoba and charged with conducting a review of the operating rules[1] associated with these structures.

The Panel considered opinions provided by the public over a series of earlier studies, at meetings with local governments and First Nations, technical analysis of alternative operating regimes, and public comment at open houses. The Panel undertaking this work also has had the benefit of a number of concurrent studies and the experience of the devastating 2011 and 2014 floods.

Difficult Choices

Operation of flood control structures can require difficult choices. In major flood events, the commitment to minimize overall flood damage can adversely affect one area to prevent much greater damage elsewhere. There are competing demands and priorities.

A large percentage of the province is affected in some way by the operation of these structures. This includes residents of Winnipeg, residents upstream and downstream of the Red River Floodway, populations along the Assiniboine River, and residents on Lake Manitoba and downstream through Lake St. Martin to Lake Winnipeg. This is a diverse population that includes urban centres, agricultural interests, seasonal and permanent residents, First Nations and municipal governments. Many benefit from the operation of the structures, but some are left unprotected or even adversely affected.

[1] *The term "rules" is often used to describe what are clearly "guidelines" under The Water Resources Administration Act. The Panel recommends in a later chapter that the term "rules" be dropped and "guidelines" be used.*

This review is specific to the operation of the structures. The Panel recognizes there are many flood-related issues that are important to Manitobans. The Panel, however, has considered these issues only as they relate to the flood control structures and their operating guidelines.

While the flood control structures under review are dispersed over a wide geographic area and affect a wide range of communities and interests, the Panel encountered several overarching and recurring themes:

- flood control as a system;
- the benefits of flood control overshadowed by discussion of adverse effects;
- difficult choices arising from competing interests;
- artificial vs. natural flooding, financial assistance and compensation;
- communications; and
- impacts from operation.

Certain issues required particularly in-depth review and discussion:

- Lake levels of Lake Manitoba and Lake St. Martin and the role of the Portage Diversion; and
- Non-spring operation of the Floodway.

The general findings of the Panel are:

- With respect to the operations of the Fairford River Water Control Structure (FRWCS), the Panel notes that these operations were reviewed in 2003 and 2013, and recommends only minor changes regarding frazil ice are required respecting operating guidelines.
- With respect to the Lake St. Martin Emergency Outlet Channel (LSMEOC), the Panel notes the LSMEOC has provided significant water level reductions for Lake St. Martin and has made a number of recommendations.
- With respect to the operation of the Red River Floodway, the Panel has made recommendations related to application of the operating guidelines and other issues. The Panel has recommended against non-emergency summer operation of the Floodway. The objection to summer use of the Floodway by upstream residents is well understood and not unreasonable. Pursuing summer use of the Floodway requires dealing with those objections by means other than compensation – it requires developing a common vision of our waterways.
- With respect to the Portage Diversion, the Panel notes this is the only flood control structure that has not been subject to an earlier review of operations though it has been the subject of intense interest and public comment. Lake Manitoba levels have been high over the last 10 years and Lake Manitoba residents have been subjected to two significant floods. The Portage Diversion is seen by residents as contributing significantly to flooding problems, shoreline erosion, water quality deterioration, and other issues. The Portage Diversion, however, is also part of a system that includes the outlet from Lake Manitoba (the Fairford River Water Control Structure). The Portage Diversion cannot be taken out of operation without serious implications for the lower Assiniboine River and Winnipeg. The core problem over the last few years has been too much water. There is no solution that will satisfy all of our interests. The Panel has proposed a revised set of operating guidelines for the Portage Diversion that may lessen the burden on Lake Manitoba. The Panel also has suggested that the government of Manitoba conduct a study on how to improve the financial assistance provided to Lake Manitoba residents for damage to structures and agricultural losses under specific circumstances where the Portage Diversion has to be used to prevent catastrophic damage on the lower Assiniboine River and where, this action result in significant flood damage on Lake Manitoba.

Analysis leading to these recommendations is found in Chapters 11 and 12. A summary of recommendations is provided in Chapter 13.

The issues considered in this report are of particular interest to those who see themselves as adversely affected by flood control structures. To understand these concerns and to arrive at conclusions and recommendations the Panel has relied on technical analysis of the operation of these structures and extensive consultation with those affected. The challenge for the Panel has been to present technical detail in a way that might be easily understood. In the end, given the serious nature of the concerns, the decision was taken to present a reasonably full account of the entire analysis. This makes for a more difficult read, but better reflects the deeply held convictions of those who attended public consultations or made presentations to the Panel.

2 TERMS OF REFERENCE AND APPROACH

The government of Manitoba appointed a three-member Panel to review the operating rules and guidelines of three flood control structures in southern Manitoba and to identify potential revisions to those operating rules. The structures considered in the review include the:

- Red River Floodway
- Portage Diversion
- Fairford River Water Control Structure

In addition, the Panel was asked to consider the Lake St. Martin Emergency Outlet Channel (LSMEOC), which was built in 2011 to relieve flooding on Lake St. Martin. Operation of the Shellmouth Dam was excluded from this review.

The Terms of Reference required the Panel to review and respond to the concerns raised by the public, and to consider these concerns in their review of the operating guidelines. While public input was to be considered, the review has a large technical component and recommended guidelines were to reflect the fact that the overall purpose guiding operation of the control structures is to minimize flood impacts.

Recommended operating guidelines for the Portage Diversion and the Fairford River Water Control Structure were to be considered interim in nature, reflecting the realities of the current network of flood control structures. New structures have been announced or are expected as a result of the Assiniboine River and Lake Manitoba Basins Flood Mitigation Study. Operating guidelines for the Portage Diversion and Fairford River Water Control Structure cannot be finalized until the new or upgraded infrastructure is designed and constructed.

Specific objectives of this review were to:

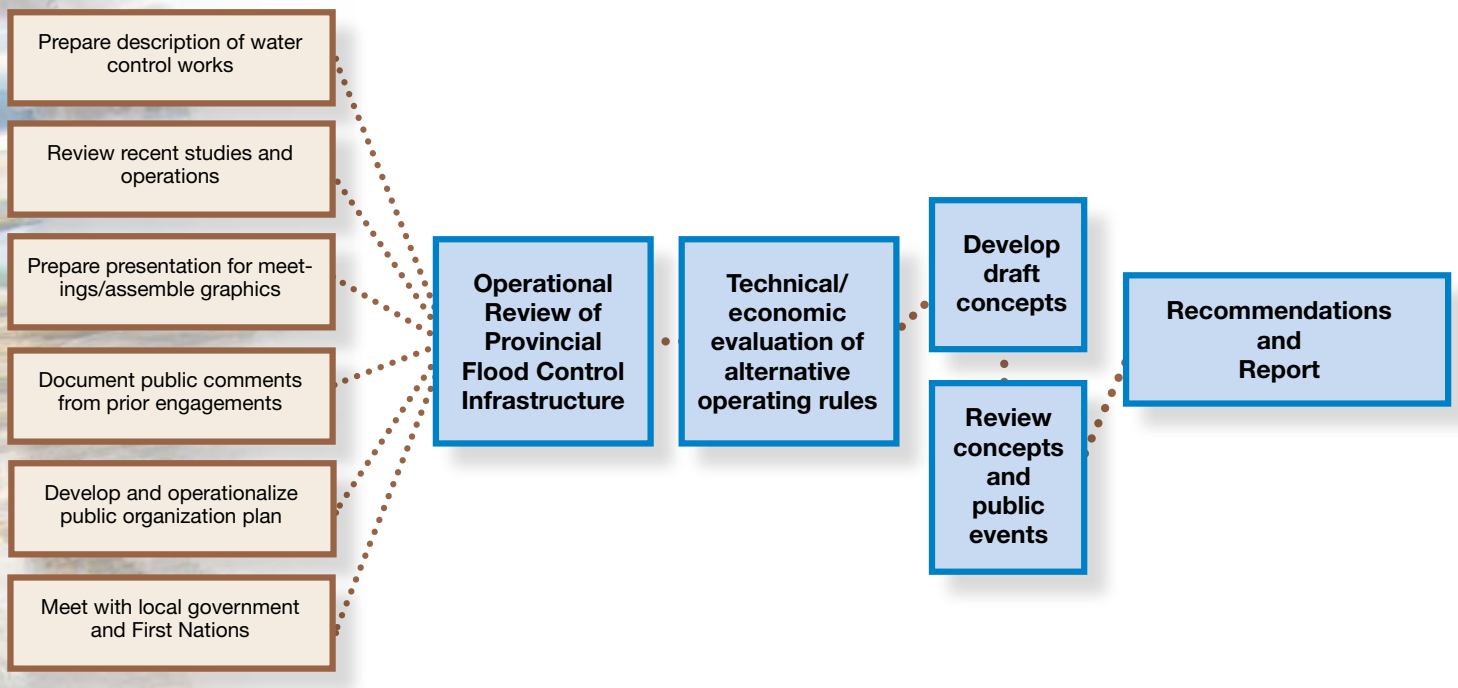
1. Review operating rules for the Red River Floodway.
2. Review operating guidelines for the Portage Diversion, Fairford River Water Control Structure, and Lake St. Martin Emergency Outlet Channel (LSMEOC).
3. Engage with the public, stakeholders, First Nations and local governments to identify questions and concerns about the operation of these flood control structures, and provide an independent summary response to the issues raised.
4. Improve public understanding of these flood control structures and how they are operated as part of a system of provincial flood control structures.

The complete Terms of Reference are presented in Appendix A.

2.1 Review Process

The Panel's approach to this work is set out in the schematic below.

Figure 1 – Review Process



In addition to the significant public engagement required by the Terms of Reference, the Panel completed a detailed review of several reports concerning these structures undertaken over the last 10 years, many of which included public engagement. This review of prior public comment was one of the Panel's first steps in preparing this report. The Panel also reviewed newspaper articles from the late 1950s and early 1960s when these projects were being intensely debated.

These prior public reviews and technical reports included:

- *Assiniboine River and Lake Manitoba Basins Flood Mitigation Study* (interim findings, December 2014)
- *Surface Water Management Strategy* (2014)
- Manitoba 2011 Flood Review Task Force Report (2013)
- *2011 Flood: Technical Review of Lake Manitoba, Lake St. Martin and Assiniboine Water Levels* (2013)
- *Lake Manitoba/Lake St. Martin Regulation Review* (2013)
- *RM of Ritchot Artificial Flooding Study (Manitoba Floodway Authority,* 14-08601-001-W01, August 2012)
- *Red River Floodway: Public Consultation on the Rules of Operation* (2010)
- *Red River Floodway Expansion: Report on Public Hearing (Manitoba Clean Environment Commission*, 2005)
- *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues* (2003)

The purpose of the Portage Diversion and Red River Floodway is to provide flood protection for Winnipeg. The Panel accepted this purpose as an underlying premise to its work. However, there have been substantial changes to the landscape and our knowledge has increased since these structures were built: an additional 50 years of hydrological data is available; there has been a marked change in land use; and there have been additional flood mitigation measures undertaken throughout much of southern Manitoba. The Panel's work focussed on how these structures were operated as a system to achieve that underlying purpose, what has been the effect of those operations, and whether there are alternative operating guidelines that would provide a better balance of interests.

2.2 Public Engagement

Manitobans have participated in a number of consultation activities examining flood control structures over the last decade or more. Reports from those processes have included the comments, concerns and ideas shared during the consultations. Many of these focussed on impacts believed to be associated with the control structures, but some comments related to operating rules and guidelines. One of the first steps in the review was to summarize what was said previously. The results are woven throughout this report and presented in full in the "What You Told Us Previously" section of the Public Consultation Report (see Appendix E).

Public engagement was initially undertaken by the Panel through meetings with elected officials and administrators of affected and interested rural municipalities and First Nations. These meetings took place after the Panel completed their initial research. A website was established to provide background information and a means by which the general public could submit comments. In January 2015, following the formulation of initial concepts, the Panel hosted public open houses in six locations to share these concepts and solicit responses from the public. These included Q&A sessions at each location.

The results of the public engagement process appear in several places in this document. Each chapter for the reviewed control structures includes a summary of comments regarding operating rules and guidelines and the impacts of operation. Specific feedback on the possible changes to operating guidelines that were presented at the January 2015 open houses is summarized in Chapter 10. The full consultation report is included as Appendix E.

2.3 Presentation of this Report

The intended audience for this report is the general public. Engineering reports and knowledge, scientific studies, environmental assessments and other research have been considered in the work of the Panel. Equally important, the Panel has taken into account the opinions, information and experiences of people affected by the operation of the flood control structures.

In developing their recommendations, the Panel recognized that understanding the past, present and potential future implications of these structures was important to guide the review. This context includes the historic rationale for the construction of the flood control structures, the evolution of the operating rules and guidelines, and the impact that those operating decisions have had and may have in the future.

The Panel believes it is important for the public to know the basis for its recommendations. Knowledge and understanding by all stakeholders will enhance future discussions and decision-making, and will contribute to an ongoing and productive dialogue on a topic that affects most Manitobans. Chapters 3 and 4 provide an overview of Manitoba's flood control system and operating guidelines in general. Important background on each of the structures considered in this review is presented in Chapters 5 through 8.

Chapters 9 through 13 provide the deliberations of the Panel, beginning with review criteria. Potential changes are introduced in Chapter 10. The next chapter discusses issues relating to the Panel's potential guildine changes and recommendations. Conclusions and recommendations respecting operating guidelines and other recommendations are presented in Chapter 12. Finally, Chapter 13 provides a summary of recommendations.

Winnipeg Open House

3 MANITOBA'S FLOOD CONTROL SYSTEM

Manitoba is blessed with abundant water. Water flows into Manitoba from the peaks of the Rocky Mountains to the west, from almost as far east as Lake Superior, and from four northern states. However, with the flat terrain in the southern parts of the province, this abundant water often leads to flooding.

The most devastating flood documented in Manitoba occurred on the Red River in 1826. This event was catastrophic for the Red River Settlement, and led the Hudson's Bay Company to move its headquarters from Upper Fort Garry in present-day Winnipeg to Lower Fort Garry near Selkirk, 30 km downstream. [2]

For Lake Manitoba, there are reports of major floods in 1881/82 and 1913. Although measured lake levels are unavailable for these early floods, the peak level in 1881 was likely over 817 feet (3 to 4 feet over flood stage), and the 1913 flood was likely about one foot lower.

Floods were of great concern to Manitobans in the 1950s following the devastating flood in the Red River Valley and the impact on Winnipeg. Improvements in flood control occurred, including the construction of several major flood control structures in the subsequent decades. From experience gained in the operation of the structures, flood effects in other areas, particularly Lake St. Martin, were identified. Concerns regarding floods have once again been heightened in the past two decades, as significant flood events have occurred not only in the Red River Valley but virtually across the entire province, with western Manitoba and Lakes Manitoba and St. Martin particularly affected.

To provide protection from these floods, four types of permanent structures have been constructed:

1. Dikes beside the river or around communities and property.
2. Dams that can hold back the flood peak and release the water later in the year.
3. Diversions that can convey water away from flood-prone regions.
4. Channel enlargements.
5. Flood-proofing individual properties

Manitoba's flood protection system is still a work in progress. The "flood of the century" in 1997 spurred mitigation measures along the Red River that are now complete. The "flood without precedent" in 2011 resulted in proposed works and measures around Lake Manitoba and Lake St. Martin. The 2014 flood is now causing further evaluations, and will undoubtedly result in additional structures and measures. In some of these extreme flood events, flood control structures were pushed to their limits.

Flood control structures are a dynamic system. Water can be held back, released and redirected by the operation of the structures. The operation of any one structure affects the others. The design of the Fairford River Water Control Structure took into consideration the operation of the Portage Diversion. The capacity and reliability of dikes are considered when diversion decisions are taken. The major flood control structures in Manitoba are operated together as a system to optimize the flood reduction benefits for the province as a whole.

The flood control structures under review are shown in red in Figure 2.

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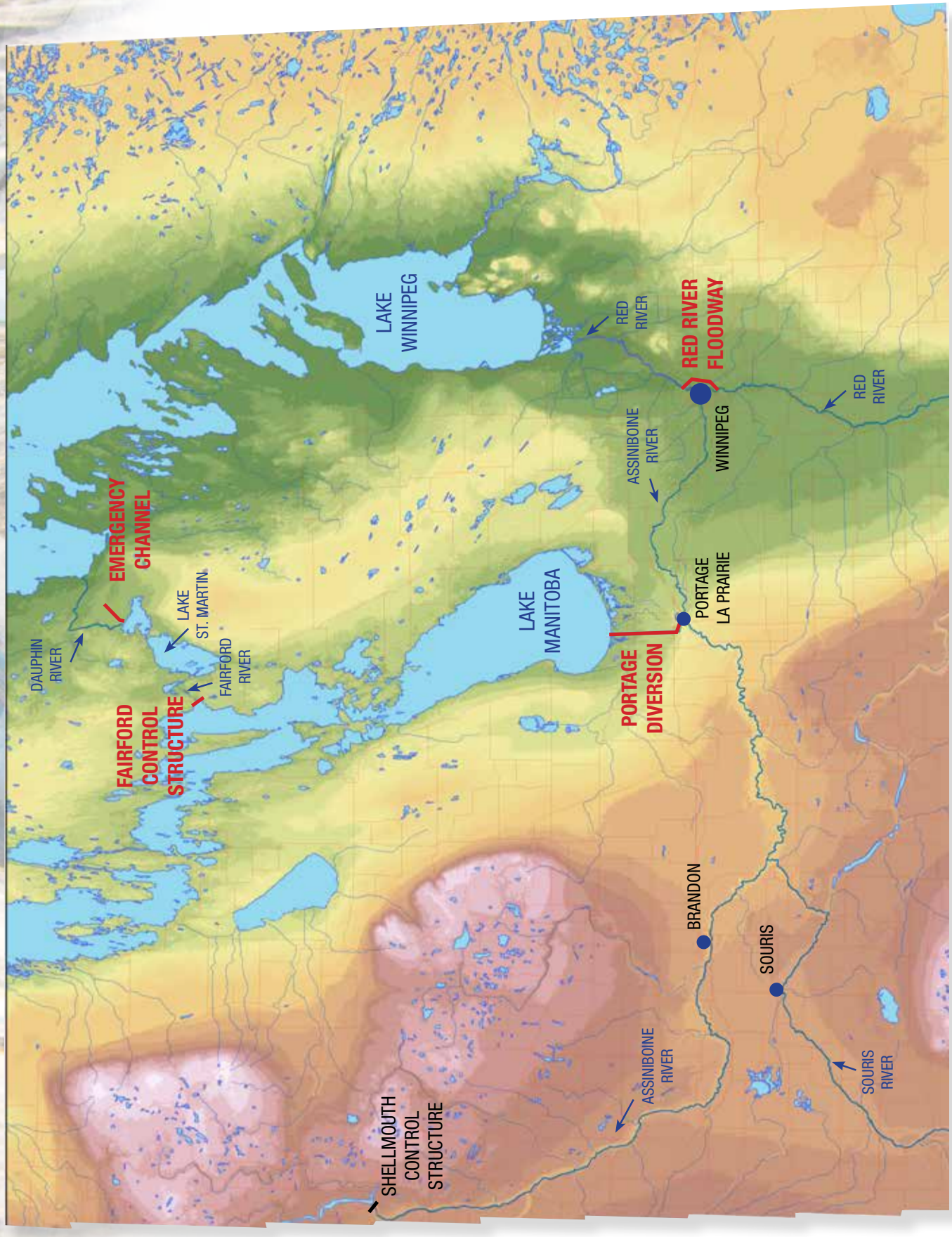
[2] *W.F. Rannie, "Some observations on peak stages during the 1826 Red River flood and the 'Fleming Conundrum'," in D. Eberts and D. Wiseman (ed.), Prairie Perspectives: Geographical Essays, Vol. 6 (2003): 1-15.*

Figure 2 - Manitoba Flood Control Structures under review



3.1 Diking

Dikes are considered passive structures, as they must be maintained but are not operated. Important dikes in Manitoba include the primary dikes along the Red River and Assiniboine River in Winnipeg, dikes along the Assiniboine River east of Portage la Prairie, ring dikes around communities in the Red River Valley, and other community dikes such as those in Brandon and St. Lazare. These dikes are the first line of defense in flood management. The government of Manitoba then operates the flood control structures jointly as a system in an effort to hold lake and river levels below the tops of these dikes.

3.2 Flood Control Works

The major flood control structures in southern Manitoba are the:

- Red River Floodway
- Fairford River Water Control Structure
- Portage Diversion
- Shellmouth Dam

An important flood control structure in northern Manitoba is the Lake St. Martin Emergency Outlet Channel (LSMEOC). The LSMEOC and the first three structures listed above are described in detail in Chapters 5 through 8.

Although not part of this review, the Shellmouth Dam is an important component of Manitoba's flood control system. The Shellmouth Dam is an earth embankment dam built by the Prairie Farm Rehabilitation Administration (PFRA). Construction started in 1964 and was completed in 1972, costing $10.8 million. The dam is 70 feet (21 m) high and 4,200 feet (1,300 m) long. The reservoir is 35 miles (56 km) in length and stores 390,000 acre feet (480 million cubic metres) at its full supply level of 1,408.5 feet (429.3 m). Outflows are controlled by a gated conduit and a 210-foot (64 m) wide concrete chute spillway.

Shellmouth Dam was designed to store river flows during the spring to reduce downstream flooding, and to release water over the summer period to enhance water supplies. Over the fall and winter, water is released to provide storage for the following spring's inflow. The volume of storage is adjusted over the winter depending on spring inflow forecasts.

3.3 Benefits of the System

Manitoba has a flood control system that encompasses much of southern Manitoba. It comprises dikes, dams and mitigation measures that protect individual properties and towns, as well as flood control structures that can divert floodwaters into less damaging locations. It is, in total, one of the most comprehensive flood control systems in North America. In some locations it is so effective that, for the most part, it goes unnoticed.

The flood control structures have provided excellent protection for the citizens of Manitoba over the years since they were constructed. Much of southern Manitoba formed the bottom of glacial Lake Agassiz during the last ice age. Consequently the land is flat and prone to flooding, particularly in the spring when the snow melts. Winnipeg developed at the confluence of the Assiniboine and Red Rivers. This was a natural location for a settlement when rivers were used as the main transportation routes, but it has proved to be a poor location in terms of potential flooding.

In 1826, a major flood nearly wiped out the Red River Settlement. Flow records for this flood are not available, but based on flood levels documented by Sir Sanford Fleming in 1880, the magnitude would have been approximately 40% larger than the "flood of the century" in 1997. As a result of the flood, the Hudson's Bay Company relocated its headquarters downstream to Lower Fort Garry. Although there were two other large floods in 1852 and 1861, the next large flood did not occur until 89 years later in 1950

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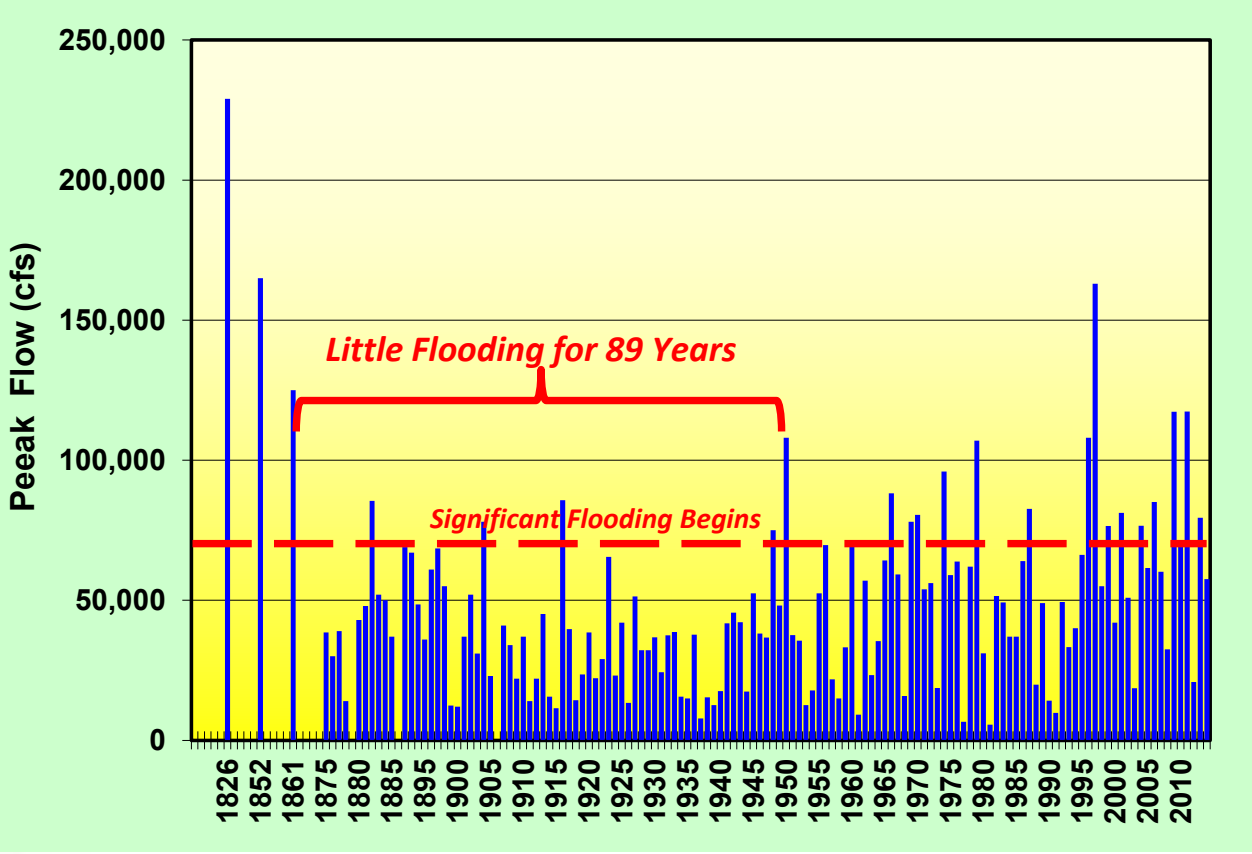
Figure 3 - Red River Flood Peaks (Unregulated)



This long period without major flooding led to continued development on the floodplain, as residents assumed that large floods would be rare. But then the flood of 1950 caused extensive damage in Winnipeg. Eight dikes gave way and flooded much of the city. The City of Winnipeg turned to the Canadian Army and Red Cross for help. In the end, four of 11 bridges were destroyed and nearly 100,000 people had to be evacuated from their homes and businesses.

In response, the government of Manitoba recognized that flood protection structures were needed to prevent a repeat of the 1950 disaster. The Royal Commission on Flood Cost Benefit recommended the construction of three flood control works: the Red River Floodway, a dam on the Assiniboine River near Russel and the Portage Diversion.

At the same time, a major flood on Lake Manitoba in 1955 led to the construction of the Fairford River Water Control Structure, which was completed in 1961. This also included widening and deepening the channel, particularly between Lake Manitoba and the dam, more than tripling the capacity of the Fairford River. It was designed to maintain lake levels between 811 and 813 feet in all but the most extreme flood years.

After the 1997 Red River flood, the capacity of the Floodway was increased, ring dikes were raised and expanded around communities, and individual homes were protected.

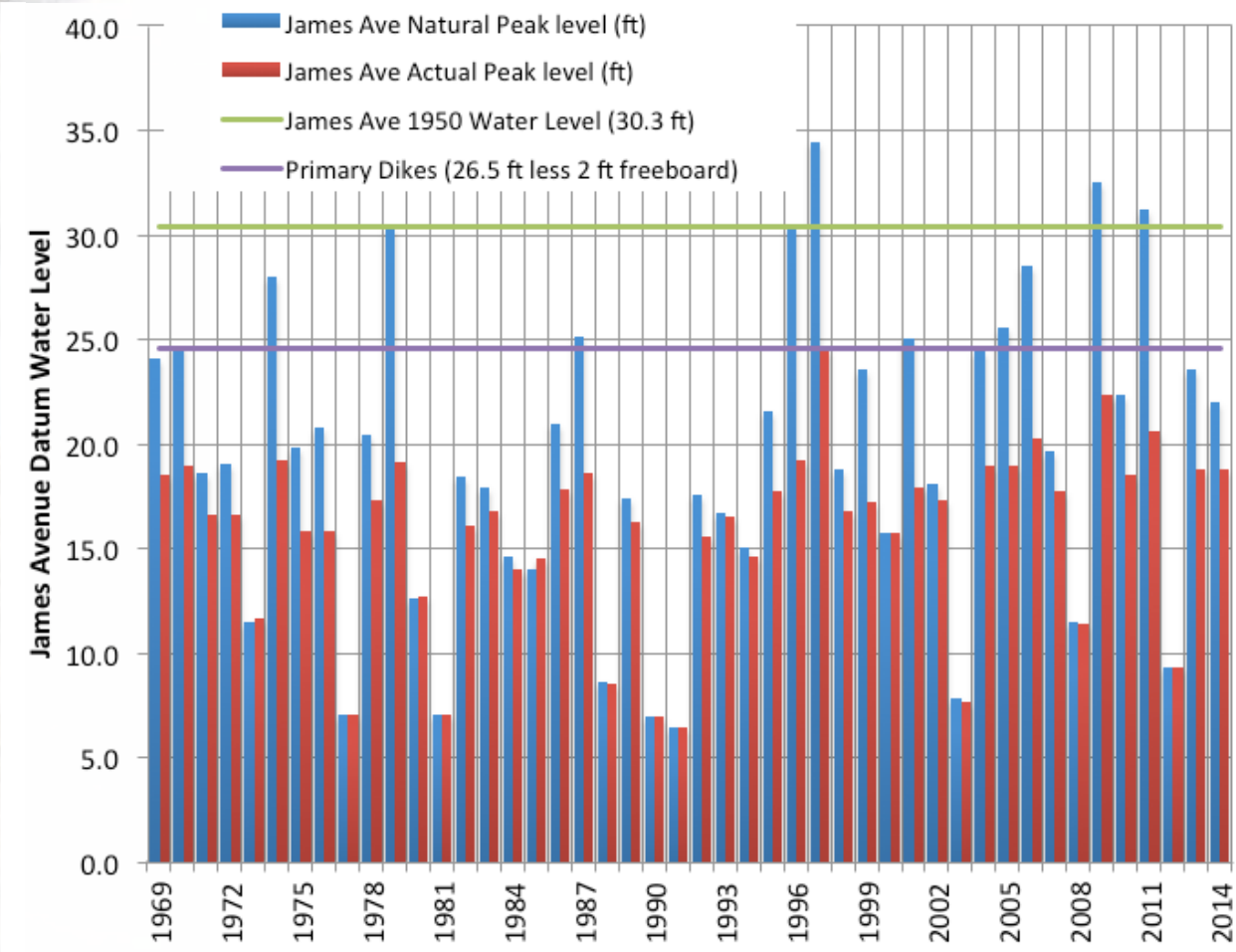
The benefits to Manitobans arising from these flood control structures have been greater than had been anticipated in the 1958 Royal Commission Study. As shown in Figure 3, there have been 15 flood events since the Red River Floodway was completed where significant damage would have occurred in Winnipeg. In total, the flood control structures have been estimated to have prevented more than $10 billion in damages in Winnipeg alone.

The operation of the Floodway, together with other flood control structures, has saved many times its cost since it was put into operation in 1969. In conjunction with the other flood control structures, the Floodway reduces water levels throughout Winnipeg and downstream, as far as the outlet where it rejoins the Red River.

Figure 4 illustrates the magnitude of the flood control works' impact in lowering water levels in Winnipeg. In the "flood of the century" of 1997, water levels within the Floodway were effectively lowered by 9.9 feet, saving millions in flood fighting costs and damages. Similar reductions occurred in 1979 (11.2 feet), 1996 (11.1 feet), 2009 (10.2 feet) and 2011 (10.6 feet). Without the flood control structures, the levels would have exceeded the 1950 level in, 1997, 2009 and 2011. The level of the primary dikes would have been exceeded even more regularly. Winnipeg residents and businesses have been significant beneficiaries of the flood control system.

Fairford RIver Water Control Structure

Figure 4 - James Avenue Natural and Actual Peak Elevations



If the Shellmouth Dam and the Portage Diversion had not been in place during the 2011 flood on the Assiniboine River, much of the land between Portage la Prairie and Winnipeg would have been flooded. The emergency diked capacity of the Assiniboine River east of Portage la Prairie is 18,000 cfs, but the peak flow at Portage without flood control works would have been 64,000 cfs. Without Shellmouth and the Portage Diversion, the flow on the Assiniboine would have exceeded the 18,000 cfs capacity for more than 14 weeks. Much of this excess water would have spilled out of the channel northward to Lake Manitoba and over the south bank of the Assiniboine at the Hoop and Holler site 6 km east of Portage la Prairie. The flow would have flooded a large area, inundating all communities along the La Salle River. Additional flows would have overtopped the banks of the river downstream, flooding an area north of the Trans-Canada Highway 20 km wide all the way into Winnipeg.

The Fairford River Water Control Structure has been generally effective in regulating levels on Lake Manitoba. In the first few years of operation, inflows to Lake Manitoba were unusually low. The ability to add stop logs to minimize outflows prevented the lake from dropping to 810 feet in late 1964. With higher inflows from 1967 to 1976, the increased discharge capacity enabled the operators to hold levels on Lake Manitoba relatively stable. This stabilizing of levels resulted in increased fluctuations downstream on Pineimuta Marsh and Lake St. Martin.

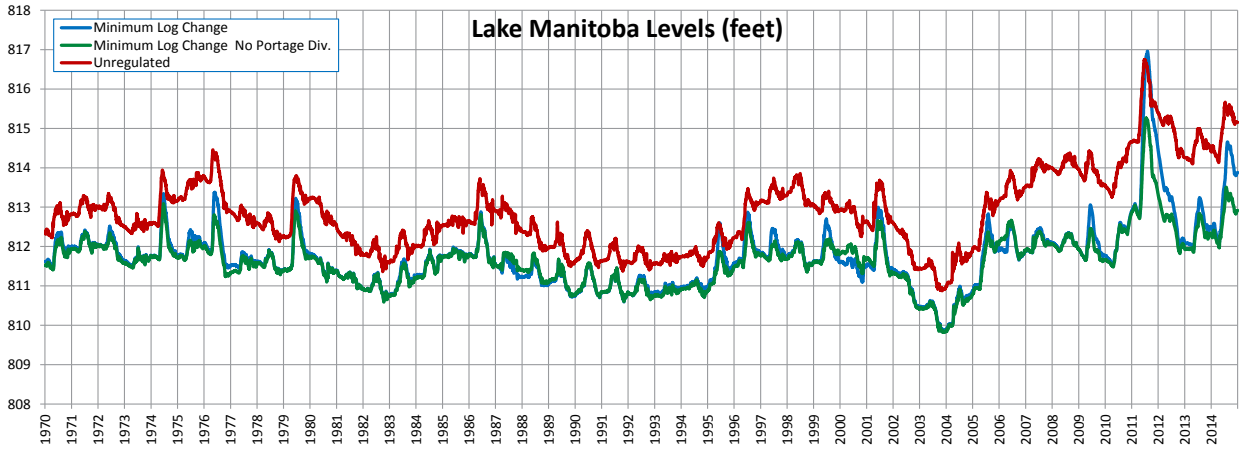
Over the past decade, from 2005 to 2014, the average Lake Manitoba level was 812.6 feet. Without the operation of the Fairford River Water Control Structure and the Portage Diversion, the average lake level over that period would have been 814.2 feet (well above flood stage).

But, as noted elsewhere, the system has not prevented all damages on Lake Manitoba. In 2011, with the unusually high natural inflows via the Waterhen River and the record high volume passed through the Portage Diversion, the lake experienced the highest levels ever recorded.

Figure 5 shows simulated levels on Lake Manitoba for three scenarios:

1. Lake Manitoba under current operating guidelines with recorded Portage Diversion Inflows. ("Minimum [stop] log change")
2. Lake Manitoba under current operating guidelines, but with no Portage Diversion Inflows. ("unregulated")
3. Lake Manitoba without Portage Diversion and with the natural outlet at Fairford.

Figure 5 - Lake Manitoba Simulated Levels



One observation is that the flood control structures, operated as a system, have provided benefits to Lake Manitoba for nearly all of this period. The average lake level over the 44-year period from 1970 to 2014 was reduced from 812.9 feet under unregulated conditions to 811.7 feet under the current minimal log change rules as described in Section 7.2. If the Fairford River Water Control Structure had been in operation with no Portage Diversion flows, the average level would have been 811.6 feet.

Figure 5 also indicates that, for most of the time, there is little difference between the plots with and without the Portage Diversion. However, there are occasions where the inflows from the Portage Diversion raised Lake Manitoba levels above elevation 813.0 feet in 1974, 1976, 1979, 2009, 2011, and 2014. The peak annual levels for these five years for each simulation option are as follows:

Table 1 – Peak Lake Levels for Flood Years (feet)

Year	Actual	Current Operation, no PD	Difference	Unregulated*	Difference
1974	813.3	813.1	0.2	813.9	0.6
1976	813.4	812.8	0.6	814.5	1.1
2009	813.1	812.5	0.6	814.4	1.3
2011	817.0	815.3	2.7	816.7	-0.3
2014	814.7	813.5	1.2	815.7	1.0

** Unregulated - no Portage Diversion and no Fairford River Water Control Structure*

It could be suggested that, in these flood years, some of the flood reduction benefits of the Fairford River Water Control Structure (FRWCS) were transferred from Lake Manitoba to the lower Assiniboine River. For example, in 1974, under current operation the peak level would have been reduced from 813.9 to 813.3 feet, or by 0.6 feet (due to the FRWCS). If the Portage Diversion had not been in operation, the peak level would have been reduced a further 0.2 feet. Therefore, the percentage of benefit arising from the operation of the FRWCS that was transferred from Lake Manitoba to the lower Assiniboine River would have been 0.2/(0.2 + 0.6) or 25%. In 2011, it would have been greater than 100% since in that year the actual peak level was higher than the simulated unregulated peak level.

Difficult Choices

The land around Lake Manitoba is flat. Once the lake level exceeds 813 feet, extensive flooding of the surrounding pasture land occurs. This type of flooding is difficult to mitigate and remains a factor that needs to be taken into account in operational decision-making. The photo below shows pasture land near Lake Manitoba on June 18, 2014. The drainage channel is backed up because of high lake levels. The lake level that day was 813.5 feet. The peak 2014 level was 814.7 feet at the end of July.

In summary, the combined operation of the Fairford River Water Control Structure and the Portage Diversion has provided significant benefits to both Lake Manitoba and the lower Assiniboine River for most of the 44-year period since the Portage Diversion was put into operation. However, in the two largest floods, a significant percentage of the benefits of the Fairford River Water Control Structure was transferred from Lake Manitoba to the lower Assiniboine River because of the extended operation of the Portage Diversion. This operation provided major flood reduction benefits for the lower Assiniboine River and for Winnipeg, but aggravated flooding on Lake Manitoba.

Drain and Pasture near Lake Manitoba

4 OPERATING GUIDELINES AND RULES

Flood control structures are governed by operating guidelines or "operating rules" as they are more generally known. For the Red River Floodway "rules" are formalized as such in the environment act licence. In practice, operating rules are not "rules" in the usual understanding of the term. *The Water Resources Administration Act* makes this distinction with the use of the term "guidelines" rather than "rules" (see below). They provide guidance to the operator, and it is understood that the operator of the structure can deviate from the "rules" if conditions warrant.

Guidelines are particular to each structure and were developed to suit circumstances at the time of commissioning. In each case, they have been subject to revision to reflect growing understanding of the associated water regime. As a result, while the intent and purpose are similar, the operating guidelines for each of the structures under review have evolved and are documented in a variety of ways.

Historically, the terms "guidelines" and "rules" have been used interchangeably, and refer to the same thing.

Operating guidelines have a legislative basis. *The Water Resources Administration Act* was revised in 2008 with respect to operating guidelines for flood control structures. Selected excerpts are provided below:

Operating guidelines for water control works

5.1(1) The minister may approve operating guidelines for a water control work.

Minister to have regard to operating guidelines

5.1(2) In operating a water control work for which operating guidelines have been approved, the minister must have regard to, but is not bound by, the guidelines

Considerations in approving operating guidelines

5.2(1) Before approving operating guidelines for a water control work, the minister must consider

- *(a) the purpose or the multiple purposes, as the case may be, that the water control work serves;*
- *(b) the effect that*
  - *(i) operation of the water control work may have on the operation of other water control works, and*
  - *(ii) operation of other water control works may have on the operation of the water control work;*
- *(c) the competing needs of persons affected by the water control work or its operation; and*
- *(d) an approved watershed management plan, as defined in The Water Protection Act, to the extent that the plan applies to the water control work.*

Included or other considerations

5.2(2) As part of, or in addition to, the matters to be considered under subsection (1), the minister may consider information related to

- *(a) flood control;*
- *(b) water storage and supply needs;*
- *(c) drainage;*
- *(d) means of minimizing artificial flooding;*
- *(e) the protection and maintenance of fish and wildlife habitat and aquatic ecosystems;*
- *(f) recreational uses;*
- *(g) the effect that different climatological or hydrological conditions in the watershed may have on the operation of the water control work;*
- *(h) uncertainty in forecasting hydrological conditions; and*
- *(i) any other matter that the minister considers relevant.*

Public consultation in guideline development

5.2(3) Except in circumstances that the minister considers to be of an emergency nature, before approving operating guidelines under section 5.1, the minister must provide an opportunity for public consultation regarding the proposed guidelines.

Advisory committees

5.3(1) The minister may establish one or more advisory committees to provide advice to the minister about water control works.

Role of advisory committee

5.3(2) An advisory committee is to provide advice to the minister in accordance with directions or terms of reference provided by the minister.

Operating guidelines for the Red River Floodway and the Portage Diversion are found in Appendix B and Appendix C. Operating guidelines for the Fairford River Water Control Structure are provided in Appendix D.

4.1 Operating Guidelines in Practice

Operating guidelines provide direction to the operator and a frame of reference for the people who may potentially be impacted by the operation. However, it is understood that the operator of the structure can deviate from the "rules" if conditions warrant. Operating guidelines are revised from time to time based on experience gained during flood or drought events. However, each hydrologic

Portage Diversion and Control Panel Inside the Operations Room

event is different. If during a future event strict adherence to the "rules" would result in undesirable consequences, the operator is expected to make adjustments to ensure maximum overall benefit to all affected interests.

Legally, operating decisions are the responsibility of the minister referenced in *The Water Resources Administration Act*. In practice, the decisions are made in the Hydrologic Forecasting and Water Management unit of Manitoba Infrastructure and Transportation (MIT). Occasionally, operational adjustments must be made by the field operator and then reported after the fact. An example would be operation of the Portage Diversion during the initial ice run in the spring. Protocols are in place for the operator to follow as the flow surge enters the Portage Reservoir, but rapid gate adjustments must be made in response to changing inflows when there is no time to contact the director to ask for his or her concurrence.

MIT field staff operate all major flood control structures. For structures like the Red River Floodway inlet control structure and the Portage Diversion, where multiple gate changes can be required on some days, the structures are staffed 24 hours a day during a flood event. During the rest of the year the structures are visited and inspected from time to time, but are not staffed. The Fairford River Water Control Structure is visited only when changes in the stop logs are required, or when an inspection is scheduled. Typically, stop log adjustments are required only once or twice a year, so there is no need for the presence of an operator even during a flood event.

4.2 Operational Considerations

Operation of the province's flood control structures can be controversial. During the work of the 2011 Manitoba Flood Review Task Force, comments on the operation of flood control infrastructure were the most frequent among all public responses. Through a Task Force survey, 23 out of 27 respondents indicated they were not given the opportunity to provide input into the operation of structures that affect them, and the majority felt that local interests were not well represented in decisions made regarding control structure operation in their area. It was consistently expressed that people affected by flood control structures must be given more consideration. The Task Force often heard that the major control structures are used for the protection of communities located relatively far downstream, in particular Winnipeg and Portage la Prairie, despite the fact this causes problems for people in the vicinity of the structures.

The flood control structures are operated as an overall system in an effort to minimize the overall damage caused by a flood event. Because of the large population in Winnipeg and the potential for major flood damage, flood protection for Winnipeg is normally given top priority in the operation of the provincial flood control structures.

Weather patterns and even climatic cycles are changing, sometimes in unpredictable and unprecedented ways. The impact of flooding on Manitobans is also in flux, affected by changing land use patterns and mitigation measures. Balanced operations of flood control structures remains challenging, sometimes requiring difficult choices.

Difficult Choices

Operation of flood control infrastructure can involve difficult choices. While the intention is not to harm one area or group to the benefit of another, in extreme flood events this may be difficult to avoid.

5 THE RED RIVER FLOODWAY

The Red River Floodway diverts floodwaters from the Red River around Winnipeg and lowers water levels within the city below what they would have been otherwise. Because of its importance, the Floodway and its operation is well known to Winnipeggers, as well as populations living upstream and downstream.

The Floodway consists of an inlet control structure on the Red River south of St. Norbert; an excavated earth channel extending from just above the structure, around the east side of Winnipeg to the Red River near Lockport; and an outlet control structure at the north end of the floodway channel. There is also a dike extending west from the inlet control structure to prevent flood flows from bypassing the structure and entering the La Salle River.

The floodway channel is 47 km (29 miles) long. The Floodway has an average depth of 30 feet (9 m), with the deepest section at 65 feet (20 m) in the Birds Hill area.

5.1 Background

The 1950 flood caused major damage in Winnipeg, with about 10,000 homes flooded and 100,000 people evacuated. The flood had a peak flow of 103,600 cfs and a level in Winnipeg of 30.2 feet James Avenue Datum[3]. It was thought at the time that another foot of water would have required evacuation of the entire city. This flood came as a surprise to Manitobans, since it was the first major flood in 89 years. The 1861 flood was two feet higher than the 1950 flood.

> *"Faced with the certainty of floods, the people of Greater Winnipeg and of the Red and Assiniboine Valleys can do one of two things: (a) accept the damages from floods when they arise, or (b) take engineering steps to reduce or prevent them."*
>
> Source: Report of the Royal Commission on Flood Cost Benefit. December 1958, p. 1.

Dikes and pumping stations were constructed immediately after the 1950 flood to improve future protection. Soon afterward, the Province undertook engineering and cost-benefit studies for improved flood protection. An analysis at the time estimated that the 1950 flood had a return period of only 36 years. High flood waters in 1956 further raised concerns.

In 1958, the Royal Commission on Flood Cost Benefit recommended construction of the Greater Winnipeg Floodway with a capacity of 60,000 cfs.[4] The study concluded that it was the more cost-effective and versatile flood control option when compared to expanding the river channel through Winnipeg. The same study recommended both the Portage Diversion and Russell Reservoir (later moved to Shellmouth because of foundation issues). Together, the flood projects would handle a flood of 169,000 cfs with a return period of 165 years.[5] The Royal Commission calculated the benefit-cost ratio of the Floodway to be 2.9.

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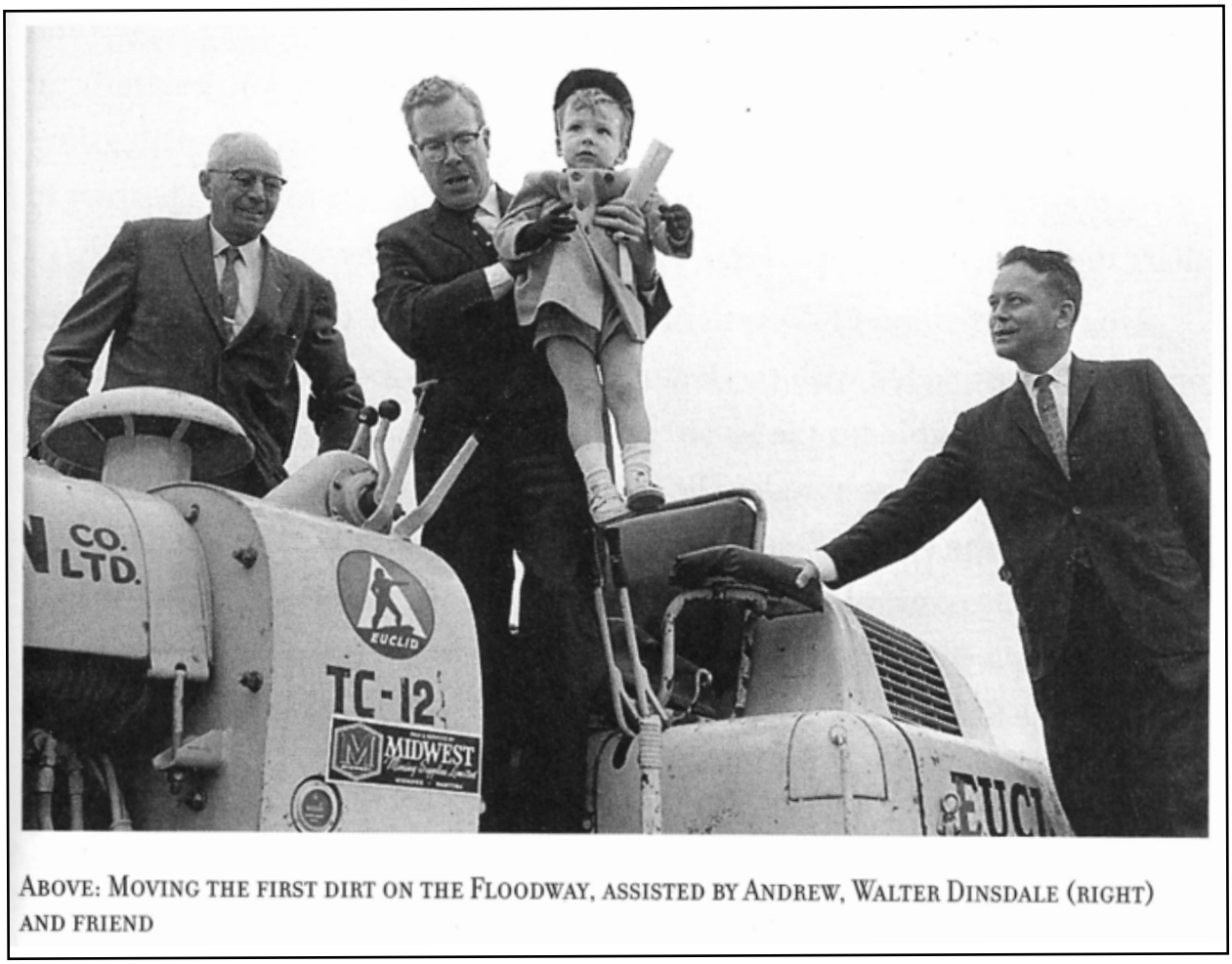
[3] *River levels in Winnipeg are often referenced to James Avenue Datum, which is 727.57 feet geodetic or about normal winter ice level.*

[4] Manning. Report of the Royal Commission on Flood Cost Benefit, *December 1958.*

[5] *Now considered to be about a 1-in-90 years level of protection.*



ABOVE: MOVING THE FIRST DIRT ON THE FLOODWAY, ASSISTED BY ANDREW, WALTER DINSDALE (RIGHT) AND FRIEND

The building of the Floodway was completed in 1968. It is often referred to as "Duff's Ditch" in recognition of Premier Duff Roblin, who is given credit for spearheading its construction.

After a period of lesser floods, the 1997 flood surprised Manitobans, as had happened in 1950. The 1997 flood reached the "design flood" levels, with an estimated natural flow at Winnipeg of 163,000 cfs. This flood became known as the "flood of the century". A flood of this magnitude has a return period of about 90 years.

The 1997 flood was of such magnitude that many homes and even communities in Manitoba were damaged significantly. Subsequently, significant rebuilding and flood protection works were carried out throughout the Red River Valley. Decision-makers also realized that the 1997 flood represented a "close call" for Winnipeg and that the existing flood protection for Winnipeg was inadequate. This realization resulted in a new wave of engineering studies, benefit-cost ratio calculations, and a proposal to expand the Floodway to increase its capacity from 60,000 cfs to 140,000 cfs, to protect against a design flood of 272,000 cfs with a return period of 700 years. Following environmental licensing, the expanded Floodway was completed for the spring of 2009.

In 2009, the Floodway kept levels at 22.3 feet James Avenue Datum in Winnipeg when they would have been the equivalent of 32.5 feet without the flood control structure.

5.1.1 How the Floodway Works

Under early spring and normal flow conditions, the water level in the Red River is below the floodway channel inlet lip. All of the Red River flow passes through Winnipeg.

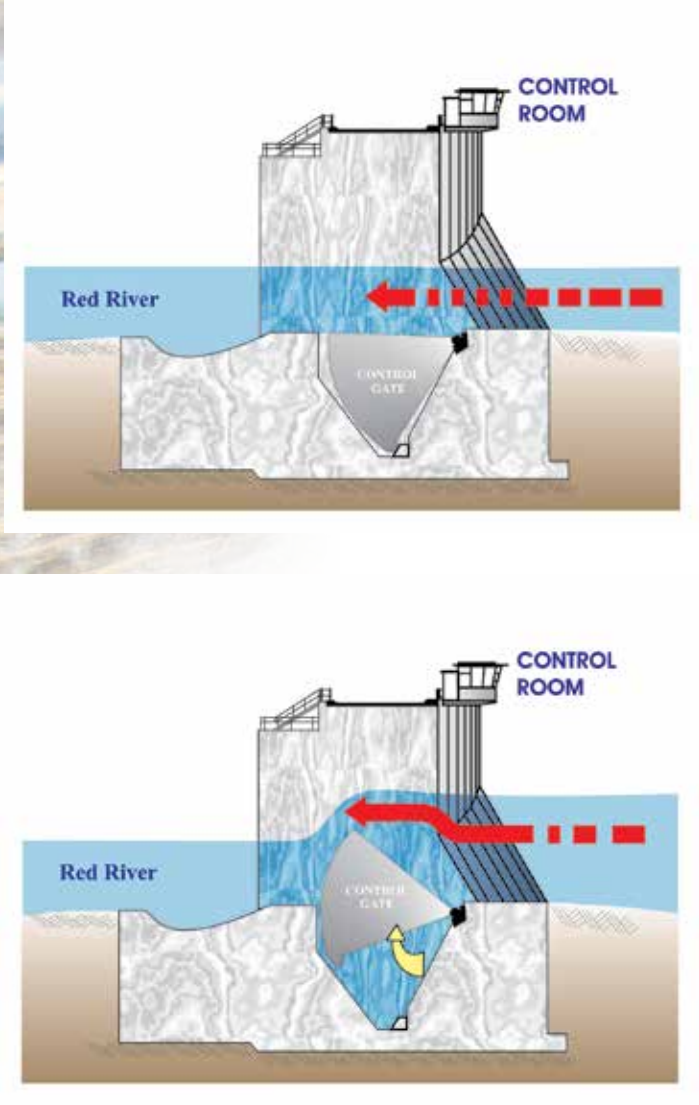


Figure 6 - Floodway Control Structure Operation

When the water level in the Red River rises above the top of the floodway channel inlet lip, most of the Red River flow still passes through Winnipeg but some of the flow starts going down the floodway channel. As water begins flowing into the floodway channel, upstream levels drop below natural.

When the water level upstream of the floodway inlet control structure falls below natural levels, the gates at the inlet control structure can be raised and the water level upstream returns to natural levels.

Under non-extreme flood conditions, as the water level in the Red River continues to rise well above the top of the floodway channel inlet lip, the gates at the inlet control structure continue to be operated to keep upstream levels at natural levels and to allow water levels in Winnipeg to be lower than what they would be if the flood levels were not controlled.

During extreme floods, the water level upstream of the floodway inlet control structure is raised above natural level due to operation of the gates.

The floodway outlet structure north of Winnipeg is important to dissipate energy that would otherwise cause damage. This is because the water level drop in the river channel is 32 feet along the Red River but only 18 feet along the Floodway. (The Floodway slope was chosen to ensure velocities in the floodway do not cause erosion.)

5.1.2 Definition of Natural vs. Artificial Levels

In essence, the Red River Floodway is intended as a "safety-valve," designed to reduce high water levels in Winnipeg without increasing natural levels upstream. The definition and interpretation of "natural" is important, and sometimes misunderstood and contentious.

The levels upstream of the Floodway are to reflect the level that would have been there if the entire flood protection system (Shellmouth Dam, Portage Diversion, Floodway and river dikes) were not there, i.e., the "natural" level. The natural level is also defined in *The Red River Floodway Act* as follows:

"natural level" *means the scientifically demonstrable water level that would be expected in the Red River at a given time during spring flooding in the absence of the floodway, the Assiniboine River Diversion, the Assiniboine River dykes, the Shellmouth Dam, the primary dykes in the City of Winnipeg, and urban development in the area protected by the floodway since its design was finalized.*

In order to operate the Floodway to "natural levels" upstream of the control structure, operators compute the real flows and take into account flow reduction at the Shellmouth Dam, and flow diverted down the Portage Diversion and overflows prevented by Assiniboine River dikes. Using the flows that would have been there without these flood control works engineers can calculate what the level would have been upstream of the Floodway using a rating curve[6] since there is not a straight-line correlation between water flow and water level.

Analysis at the time of the Floodway expansion showed that the pre-expansion Floodway had a "capacity" for a flood in Winnipeg of 169,000 cfs (a 90-year event) where natural levels (770.25 cfs) could be maintained south of the Floodway. The flow in the Floodway itself would be 60,000 cfs for such an event. The maximum capacity of the pre-expansion Floodway was for a natural flow of 210,000 cfs at Winnipeg (a 225-year event) with above-natural or artificial flooding to elevation 778 feet upstream of the Floodway. The flow in the Floodway at this elevation would have been 100,000 cfs. The reliability of this extreme capacity was questionable because bridges over the Floodway would have been submerged and the west dike would have been inadequate.

Return Periods vs. Probability of Failure

Extreme events are often classified by their return period, which is an equivalent expression for probability and is often misunderstood.

For example, a flood with a return period of 100 years does not indicate the time between floods. Rather, it is shorthand for a flood that has a 1% chance of occurring in a given year.

Statistically, over two years, the probability of at least one 100-year flood is nearly 2%, and there is a 63% probability that it will be equalled or exceeded over a period of 100 years. So if you design for a 100-year flood, the probability is 63% that it will fail (if no mitigation is undertaken) in the next hundred years.

If the life of a structure is 100 years, the designer will often consider which probability of failure over its life is acceptable.

Return period design event	Probability of failure over 100 year life*
100 year	63%
700 year	13%
10,000 years	1%

*For independent events

To achieve a low probability of failure in cases with loss-of-life consequences, structures are designed for very rare events.

[6] *A rating curve is a plot of the normal flow in a river vs. elevation at a point; the higher the elevation, the higher the normal flow.*

The expanded Floodway has a capacity for a flood in Winnipeg of 175,000 cfs (a 120-year event) where natural levels can be maintained upstream of the Floodway. The maximum capacity of the expanded Floodway is for a flood in Winnipeg of 270,000 cfs (a 700-year event) with artificial flooding to elevation 778 feet upstream. The design flow in the Floodway for this event is 140,000 cfs.

5.1.3 Influence of the Portage Diversion and Shellmouth Dam

The major flood control structures in southern Manitoba operate as a system. The Shellmouth Dam and Portage Diversion, which control flows entering Winnipeg on the Assiniboine River, were designed to operate in concert with the Red River Floodway to control flooding in Winnipeg. In general terms, any flows held in the Shellmouth Reservoir or diverted through the Portage Diversion are flows that would have reached Winnipeg if the system was not in place. The operators use this information to calculate the natural level at the floodway inlet. Since more flow would have reached Winnipeg, the natural level at the floodway inlet is in fact higher than actual; the floodway gates are raised without going above this natural level (in practice, the target level is 0.5 feet below natural). This results in more water being diverted into the Floodway further reducing water levels in Winnipeg and realizing the benefits of the Shellmouth Dam and Portage Diversion to Winnipeg.

The first "rule" of operation for the Portage Diversion is:

> *Except as provided for under Rule 8, the Portage Diversion shall be utilized to its maximum capability to keep water levels in Winnipeg below 17.0 feet (5.2 m), City Datum.*

Similarly, the Shellmouth reservoir is drawn down each winter, so that spring inflows can be stored in the reservoir to control flooding along the Assiniboine River all the way to Winnipeg.

As an example, 1997 has been referred to as the "flood of the century" on the Red River. The Red River peak level south of Winnipeg occurred on May 3. Over the preceding three weeks, the reservoir level behind the Shellmouth Dam was raised 18.5 feet as water was held back in the reservoir. This action reduced the Assiniboine River flow at Portage by about 6,200 cfs. At the time of the peak on the Red River, effectively the total flow of the Assiniboine River was being diverted to Lake Manitoba via the Portage Diversion. The coordinated operation of these three flood control works were effective in minimizing flooding within Winnipeg. At the same time, Lake Manitoba levels were held to a maximum of 813 feet through the operation of the Fairford River Water Control Structure.

Red River Floodway

5.2 Operating Rules

There are four rules governing the operation of the Floodway (reproduced in full in Appendix B). The following table summarizes the purpose and impact of each rule.

Table 2 – Red River Floodway Operating Rules

Rule	Title	Purpose	Upstream Artificial Flooding	Upstream Flood Level
1	Normal Operation	Raise level upstream to "natural" to allow flow in floodway to reduce water levels in Winnipeg below "natural"	No – level is kept at or below "natural"	750 – 770 feet
2	Major Flood Operation	Keep water levels in Winnipeg below the primary dike system	Yes - level is raised above "natural" (2.2 feet in 1997)	770 – 778 feet
3	Extreme Flood Operation	Protect the inlet structure and West Dike from catastrophic failure (dam break) by keeping upstream level at 778 feet and allowing excess flow into Winnipeg	Yes – level is above "natural"	Up to 778 feet
4	Emergency Operation to Reduce Sewer Backup in Winnipeg	Raise water levels upstream to bank full condition (up to 760 feet) to lower levels below "natural" in Winnipeg to provide increase sewer discharge capacity	Some – level is kept to "bank full"	Up to 760 feet

The rules were first introduced in March 1970 when the Manitoba Water Control and Conservation Branch produced a report titled Red River Program of Operation . The report used the term "Operation Schedule", which was essentially the same as the modern Rules 1 through 3.

The Program of Operation was revised in 1984[8]. This report expands on the 1970 Program of Operation by adding guidance around ice pan movement prior to the initial gate setting. This report also introduces the concept of operating 0.5 feet below "natural" during the crest and during falling stages.

In 1999, after the flood of 1997 and in response to a recommendation of the Manitoba Water Commission , the Province established the Red River Floodway Operation Review Committee to review the operating "rules" for the Floodway. A significant change to Rule 1 was introduced in that report, revising the transition elevation from Rule 1 to Rule 2 from 25.5 feet introduced in 1984 to 24.5 feet at James Avenue Datum to provide 2 feet of freeboard rather than one foot. This modification had been used in the 1997 flood.

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[7] *Manitoba Department of Mines and Natural Resources. Planning Division, Water Control and Conservation Branch,* Red River Floodway Program of Operation*, March 1970.*

[8] *Toye, John, P.Eng. Manitoba Natural Resources.* Red River Floodway Program of Operation, *October 1984.*

[9] *Manitoba Water Commission.* An Independent Review of Actions Taken During the 1997 Red River Flood*, June 1998.*

[10] *Red River Floodway Operation Review Committee.* A Review of the Red River Floodway Operating Rules*, December 1999.*

Rule 4 was used in 2002 based on a recommendation of an emergency operation by the Manitoba Water Branch. Rule 4: Emergency Operation to Reduce Sewer Backup in Winnipeg was formally adopted in November 2004.[11]

In 2005, an environmental license was issued for the Floodway expansion.[12] The license includes four rules for operation of the Floodway and a requirement to conduct a public review of the rules of operation not less than once every five years, commencing with the date of the license.

The first public review report was produced in 2010.[13]

5.2.1 Red River Floodway Operation Advisory Board

The Red River Floodway Operation Advisory Board exists to:

- "Provide input, guidance and advice to the Minister of Manitoba Infrastructure and Transportation on the operation of the floodway control gates in accordance with the approved operating rules during periods of flooding on the Red River
- Work together as a team to identify and resolve issues that may arise as a result of proposed gate operations;
- Facilitate the exchange of relevant and timely information between local residents and the government agencies regarding gate operations and their impact on residents." [14]

Members of the Advisory Board include:

Manitoba Infrastructure & Transportation (Chair)
Agriculture and Agri-Food Canada
Rural Municipality of Ritchot
Rural Municipality of Macdonald
Rural Municipality of Morris
City of Winnipeg
Selkirk and District Planning Area

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[11] *Letter from N. Brandson (Deputy Minister, Manitoba Water Stewardship) to E. Gilroy (CEO, Floodway Authority), November 19, 2004.*
[12] *Environment Act Licence 2691, July 8, 2005.*
[13] *Manitoba Water Stewardship. Red River Floodway Operating Rules Public Review Report, November 1, 2010.*
[14] *Red River Floodway Operation Advisory Board Terms of Reference March 2014*

5.3 History of Operations

The Floodway has been used in 31 of the 48 years since its completion in 1968. Rule 4 was applied in 2002, 2004, 2005 and 2010. Table 3 summarizes those operations.

	FLOODWAY CHANNEL		INLET CONTROL STRUCTURE			
Year	Peak Flow in Floodway (cfs)	Date of Peak Flow	Start of Operation	End of Operation	No. of Days of Operation	Peak Water Level Upstream at Inlet (ft)
1969	22,100	May 3	April 13	May 17	35	-
1970	22,800	May 1	April 19	May 20	31	759.6
1971	9,100	April 14	April 11	April 21	10	754.0
1972	1,200	April 18	April 16	April 20	4	751.2
1974	36,700	April 24 & 25	April 18 May 20	May 18 May 31	30 11	764.6
1975	9,400	May 7 & 8	April 30	May 11	11	754.4
1976	10,300	April 11	April 7	April 25	18	754.8
1978	18,100	April 16	April 9	May 3	24	758.1
1979	42,000	May 9	April 20	May 29	39	764.9
1982	600	April 18	April 16	April 21	5	751.3
1983	900	April 11	April 10	April 13	3	751.7
1986 1986	9,800	April 3	March 31 May 6	April 14 May 11	14 5	754.8
1987	17,900	April 10	April 7	April 18	11	758.3
1989	4,800	April 24	April 21	May 1	10	752.8
1992	3,600	April 8	April 6	April 10	4	752.7
1995	13,700	March 29	March 24	April 25	32	757.4
1996	38,800	April 30 & May 1 & 2	April 19	June 8	50	764.6
1997	66,400	May 3 & 4	April 22	June 3	42	771.5
1998	6,700	April 1	March 29	April 5	7	754.1
1999	15,700	April 16	April 4	May 1	27	758.2
2001	21,100	April 28	April 7	May 20	43	760.0
2002	3,200	June 19	June 18	June 25	7	752.9
2002	5,600	July 6	July 4	August 4	31	754.5
2004	15,800	April 5	April 1	April 19	18	760.0
2004	10,400	June 12	June 9	July 30	51	756.5
2005	15,300	April 8	April 5	April 20	15	759.3
2005	23,400	July 4	June 14	July 27	43	762.4
2006	33,200	April 15	April 5	May 9	34	763.4
2007	4,200	April 12	April 3	April 17	14	753.6
2009	43,100	April 18 to 21	April 8	May 24	47	767.1
2010	16,000	April 6	March 28	April 22	25	759.1
2010	12,200	June 4	May 30	July 10	41	758.3
2011	36,700	May 4	April 9	June 2	55	764.1
2011	1,700	July 10	July 7	July 17	10	752.5
2012	-	-	-	-	-	741.5
2013	15,700	May 4	April 29	June 8	40	758.1
2014	3,000	July 5	July 1	July 21	20	753.3

Denotes Rule 2 Operation

Denotes Rule 4 Operation

Table 3: History of Red River Floodway Operations

NOTES:

In summer 2002 and 2004, the Floodway was operated under Emergency Summer Operation before the formal development and approval of Rule 4.

In 2005, operation of floodway inlet structure moved from Rule 4 to Rule 1 on June 30.

In 2010, operation of floodway inlet structure moved from Rule 1 to Rule 4 on June 3.

In 2014, operation of floodway inlet structure was under Rule 1 rather than Rule 4 in July.

5.4 What You Told Us

Prior consultation regarding the Red River Floodway occurred during the following studies and associated reports:

- *Manitoba 2011 Flood Review Task Force Report* (2013)
- *RM of Ritchot Artificial Flooding Study, Manitoba Floodway Authority* (Manitoba Floodway Authority, 14-08601-001-W01, 2012)
- *Red River Floodway: Public Consultation on the Rules of Operation* (2010)
- *Red River Floodway Expansion: Report on Public Hearing (Manitoba Clean Environment Commission*, 2005)
- *Red River Floodway Expansion Project Environmental Assessment Process* (Manitoba Floodway Authority, 2005)
- *Screening Report: Red River Floodway Expansion Project* (Infrastructure Canada, 2005)

During this review, the Panel met with rural municipalities, received electronic submissions, and held public open houses in St. Adolphe, Winnipeg and Selkirk, among other locations.

Multiple consultations have occurred regarding the Red River Floodway, with many comments received from the public. Given the history of flooding in the Red River valley and the recent nearly annual operation of the Floodway, this flood control structure is probably the best understood by the public, with strongly held and often divergent opinions expressed.

There are distinct differences in opinions and in participation at public events depending on the geographic location relative to the Floodway. Winnipeg residents tend to have relatively low participation rates in public reviews, whereas there has been strong participation in public engagement events by residents upstream of the Floodway. For example, one consultation report stated, "Flooding and artificial flooding remain an extraordinary important topic for the participants in the public consultation event. Detailed presentations and written submissions indicated not only the level of concern, but also the high state of understanding and knowledge of the participants." There is also heightened concern and engagement downstream. The Panel noted that while anger and frustration is still present, it has to some extent been supplanted by resignation to flooding plus a willingness to consider different solutions. The RMs in the vicinity of Winnipeg are growing rapidly, and new dikes and flood protection measures may be having an effect on people's attitudes.

As noted in the 2010 review of the Floodway operating rules, "In general, those residents north of the floodway have concerns about flooding due to ice jams and concerns about the regular loss of the Dunning Road Crossing. People resident south of the floodway have concerns about artificial flooding and the impact to property, lifestyle and peace of mind. Residents within the floodway's protection are most concerned about high water levels that affect bank stability and the use and enjoyment of the Red River during the summer."

5.4.1 Comments on Operating Rules

Specific consultation on operating rules has occurred previously. Comments typically do not differentiate among Rules 1, 2 and 3, which address operation of the Red River Floodway during spring flood events. However, many comments focus on non-spring or summer operation (Rule 4), and these are summarized separately.

5.4.1.1 Spring Operation

The definition of "natural" water levels in the rules and the basis for its measurement has been questioned by residents in the RM of Ritchot. Some residents and associations within Winnipeg recommended that the Floodway be operated as soon as possible in the spring and that the clause stating that the Floodway gates should not be operated until ice on the river is flowing freely should be removed from the operating rules.

Most other public comments have tended not to suggest changes to the rules themselves, but have focussed more on the implementation or application of the rules, and on impacts from operation and associated mitigation. Particularly among residents upstream of the Floodway there is a history of mistrust of the provincial government and specifically the Manitoba Floodway Authority. Various commitments have been attributed to the authorities, with residents feeling these have not been carried out, or that their concerns have not been adequately taken into account.

Reservations also have been expressed about The Red River Floodway Act. There appears to be a lack of clarity about its status and associated regulations. Residents felt that appeals to decisions made under its provisions should be heard by a neutral third party.

The operating rules were described as being fast and loose, rather than hard and fast. Whatever rules exist, the opinion is that they should be enforceable and enforced. There were calls for increased participation by residents, including granting community organizations direct representation on any review of the operating rules. People also identified that there were gaps in the research that had been done on Floodway operation.

The amount of warning given to residents upstream of the Floodway and the speed with which water levels rise was a particular operational concern. This was reiterated during the Panel consultations. Municipalities downstream had previously been critical of notification procedures, but in 2014 indicated that communication had improved. There is no requirement to notify municipalities north of the Floodway when it goes into operation. As the Floodway typically goes into operation during the day, it is dark when the floodway waters reach the outlet in St. Clements, heightening the stress on residents. A suggestion was made to put the Floodway into operation around midnight. Conversely, the municipality upstream requested that the gates be operated in the morning, when rising water would be visible and could be dealt with during daylight hours.

Difficult Choices

"The flood control system was clearly constructed to protect the City of Winnipeg. The vast majority of residents above the floodway indicated to the Commission that they understand and accept the logic of being, in their opinion, 'sacrificed to save the City'. However, they feel strongly that they should be fully compensated for damages when the water elevation is caused to rise above natural conditions because of Floodway operations."

Source: Manitoba Water Commission, *An Independent Review of Actions Taken During the 1997 Red River Flood,* June 1998. p. 34.

Although communications may have improved recently, rural municipalities consulted in 2014 and 2015 indicated a desire to receive more data from the Province. For example, more forecasts for the lower river, more information on land drainage, lands affected by flooding, and the number of closure days of Dunning Road.

5.4.1.2 Summer Operation

Current summer operation under Rule 4 is intended to reduce the risk of basement flooding due to sewer back up. Many homeowners have installed backwater valves and sump pumps though more need to do so. The sewer system can be overwhelmed by summer storms even when the river level is low. Strong opposition to summer operation (Rule 4) has been expressed previously by residents and municipalities upstream and downstream of the Floodway, particularly in the RM of Ritchot. This was reiterated in the Panel's discussions with rural municipalities and the public. Benefits are viewed as attributable only to Winnipeg and that the need for Rule 4 has not been established. Residents felt summer operations had been imposed on them without consultation, assessment of its impact, or an appropriate compensation and mitigation plan in place. A number of presenters at earlier reviews requested that non-spring emergency operation be banned; failing that, they requested a variety of forms of financial mitigation, including buyouts and easements. Impacts to market gardens have previously been cited as one of the main objections in the past to summer operation of the Floodway. However, it was noted during discussions with local officials that there are now fewer market gardeners upstream of the control structure, and those that remain are small holdings. Concern remains regarding flooding of portions of St. Mary's Road when levels approach 760 feet.

Concern has been expressed during the Panel's discussions regarding the impact of summer operation on Dunning Road use. More low level crossings of the Floodway are under study and are highly desired by the growing rural municipalities. Should any be developed, these would also be impacted by summer operation of the Floodway.

Groundwater issues, particularly pollution, have been raised generally by municipalities east of Winnipeg, but also in regards to summer operation. It is recognized by local officials that other factors may be at play, such as increased development and surface water evaporation associated with gravel extraction.

The Forks in particular believes that summer operation would allow Winnipeg's premier tourist destination to flourish.

5.4.2 Comments on Impacts

The type or relative importance of impacts associated with use of the Floodway varies with geographic location and the stakeholders' experience with flooding. One submission indicated that flooding impacts had three components: water level, duration and timing. The frequency of flooding (potentially year after year) with associated impacts and need for mitigating action influences the severity of the impacts. There is a greater challenge if non-spring operation occurs in the same year as spring operation of the Floodway.

There is also considerable debate about what are the "natural" effects of flooding vs. effects caused by operation (or not) of the Floodway. The term "artificial flooding" is used in different ways in public comments. In some cases it means water levels that go above the natural level, while in other cases it is used, incorrectly, as a more generic term for summer operation of the Floodway.

Impacts or concerns identified during consultations did not always distinguish between those caused by operation of the Floodway (and so linked to artificial flooding) and impacts from natural flooding. Comments have been summarized as follows.

Outside the Floodway

- Financial, physical and emotional toll experienced by those impacted by flooding, particularly artificial flooding. This is aggravated by the feeling that residents outside of the Floodway protection are stigmatized and viewed as whiners, when in fact they have endured hardships. There is also the opinion that property and possessions had been flooded, not by acts of nature, but by acts of government policy.
- Dissatisfaction with compensation programs, including the process and amounts.
- Loss of use of Dunning Road during Floodway operation, including potentially increased response times for emergency vehicles.
- Ice jamming, which was thought to be caused by operation of the Floodway before ice on the river is flowing freely.
- Flooding of roads and access to properties and business. Damages may occur that require extra repairs.
- Impacts on market gardens, especially from non-spring flooding. Also, loss of use of personal gardens and property.
- Inhibited drainage of farmland due to elevated river water backing up into the drainage system and causing increasing economic hardship to the farming community during the summer operation of the Floodway.
- Flooded septic fields in Ritchot cannot be used for an extended period of time after waters recede.

Inside the Floodway

- Significant economic losses at The Forks due to high water levels: maintenance cost, lost tourism opportunities, and damage to reputation.
- Riverbank erosion from non-spring operation, including riverbanks within Winnipeg if the Floodway is not operated and within the floodway channel if it is operated. Non-spring emergency operations could erode dikes and riverbanks that are less susceptible to these problems in the spring when they are frozen. Associated impacts could be increased sediment loads and impacts on fish habitat.
- Death of riverbank trees and loss of vegetation, which will further weaken riverbanks.
- Negative impact of non-spring emergency operations on wildlife, which may have nests established and be more vulnerable.
- Increased mosquito breeding and concern about elevated West Nile disease levels.

The need for additional studies to better understand the impacts and associated costs and benefits was identified. Several mitigation measures were discussed to address these impacts, including the need for better education about how the Floodway is operated and the implications.

Compensation for artificial flooding has been an issue since it was first experienced in 1997. Normally, compensation for floods is based on the Disaster Financial Assistance (DFA) program that limits eligibility, eligible costs and maximum payable. In 2005, the Manitoba government passed The Red River Floodway Act, which provides full compensation (repair or replacement costs and economic loss) without any deductible portion or depreciation.

While The Red River Floodway Act relates to artificial flooding for spring floods (Rule 2), the government has committed to full compensation for summer and fall operation (Rule 4). The government extended the right to full compensation for artificial flooding from regulated water control work in 2008 through amendments to The Water Resources Administration Act. To date, the only regulation applies to the Shellmouth Dam.

5.4.3 Roundtable on Summer Use of Rivers

The Panel met at The Forks office with people who have an interest and expertise in waterfront development in Winnipeg and along the Red River. Those in attendance represented the following organizations:

- The Forks North Portage Partnership
- Entreprises Riel
- Architecture firm
- Landscape architecture firm
- Rivers West - Red River Corridor Inc.

Observations from that meeting are summarized below.

Overview Comments

- Citizens no longer see our rivers as usable due to high summer levels.
- The public has forgotten what it is like to have ready access to our river system.
- While we have done well with some river-orientated development, for the most part we have turned our backs on our river system. We need a psychological shift – to think of the river system as a primary community amenity. The question is how do we make the river system our front yard?

Quality of Life

- At an important level we are competing with every other jurisdiction based on the perceived quality of life in our communities. And we are losing!

Economics

- The economic argument for river-based development is hard to quantify but it is very real.
- What works well on a personal level – improved quality of life, more appealing community, aesthetics – also works well at an economic level.
- Every attempt to do something of quality in association with our river system has been a success – The Forks, Esplanade Riel, Canadian Museum for Human Rights. Even the Bridge Drive Inn (BDI) derives its success from its association with the Red River.

The underlying premise of the roundtable discussion was that our river system is Winnipeg's most defining natural feature. We have largely turned our backs on our rivers, but with proper management they will become the core of revitalized communities. The Go... to the Waterfront plan adopted by the City of Winnipeg notes that in other jurisdictions, "Public and private investment in public spaces and compatible development along these urban waterfronts have transformed underutilized or inaccessible riverfront lands, added character, raised 'quality of life' and contributed to each city's tax base."

One obstacle to public action is that we are not all in the same boat. Residents upstream of Winnipeg feel that the vision can only be achieved at their expense.

6 THE PORTAGE DIVERSION

The Portage Diversion is a 29 km (18 mile) channel that diverts water from the Assiniboine River, just west of Portage la Prairie northward into Lake Manitoba near Delta Beach.

It not only provides flood protection for Winnipeg, but it also prevents uncontrolled breaches of the river east of Portage la Prairie. Throughout most of its length, the Assiniboine River is in a well-defined valley. However, just west of Portage La Prairie, the river emerges from the Manitoba escarpment onto the Assiniboine River Delta. Because of sediment deposition, parts of the river in this reach are perched. Therefore, when the river overflows its banks, the water flows across the prairie to other receiving water bodies including the La Salle River to the south and Lake Manitoba to the north.

From Portage la Prairie to Winnipeg, the natural channel capacity of the river is between 8,000 and 10,000 cfs. Over the period of settlement, dikes have been constructed along both sides of the river to increase the channel capacity. The current safe operating capacity is around 15,000 cfs, although higher flows up to 18,000 cfs could be safely passed for short periods of time.

6.1 Background

The Portage Diversion was designed as one component of the flood control scheme for reducing the flood threat in Winnipeg. The Report of the Royal Commission on Flood Cost Benefit (1958) recommended its construction along with the Red River Floodway and a dam on the Assiniboine River near Russell. Construction on the Portage Diversion started in 1965. It was first put into operation in the spring of 1970.

The initial design for the Portage Diversion was presented in the Report on Investigations into Measures for the Reduction of the Flood Hazard in the Greater Winnipeg Area (1953). This study

examined three capacities for the Portage Diversion: 10,000 cfs, 25,000 cfs and 40,000 cfs. The report also suggested two routes for the Portage Diversion, each following old channels between the Assiniboine River and Lake Manitoba. The Fort la Reine route would start on the north bank of the Assiniboine River 3 km (2 miles) west of Portage la Prairie and follow a more or less direct line due north to the lake. The High Bluff route would leave the river about 8 km (5 miles) east of Portage la Prairie and follow a northwesterly course to Portage Creek and thence along the creek to the lake.[15]

The *Red River Basin Investigation Report* provided an initial design for a dam across the Assiniboine River to control downstream flows, but no dam was included at the Portage Diversion inlet. Rather an overflow weir was designed, somewhat like the plug at the start of the Red River Floodway.

The report recommended that the capacity of the Portage Diversion be 25,000 cfs or less based on expected costs and benefits. The report also states, "Although the estimated cost of the High Bluff diversion is less than that of the Fort la Reine diversion there would be a serious disadvantage in the former, in that the City of Portage la Prairie would be behind a system of dikes rather than below the point of diversion." [16]

The core structures of the flood control system that were conceived as the result of the 1950 flood are now some 50 years old. Attitudes and concerns were molded by the experience of the time. The collective memory for people in western Manitoba, for example, was one of drought – not flood. The concern with some of these structures at the time was that they may "waste" a very precious commodity: water. There were no substantial cottage developments on Lake Manitoba and no concern about the flood impacts of the Portage Diversion. In the 1950s, urban dwellers had a better understanding of rural issues due to recent migrations from the farm to urban life.

Upon completion of the Red River Basin Investigation Report, the government of Manitoba established the Royal Commission on Flood Cost Benefit to undertake a public inquiry into the benefits of the various flood control structures recommended in the report. The Royal Commission's report, completed in 1958, recommended a 25,000 cfs capacity diversion be constructed. It recommended the High Bluff route east of Portage la Prairie rather than the Fort la Reine route because the cost of construction would be $2.3 million less. The report states, "It would seem likely that with only a moderate additional expenditure on the High Bluff route the dikes protecting Portage la Prairie could be made completely safe."[17]

At a benefit-cost ratio of 9, as computed by the Royal Commission on Flood Cost Benefit, the Portage Diversion was the flood control project with the highest individual benefit-cost ratio. However, a review of the Winnipeg Free Press archives from this period indicates that the Portage Diversion faced greater public opposition than the other recommended control structures. The major complaints were:

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[15] *Red River Basin Investigation Report, p. 57.*
[16] *Red River Basin Investigation Report, Appendix G, p. 83.*
[17] *Red River Basin Investigation Report, p. 19.*

- The Portage Diversion would waste water by running it into Lake Manitoba and away from where it would be useful. D. L. Campbell (MLA Lakeside) said the Portage Diversion would mean the ***"worst conservation use"*** of the waters of the Assiniboine River. He said that Lake Manitoba, where water from the Assiniboine would be diverted, was where *"great evaporation takes place . . .* ***Don't run water out of where it is needed now."***[18]
- The High Bluff route recommended by the Royal Commission and adopted by the government would provide no flood control benefits to Portage la Prairie. In fact, the creation of the reservoir east of the city would raise river levels through Portage la Prairie.

Manitoba Agriculture Minister George Hutton responded to the first concern as follows: ***"The diversion was the most exciting of all government water conservation projects. By using Lake Manitoba – Lake Winnipegosis complex as a reservoir the province could ensure a water supply to a huge area of western and central Manitoba.*** *To achieve the same results by other methods would cost between $30 and $50 million."* [19]

In the same Winnipeg Free Press article, the Minister stated that engineers were studying a third possible route for the Portage Diversion, upstream from the two recommended in earlier studies.

Interestingly, no comments or complaints were found about the impact of the Portage Diversion on Lake Manitoba levels. This is likely because lake residents believed that the recently completed Fairford River Water Control Structure would alleviate future flooding, along with assurances that the impact on Lake Manitoba levels would be minor, usually less than half a foot.

The Portage Diversion was eventually constructed more or less along the Fort la Reine route and included two control structures: one on the river to control flows eastward towards Winnipeg and one at the head of the Portage Diversion to control the flows.

6.1.1 Aging Infrastructure

As of 2014, the Portage Diversion structure was 45 years old. Much of the infrastructure is aging and requires updating. For example, there is no good way to measure the gate settings in the control structure. Also, in 2011, the reservoir level was so high there was water in the control room. A study is currently underway regarding refurbishing the control structure and increasing the design capacity to 34,000 cfs.

6.2 Operating Guidelines

In the Red River Basin Investigation Report, the design of the Portage Diversion was based on the following considerations:[20]

- In spring, the control gates would not be operated until the river is free of ice.
- Once the ice has cleared, for flows below 10,000 cfs send all flows down the river.
- From 10,000 to 35,000 cfs, send 10,000 cfs down the river and divert the rest to Lake Manitoba.
- When the Red River in Winnipeg is in flood, the complete flow of the Assiniboine River up to the diversion capacity would be diverted into the diversion channel.
- Do not exceed 25,000 cfs in the diversion channel.

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[18] *Winnipeg Free Press, March 1962.*
[19] *Winnipeg Free Press, December 22, 1962.*
[20] *Red River Basin Investigation Report, Appendix G, p. 78.*

The first documentation of the Portage Diversion operating rules adopted after the structure was completed was included in the Red River Floodway Program of Operation (October 1984). The rules set out the following operating objectives:

1. To provide maximum benefits to Winnipeg and areas along the Assiniboine River downstream of Portage la Prairie.
2. To minimize ice jams forming along the Assiniboine River.
3. Not to increase the water level in Lake Manitoba beyond the maximum regulated level of 812.87 feet (247.76 m), if possible.
4. Prevent overtopping of the failsafe section in the Portage Diversion, if possible.

Difficult Choices

When levels are high on Lake Manitoba should more flow be kept in the lower Assiniboine River, or should diversion to Lake Manitoba continue unabated?

An increase of 5,000 cfs on the lower Assiniboine River would immediately flood agricultural lands, whereas a diversion volume of 5,000 cfs is equivalent to 1/10th of an inch per day or ¾ of an inch per week on Lake Manitoba.

The impact on the lower Assiniboine is immediate and observable, but the long-term impact of accumulated diversion volumes may be greater on Lake Manitoba.

The eight rules contained in the Program of Operation are:

1. Except as provided for under Rule 8, the Portage Diversion shall be utilized to its maximum capability to keep water levels in Winnipeg below 17.0 feet (5.2 m), City Datum.
2. The flow in the Diversion shall not be allowed to exceed 25,000 cfs (708 m^3/s).
3. If flow forecasts indicate that the peak inflow into the reservoir to be 20,000 cfs (566 m^3/s) or more, the Diversion will be put into use as soon as possible to flush out snow blockages and in situ ice.
4. During the period that there is ice on the reservoir, the water level of the reservoir will not be allowed to exceed 865.0 feet (263.65 m) to provide room for releases from breaching of upstream ice jams.
5. The conduits of the Spillway Structure shall be closed while there is water going over the bascule gates.
6. While there is ice on the Assiniboine River downstream of Portage la Prairie it is desirable to limit flows to approximately 5,000 cfs (142 m^3/s) in the River if possible. Flows of this magnitude appear to be optimum flows required to assist in flushing the ice down river without causing major ice jams or flooding to adjacent farm lands through local drainage inlets. This procedure provides additional capacity, if required, on the River downstream of Portage la Prairie when the second peak arrives. The level of Lake Manitoba should not be taken into account while there is ice on the Assiniboine River, as the period during which there is ice on the River during the spring runoff is only a few days, and diverted flows for this short a period of time have a negligible effect on the level of Lake Manitoba.
7. After the ice has gone from the Assiniboine River downstream of Portage la Prairie, it is desirable to maintain flows less than 10,000 cfs (283 m^3/s) in the River if possible. Flows greater than 10,000 cfs (283 m^3/s) are above the natural bank stage of the River, and backup of local streams which outlet into the Assiniboine may occur at this level. There also may be seepage problems through the dike, leakage under the dike through gated culverts and flooding of cultivated land between the dikes.

8. For flows of up to 30,000 cfs (850 m^3/s) under open water conditions, the failsafe section of the west dike of the Portage Diversion should not be breached if the peak stage in Winnipeg will not exceed 18.0 feet (5.5 m).

6.3 History of Operation

The Portage Diversion has been operated in 33 of the 45 years between 1970 and 2015. Table 4 summarizes the annual operations. Years during which the diverted volumes raised levels on Lake Manitoba by half a foot or more are shown in red.

Table 4: History of the Portage Diversion Annual Operations [21]

Year	Volume (ac ft)	Number of days	Year	Volume (ac ft)	Number of days
1970	212,000	21	**1993**	4,560	7
1971	25,300	12	**1994**	121,000	64
1972	247,000	41	**1995**	1,120,000	68
1973	-	0	**1996**	619,000	60
1974	533,000	64	**1997**	625,000	57
1975	537,000	71	**1998**	52,400	13
1976	1,420,000	63	**1999**	914,000	87
1977	-	0	**2000**	-	0
1978	3,260	2	**2001**	628,000	61
1979	528,000	55	**2002**	-	0
1980	-	0	**2003**	3,590	2
1981	-	0	**2004**	60,200	10
1982	29,500	5	**2005**	778,000	65
1983	129,000	32	**2006**	461,000	58
1984	-	0	**2007**	277,000	37
1985	44,600	8	**2008**	-	0
1986	93,600	24	**2009**	932,000	57
1987	118,000	13	**2010**	497,000	95
1988	-	0	**2011**	4,770,000	125
1989	7,930	4	**2012**	-	0
1990	-	0	**2013**	628,000	70
1991	-	0	**2014**	2,220,000	61
1992	139,000	26	**2015**	159,000	32*

** current as of 20 July 2015*

[21] *Does not include flows diverted for irrigation along the Diversion channel.*

6.4 What You Told Us

Previous public consultations regarding Lake Manitoba occurred as part of the following studies and associated reports:

- *Assiniboine River and Lake Manitoba Basins Flood Mitigation Study* (interim findings in 2014)
- *Lake Manitoba/Lake St. Martin Regulation Review* (2013)
- *Manitoba 2011 Flood Review Task Force Report* (2013)
- *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues* (2003)

During this review, the Panel met with rural municipalities and First Nations, received electronic submissions, and held public open houses in Portage la Prairie, Winnipeg, St. Laurent and Ashern, among other locations.

6.4.1 Comments on Operating Guidelines

Recent consultation processes heard quite a few comments regarding the operation of the Portage Diversion, including the circumstances or rationale under which it is used. Many of those consulted by the 2011 Manitoba Flood Review Task Force felt that the Portage Diversion is overused; that it was intended only to be used in emergencies but instead is used as a first response to potential floodwater problems, thereby keeping Lake Manitoba levels artificially high. Some questioned the validity of the reasons given for operation of the Portage Diversion in recent years, including in the months leading up to the 2011 flood. It was questioned why the Portage Diversion was used to the extent that it was in 2010, raising the level of Lake Manitoba rather than running the Assiniboine River to its full capacity, which some people believed was an option. Multiple comments linked the operation of the Portage Diversion to outflow via the Fairford River Water Control Structure or other potential outflow structures. Survey respondents suggested that the Portage Diversion flows should be capped at a more manageable level if outflows from Lake Manitoba are not increased.

During the Panel's public engagement process, similar comments were made by both officials from rural municipalities and the public. One of the most frequent comments concerned the need to balance the flow of water in and out of the Lake Manitoba. As more than one person put it, "cup of water in, cup of water out."

Comments regarding the operation of the Portage Diversion were usually in the context of appropriate Lake Manitoba water level. The Lake Manitoba/Lake St Martin Regulation Review Committee specifically sought input on this topic: "Comments received from residents around Lake Manitoba were quite consistent in suggesting that Lake Manitoba has been kept too high over the past few years, but that 'natural variability' is necessary for the health of the lake. Many also suggested that after the recent high water period, levels need to be held in the lower part of the range, so that marshes and shoreline vegetation can be re-established and natural beach ridges can re-develop. The most common recommended top of range was 812.0 feet." Multiple reasons were given as to why the lake needs to be regulated at particular levels, related to the impacts of levels that are either too high or too low. One recommendation made to the Lake Manitoba/Lake St. Martin Regulation Review Committee was to create a regulatory framework (i.e. a statute and regulatory board) to direct future generations on the transparent management of the lake.

Different stakeholder groups had more specific suggestions for operations. For example, ranchers suggested closing the Portage Diversion earlier in the season to allow high water to recede in time for the hay harvest. Tourist operators at the Narrows expressed a desire for stable lake levels in a range that would allow good access to their docks for boating. Cottage owners had divergent views, often linked to where their cottage was located and whether they were consulted during a period of low water (early 2000s) or after the 2011 flood. Some participants concerned with ecosystem health suggested that the Portage Diversion should be operated only when absolutely necessary and should be managed in such a way as to avoid spillover into Delta Marsh.

During the Panel's meetings and open houses, more specific comments were received regarding operating rules. For example, interests along the lower Assiniboine River stated:

1. Drains begin to back up at 8 000 cfs.
2. Flows greater than 8,000 cfs delay seeding.
3. Flows greater than 10,000 cfs after seeding destroy crops.
4. At 13,000 cfs after planting, crop damage is significant. Prior to planting, it may delay seeding.
5. Crops on the lower Assiniboine are high value. It would be better to compensate agriculture interests on Lake Manitoba and protect agriculture on the lower Assiniboine River.

Photo Credit: Wayne Glowacki, Winnipeg Free Press

Protests related to flooding on Lake Manitoba and Operation of the Portage Diversion (2013)

6.4.2 Comments on Impacts

As with the Red River Floodway, impacts and concerns identified during consultation did not necessarily distinguish between those associated with flooding generally and those related to the operation of the Portage Diversion and associated lake levels. Comments included:

- Loss of and damage to homes from flooding. In previous consultations, this was most frequently applied to homes and cottages along Lake Manitoba. Concerns continued to be expressed during the Panel's open houses, although mitigation measures have been put in place since 2014. The Panel also heard concerns regarding residential property in the RM of Headingley if flows down the Assiniboine were to exceed 20,000 cfs and especially 23,000 cfs. That is, the Panel heard concerns about using the Portage Diversion too much and not using it enough.
- Loss of and damage to recreational properties from flooding.
- Financial, physical and emotional toll experienced by those in the Lake Manitoba area during and after the 2011 flood.
- Decline in water quality, notably from higher sediment loads (leading to siltation) and increased levels of phosphorous and negative impacts on the fishery. This topic received considerable attention during the Panel's discussions with rural municipalities and during the open houses.

- Siltation has reduced the capacity of the Portage Diversion channel and affected Lake Manitoba as well.
- Large amounts of debris, including hazardous wastes, have accumulated in the marshes and on the beach. Some debris and waste comes from flooded cottages sites, but these are also attributed to the use of the Portage Diversion.
- Flooded wells and holding tanks, as well as impacts on municipal water supplies and sewage treatment facilities.
- Impacts on Lake Manitoba fishery from high water levels and reduced water clarity. This was noted in both 2014 and 2015 public consultations.
- Significant damage to ranch land, including increased salinity levels, lack of access and lack of sufficient pasture.
- Alterations to the natural environment, most often cited as the loss of marsh habitat due to reduction in natural fluctuations, with associated impacts on fish and wildlife.
- Recreational opportunities were impacted by too high water levels and too low water levels.

During meetings with rural municipalities and at the public open houses, the Panel clearly heard the desire for compensation. For example, one market gardener near Baie St. Paul, who produces 60% of cauliflower in Canada in season, lost everything in 2011. It was suggested there should be more analysis of economic impacts. Crop insurance does not fully recognize the loss arising from those fields that are flooded. Concerns about salinization were also noted, particularly for a producer of shallots. It was recognized that the 4-16 inch pumps that were installed in the Long Lake Drain reduced agricultural losses in 2014. Overall the message was clear: financial assistance is required for agricultural interests damaged by operation of the Portage Diversion.

6.4.3 Roundtable on the Portage Diversion

The Panel met at the offices of the Rural Municipality of Portage la Prairie with people who have an interest in and expertise regarding agricultural and water quality issues in this area. Those in attendance represented the following organizations:

- Rural Municipality of Portage la Prairie
- University professor
- Agricultural organization
- Community organization
- Retired politician

Within a wide-ranging discussion, the Panel posed the following questions:

1. With the mitigation now in place on Lake Manitoba and the lower Assiniboine River, is flood damage now primarily agricultural?
2. What is the best balance of interest between Lake Manitoba, the lower Assiniboine and Winnipeg?
3. Have mitigation measures been successful for dwellings?
4. How should we take into consideration the effects on Lake St. Martin?
5. Perspectives on the flood control structures operating as a system?

There was general agreement that agriculture is an important issue, although there were differences depending on the type of production and location of the property, particularly whether the property was along the Assiniboine River or along Lake Manitoba. Emotional impacts included the destruction of families and receivership of farms. Compensation was raised as an important issue that has not been adequately resolved for producers.

In considering the balance of interests, the need to protect Winnipeg was acknowledged. One suggestion was to do this within the Assiniboine watershed. The number of drainage projects underway is large, which could be contributing to greater peak flows. It was noted that the Portage Diversion is operated largely independent of Lake Manitoba levels; operating guidelines that were conditional on the level in Lake Manitoba would be helpful. Some noted that water in Lake Manitoba has nowhere to go. It was suggested that if the Portage Diversion were proposed today, it would never be approved. Concern about climate change was noted along with reference to the "Public Trust Doctrine", which states that environmental damage to natural areas is not permitted.

There was general agreement that mitigation measures have largely been successful for dwellings even though it is recognized that some structures have been built in vulnerable locations. Concerns remain about property flooding. It was noted that many have not taken advantage of flood-proofing because they cannot afford their share of costs.

A portion of the discussion focussed on water quality. It was stated that, "Lake Manitoba is the most vulnerable lake in the world." Concern was expressed regarding phosphorus loading via the Portage Diversion, which could lead to algae buildup and fish kills.

Field Tour: Portage Diversion

Is Manitoba Hydro Involved in Regulating Lake Manitoba?

A persistent suspicion has been raised by some residents on Lake Manitoba that flooding is exacerbated because Manitoba Hydro uses Lake Manitoba as a storage reservoir. It has been suggested that during periods of high levels on Lake Winnipeg, water is stored on Lake Manitoba so that it can be released into Lake Winnipeg during drier periods. This would reduce flooding on Lake Winnipeg and would permit Manitoba Hydro to generate more power on the Nelson River when river flows are lower. Such an action would have the effect of aggravating flooding on Lake Manitoba. But is it true?

Records from MIT show that the Fairford River Water Control Structure was kept fully open during the period from 2006 until 2014, with the exception of the winter flow reductions in 2007/08, 2008/09 and 2010/11. These flow reductions were required to prevent frazil ice development. Therefore, no water was being stored during that period for the benefit of Manitoba Hydro. Furthermore, MIT staff has assured the Panel that Manitoba Hydro's interests are never taken into consideration when flow adjustments are made at the Fairford River Water Control Structure. The only time Manitoba Hydro was consulted happened during the summer of 2011 when plans were being prepared to construct the emergency channel between Lake St. Martin and Lake Winnipeg. Manitoba Hydro was asked to estimate the impact that the additional flows would have on Lake Winnipeg levels.

So where did these rumours come from? In fact, in the 1950s, Lake Manitoba was studied as a potential reservoir for hydro power generation. The Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba (1958) included the following in its terms of reference: "The Board … shall determine and report what further developments and controls of these water resources in its judgement would appear to be physically practicable with particular reference to (a) flood control and (b) hydro-electric power." The report compared two options for power development on the Saskatchewan River system:

1. Development of a power plant with a head of 120 feet near Grand Rapids; and
2. A diversion from Cedar Lake via Lake Winnipegosis and Lake Manitoba into the Fairford River. A dam and one power plant with a head of about 20 feet would be built between Lake Winnipegosis and Lake Manitoba. A second power plant with a head of about 93 feet would be built near the mouth of the Dauphin River.

Although the diversion from Cedar Lake would provide somewhat higher benefits in terms of power production, it was determined that the project would be more costly to construct. Also, the use of Lake Winnipegosis as a storage reservoir would require a regulation range of 10 feet, which would impact developments on Lake Winnipegosis. Because of these and other considerations, option 2 was rejected and the Grand Rapids Generating Station was constructed and put into operation in November 1968.

The report also examined the benefit of using Lakes Winnipegosis and Manitoba as storage reservoirs to supplement Lake Winnipeg storage. Page 39 of the report states, "It was found that due to the relatively small local inflow, the beneficial effect was negligible, even when assuming full Nelson River power development."

7 FAIRFORD RIVER WATER CONTROL STRUCTURE

The Fairford River Water Control Structure is an outlet located on the Fairford River between Lake Manitoba and Lake St. Martin. It serves to regulate water levels on Lake Manitoba.

Lake Manitoba has a long history of flooding issues. In 1915, the federal Department of the Interior published the Report of the Lowering of Lake Manitoba. It states:

> *The desirability of permanently lowering the elevation of Lake Manitoban has been long recognized and its consummation earnestly looked forward to by the settlers around the lake. The shores are generally low and indefinite and the adjoining lands subject to flooding during periods of high water and, to a considerable extent, even at ordinary elevations of the water. This is particularly true at the south end of the lake where many thousands of acres are rendered unfit for cultivation. (page 5)*

The report describes a major flood on Lake Manitoba in 1881 and another major flood in 1912/13. Although there are no recorded lake levels for that period, the maximum recorded Fairford River flow was 14,800 cfs in 1881 and 11,500 cfs on September 9, 1913. The 1881 peak flow would correspond to a Lake Manitoba level of over 817 feet and the 1913 flow would correspond to a lake level of over 816 feet. Both of these peak levels are higher than the extreme levels observed in 1955. Therefore, Lake Manitoba had experienced two major floods during the 50-year period from 1910 to 1960, and three over the 80-year period from 1881 to 1960.

The report goes on to observe that, during periods of low levels, settlers farmed the exposed lands and harvested excellent hay crops: “At such times considerable land has been taken up by settlers which afterwards proved to be useless on account of flooding.” It notes that a channel was excavated at the Fairford outlet in 1904 to control high levels, but was ineffective. The report included a study of the limited lake level and flow data that was available, and recommended construction of a somewhat larger channel with a width of 300 feet and a length of 3,400 feet. It estimated that such a channel would lower Lake Manitoba levels by 2 feet. However, over the following years, Lake Manitoba receded to more normal levels and no further excavation was undertaken.

Systematic monitoring of Lake Manitoba levels started in 1914. Figure 7 shows the recorded lake levels from 1914 to 1961.

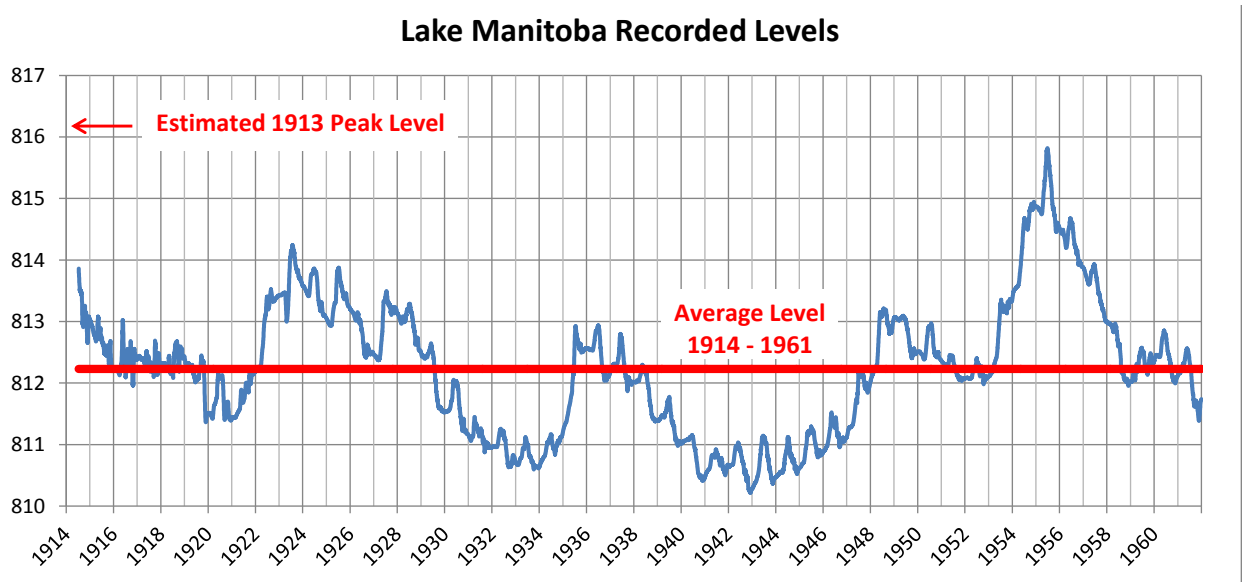

Figure 7 - Recorded Lake Levels to 1961

Before the Fairford River Water Control Structure was completed in the fall of 1961, Lake Manitoba was effectively uncontrolled, fluctuating with changing inflows and outflows. From 1914 to 1961, lake levels fluctuated over long-term cycles through a range of five feet. There were periods of high levels in the 1920s and the 1950s. But during the 19-year period from 1930 to 1948, the levels were persistently about one foot below the long-term average level.

In 1934, the Province of Manitoba constructed a small stop log dam in an attempt to maintain higher lake levels during dry years. The dam was approximately 500 feet in length. However, it provided limited benefit, largely because higher evaporation rates than inflows in dry years meant levels continued to drop in spite of the dam. From 1941 to 1945, the lake level remained between 810 and 811 feet.

7.1 Background

Demands for controlling high levels on Lake Manitoba increased as the lake level rose above 815 feet in 1955. Flooding and associated agricultural damage was extensive. It took more than three years for lake levels to recede to normal. As a result, there arose a strong local demand for a control structure at the lake outlet to stabilize levels at the long-term average level. In 1954, detailed surveys were made of the Fairford River, Pineimuta Marsh, Lake St. Martin and the Dauphin River to determine the required excavations to increase the outlet capacity of the Fairford River. The surveys are documented in the *Investigation into Means of Lowering Lake Manitoba* (October 1954).

This study was followed in 1955 with an examination of five excavation alternatives. These studies are documented in the Investigation of *Means of Lowering Lake Manitoba Levels: Upper Fairford River Channel Improvement Studies* (December 1955).

During the same period, the government of Manitoba was also examining options for regulating Lake Manitoba and Lake Winnipeg for power generation on the Nelson River. To determine the best use for regulation of the two lakes and how various interests could be satisfied, the governments of Canada and Manitoba established the Lakes Winnipeg and Manitoba Board. The *Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba* was released in 1958. It is frequently referred to as the "Lakes Board Report".

Chapter III of the report dealt with Lake Manitoba regulation for flood control. It found that Lake Manitoba agricultural losses during extremely high lake levels were severe, while lake shore erosion and damage to beach resorts were of lesser concern.[22] Two options were examined to control Lake Manitoba levels. The first option was a control structure on Lake Winnipegosis. The second was construction of a control structure on the Fairford River at the outlet of Lake Manitoba. It was determined that the Fairford structure would be less expensive than the Lake Winnipegosis structure. Also it would not negatively affect levels on Lake Winnipegosis.

The report recommended a control structure and channel improvements at the outlet to Lake Manitoba. The recommended control works were designed so that water levels of Lake Manitoba under recorded conditions (1914 to 1955) would remain within the range of 811 to 813 feet.

The analysis also examined the impact of the proposed Portage Diversion and the Lake Manitoba Supply Canal. The study determined that, over the 46-year period from 1914 to 1959, the Portage Diversion would have contributed a significant volume of water to Lake Manitoba in six of those years. The impact on Lake Manitoba levels in those years are shown in the table below.

Table 5: Maximum Mean Monthly Stage of Lake Manitoba Under Assumed Diversion Conditions

Year	Diversion (acre ft.)	Unregulated* Peak, no PD+	Unregulated* Peak with PD+	Regulated Peak, no PD+	Regulated Peak with PD+
1916	530,000	812.8	813.1	812.7	813.0
1923	630,000	814.2	814.6	811.8	812.2
1948	710,000	813.3	813.8	811.5	812.0
1950	630,000	813.1	813.5	812.7	812.8
1955	160,000	815.9	816.0	812.8	812.9
1956	865,000	814.9	815.4	811.5	812.1

Source: Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba, June 1958, Appendix 7, p. 9.
** Unregulated means without Fairford River Water Control Structure*
+ PD is Portage Diversion

The report also examined the impact regulation would have on Pineimuta Marsh and Lake St. Martin. It looked at high and low levels, but not fluctuation patterns. It found that, with the Fairford River Water Control Structure and the Portage Diversion in place, flooding would not have been aggravated on Lake St. Martin.[23]

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[22] *Lakes Winnipeg and Manitoba Board. Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba (Lakes Board Report), 1958, p. 25.*
[23] *Lakes Board Report, Appendix 5, p. 16.*

Following the release of the Lakes Board Report, the government of Manitoba requested Professor Kuiper from the University of Manitoba undertake a supplementary benefit-cost analysis of Lake Manitoba regulation. The study, documented in the Benefit-Cost Analysis Lake Manitoba Regulation (September 1958), determined that the project would have a positive benefit-cost ratio of 1.8.

This study largely computed benefits in terms of reduced flooding, but also looked more closely at the potential of coincident floods on the Assiniboine River and Lake Manitoba. The Lakes Board Report had suggested that such coincidence has a small chance of occurrence.[24] Professor Kuiper examined how much larger the excavation would need to be to ensure that, "… the resulting lake stage, with the diversion in effect, does not appreciably exceed the previously regulated maximum of 813." He determined that the effect of coincident floods on Lake Manitoba and on the Assiniboine River would be small.

What is the Flood Level on Lake Manitoba?

The flood level is the lake level above which significant flood damage starts to occur. For Lake Manitoba that level is different for each resident, depending on their particular location and exposure. Around much of the lake levels above 813 feet inhibit agricultural drainage and flood low lying fields. Generally structural damage does not start until levels are a little higher.

For many years the flood level was considered to be 813 feet. That level was recommended in the 1958 Lakes Board report (page 27), although the report did note that "the limits of 811 and 813 could be slightly exceeded for short periods of time, due to inflows or evaporation more severe than experienced. The detrimental effects, however, would be of a very minor nature." (Lakes Board Report, Page 27). Also the Red River Floodway Program of Operation (1981) included the objective "Not to increase the water level in Lake Manitoba beyond the maximum regulated level of 812.87 feet (247.76 m), if possible". The lake level of 812.87 is equivalent to the level of 813 in the Lakes Board report, with a small datum adjustment.

In more recent years with increasing development the focus of flood protection has shifted to protecting residences and infrastructure. Therefore MIT considers the current flood level to be 814 feet. This level is reasonable for protecting infrastructure, but is of concern to agricultural interests around the lake since considerable flooding of hay lands occurs at this level.

Construction of the Fairford River Water Control Structure began in 1959 and the structure became operational on July 1, 1961. The excavated channel is 7,080 feet long with a 270-feet bottom width, which more than tripled the outlet capacity of the Fairford River. The control structure consists of 11 stop log bays, each just under 20-feet wide. One stop log bay incorporates a fishway. The discharge is regulated by removing or replacing stop logs in one or more of the bays.

[24] *Lakes Board Report, Appendix 7, p. 9..*

Was the Fairford Control Structure designed to handle Portage Diversion flows?

The Fairford Control Structure was put into operation on June 1, 1960. The Portage Diversion was not completed until 1970.

- There is an assumption, therefore, that the Fairford structure was not designed to convey the additional inflows from the Portage Diversion.
- In fact, the Fairford Control Structure was designed to control Lake Manitoba between 811 and 813 ft, including the simulated inflows from the Portage Diversion based on the recorded Assiniboine flows over the period from 1914 to 1955.
- However the flows in the Assiniboine River have been higher in some years since 1970 than they were during the period used in the Fairford design.

Therefore, although the Fairford Control Structure was designed to handle anticipated Portage Diversion flows, the actual operation since 1970 has resulted in larger and more frequent Portage Diversion operation than had been anticipated.

7.2 Operating Rules

Operating rules for the Fairford River Water Control Structure were established in 1961, taking into account flood, drought and normal water conditions. The original operating rules are documented in Lake Manitoba Regulation – Operating Rules of the Fairford River Dam (November 1961). The target level for Lake Manitoba was set at the long term average level of 812.3 feet. Three rules were established for drought, flood, and normal runoff conditions:

1. A continuous 50 cfs flow shall be maintained any time when the lake level on the gauge at Steep Rock is at 812.3 or lower (wind effect eliminated).
2. To accommodate the extreme spring floods there shall be maintained available storage on the lake. If the mean outflow for October to December exceeds 4,400 cfs and the lake is close to 812.3 feet then the dam must be opened to full capacity in the following January, and held open until the flood passes and the Steep Rock gauge recedes to 812.3 feet.
3. Under normal inflow conditions maintain a level of 812.3 feet on Lake Manitoba. The document included tables to assist in determining the desired flow at the Fairford Control Structure so that the lake attains a level of 812.3 feet by the end of the month.

The second rule was based on an examination of the three highest inflow years for Lake Manitoba over the period of record: 1923, 1954 and 1955.

A datum adjustment in the early 1960s lowered all elevations around the lake by 0.13 feet, so the target level became 812.17 feet.

Through the 1960s, some residents expressed concern that the target level for Lake Manitoba was too high. In 1972, the Minister of Natural Resources asked the Manitoba Water Commission to determine "…whether or not it is practical or desirable to maintain the lake during the different seasons of the year at certain stated levels and if it be found to be practical and desirable, the recommended levels for the different seasons of the year."

The Commission examined a variety of target levels, including changing target levels with the seasons. Although a lower target level would benefit agriculture, it would have a negative impact on recreation and on shoreline marshes. The study concluded that the target level and range should remain the same[25].

Through the 1960s and 1970s, it became obvious that operation of the Fairford River Water Control Structure was having a negative impact on Lake St. Martin levels. Rapid changes in Fairford flows were causing water level fluctuations of 3 to 4 feet on Lake St. Martin. In 1977, the Manitoba Water Commission was asked to make a further study on the impacts of Lake Manitoba regulation on Pineimuta Marsh and Lake St. Martin. They considered a variety of structural options including a variety of dikes, diversion channels and control structures on Pineimuta Marsh and Lake St. Martin. While some of the structural proposals would be beneficial, it was determined that the costs would exceed the benefits. Therefore, the Commission recommended that no construction of downstream structures take place at that time[26]. They also recommended that further consideration be given to modifications to operation of the Fairford River Water Control Structure to reduce the downstream fluctuations that occur with sudden flow changes.

The Lake Manitoba Regulation Review Advisory Committee was appointed in 2001, following complaints to the Minister of Conservation regarding high water levels on Lake Manitoba. Its report, *Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues* (July 2003), discussed the negative impacts of maintaining a narrow range of regulation on Lake Manitoba. In particular, it highlighted the resulting frequent fluctuations in the levels of Lake St. Martin, and the increased frequency of flood levels on that lake.

The report noted that, since 1960, there have been numerous annual peak levels on Lake St. Martin that exceeded elevation 800.0 feet, the approximate level when flooding starts. Many of these events exceeded this level by more than one foot and a few by approximately 3 feet. Under calculated unregulated conditions, only a few events would have exceeded 800.0 feet.

The report recommends a more natural regulation regime for Lake Manitoba wherein the lake would be permitted to fluctuate between 810.5 and 812.5 feet, insofar as this may be reasonably possible, with the expectation that water levels on the lake may rise to 813.0 feet in some years and drop to 810 feet in others. To achieve this guideline, active intervention in lake levels happens at 812.5 to stem further increases and at 810.5 feet to stem further reductions, with the expectation that lake levels would either rise above or fall below the reference points, as the case may be, creating an effective normal range of 810 to 813 feet.

It also recommended that the level of Lake St. Martin be maintained within a more natural range of 797.0 feet to 800 feet, insofar as this may be reasonably possible, in order to reduce flooding, provide better access for commercial fishing and recreational interests, enhance the commercial and sports fisheries, maintain marshlands in a natural state, restore the natural aesthetics of the region, and provide hay land for local ranchers.

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[25] *The Manitoba Water Commission. Lake Manitoba Regulation. December 1973*
[26] *The Manitoba Water Commission. Lake St. Martin and Pineimuta Lake Regulation. October 1978*

After the extreme flooding that occurred in 2011 on Lake Manitoba, Lake St. Martin and the related rivers, the government of Manitoba appointed the 2012 Lake Manitoba/ Lake St. Martin Regulation Review Committee. Its mandate was to consider and provide recommendations on:

1. The need for additional water control works.
2. The most acceptable and practicable range of regulation within which the levels of Lake Manitoba and Lake St. Martin might be controlled.
3. Land use policies and zoning criteria relative to areas around the water bodies that are vulnerable to flooding.

In its report, Lake Manitoba/Lake St. Martin Regulation Review (January 2013), the Committee made three recommendations specifically related to the regulation of Lake Manitoba:

1. Make the emergency channel from Lake St. Martin to Lake Winnipeg permanent.
2. Construct a second channel from Lake Manitoba to Lake St. Martin.
3. Lower the range of regulation for Lake Manitoba from the current range of 810.5 to 812.5 feet by half a foot to 810.0 to 812.0 for a period of five years.

The Committee also recommended three modifications to the operating rules, all of which recommend that operation does not revert to normal until the lake level is at mid-range:

1. During recovery from flood conditions on Lake Manitoba, the Fairford Control Structure is kept wide open until Lake Manitoba recedes to the middle of the range.
2. For recovery from drought, the Fairford Control Structure is kept at 800 cfs until Lake Manitoba levels increase to middle of the range.
3. Under normal operating conditions, once outflow reaches normal, there are no further stop long adjustments, as long as Lake Manitoba remains within the range.

These changes have been implemented by the Province.

7.3 What You Told Us

Comments from earlier public consultations regarding the Fairford River Water Control Structure were found in:

- Lake Manitoba/Lake St Martin Regulation Review (2013)
- Manitoba 2011 Flood Review Task Force (2013)
- Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues (2003)

During this review, the Panel met with rural municipalities, received electronic submissions, and held public open houses in Portage la Prairie, Winnipeg, St. Laurent and Ashern, among other locations.

Open House at the RM of Sigliunes

7.3.1 Comments on Operating Guidelines

While people on the shores of Lake Manitoba, Lake St. Martin and Dauphin River are all subject to the same floodwaters, there are divergent experiences and interests in the region defined in part by the hydraulic relationship between the two lakes. Many comments related to the use of the Fairford River Water Control Structure (FRWCS) to manage Lake Manitoba levels. Fewer comments were received regarding the operation of FRWCS relative to Lake St. Martin water levels. Recent consultations occurred when both lake levels were particularly high and there were calls from residents around Lake Manitoba to match outflows to inflows, particularly inflows from the Portage Diversion, and that the FRWCS should operate at full capacity. There was a concern of the Lake Manitoba/Lake St Martin Regulation Review Committee that people commenting on the guidelines were not aware that the guidelines contemplated the lake rising above 812.5 feet, and that the complete guidelines had not been fully understood by the public.

Lake St. Martin and the Fairford River Water Control Structure

The Fairford River Water Control Structure was built for the benefit of Lake Manitoba. The 1958 study assessed the impact on Lake St. Martin, but found there would be no impact. As it turned out, the downstream effects were significant, adverse and long-lived. It displaced people from their homes, destroyed native pastures that First Nations had enjoyed for generations, placed large demands on the administrative resources of First Nations, created a deep seated mistrust of government intentions, and spawned lawsuits that have yet to be resolved. There are people living in Winnipeg today who still consider themselves as being displaced by the flood events of the 1960s and 1970s. While a growing recognition of this problem has led to a much more balanced use of the control structure and attempts have been made to resolve outstanding claims, there is a pervasive memory of past injustice.

Quite a few comments indicated that consideration must be given to the impact on the people around the water bodies and communities downstream, including Lake St. Martin, and on managing outflow capacity from there to Lake Winnipeg. It was suggested that this has not previously been taken into account sufficiently.

There were comments or questions regarding the timing of FRWCS operation, primarily with the aim of maximizing output. More aggressive winter operation was advocated or beginning operation early in the spring. Improved communication around the operational status during summer months was requested. There were divergent comments regarding the benefit of operating to achieve stable and consistent water levels of both lakes versus some fluctuation to mimic natural cycles.

Similar comments were heard by the Panel during its meetings and open houses. Overall, the majority of opinions expressed said the Portage Diversion should be used less. Few specific comments were made regarding the present operating rules. Many cited the need to “build the outlet” (on Lake Manitoba) for the Fairford River Water Control Structure to operate properly and that the outflow from Lake St. Martin to Lake Winnipeg should be considered. As well, more than one suggested that the control structure must be operated throughout winter to allow for the drawdown of Lake Manitoba.

7.3.2 Comments on Impacts

As with the other flood control structures, impacts and concerns identified during consultation did not necessarily distinguish between those associated with flooding generally and those related to the operation of the Fairford River Water Control Structure (FRWCS) and associated lake levels. Impacts on Lake Manitoba and Lake St. Martin were identified and were often but not always consistent. Comments about the FRWCS frequently referenced use of the Portage Diversion. Impacts noted for Lake Manitoba included:

- Loss of and damage to homes from flooding.
- Loss of and damage to recreational properties from flooding.
- Financial and emotional hardship experienced during and after the 2011 flood.
- Decline in water quality and groundwater during flood periods. This has affected wells and drinking water, and also the use of septic tanks and fields.
- Impacts on wildlife along the shores of Lake Manitoba.
- Decline in health of the marshes, particularly Delta Marsh, including loss of vegetation. This is attributed to the lack of level fluctuations.
- Loss of fishing revenue from reduced yields, equipment loss, lack of access to infrastructure, and safety concerns due to debris during high water periods.
- Significant damage to ranch land, including increased salinity levels, lack of access, and lack of sufficient pasture.
- Loss of tourism revenue when water levels are too high or inconsistent.
- Alterations to the natural environment and loss of marsh habitat due to reduction in natural fluctuations.
- Reduced access to roads and loss of recreational opportunities during floods.

Impacts noted for Lake St. Martin included:

- Loss of and damage to homes from flooding.
- Financial and emotional hardship experienced during and after the 2011 flood, particularly for those evacuated to Winnipeg.
- Decline in water quality and groundwater during flood periods. This has affected wells and drinking water, and also the use of septic tanks and fields.
- Impacts on fall spawning and fish migration patterns.
- Loss of fishing revenue from reduced yields and equipment loss.
- Loss of tourism revenue when water levels too low or inconsistent.
- Creation of greater areas of swampland due to higher water levels.
- Reduced access to roads during floods.

8 THE LAKE ST. MARTIN EMERGENCY OUTLET CHANNEL

By mid-summer 2011, Lake Manitoba and Lake St. Martin were at record high levels. It was recognized that if no action were taken, the level of Lake Manitoba would remain well above the upper range of regulation throughout 2012 leaving communities, homes, cottages and farms at high risk of further damage from flooding, wind and waves. Lake St. Martin was expected to be above flood stage into the fall of 2012, with a summer peak 2.5 feet higher than the historic peak of 1955. Additionally, winter flows into Lake St. Martin could be as high 15,000 cfs, far above the 5,000 cfs limit required to prevent frazil ice development on the Dauphin River.

The provincial government commissioned an urgent study to explore options to bring the levels of Lake St. Martin and Lake Manitoba down to the desirable range on an emergency basis as soon as possible. The Province requested a broad review of any potential options to achieve this objective in a timely and cost-effective manner while also minimizing potential impact on other areas of the province.

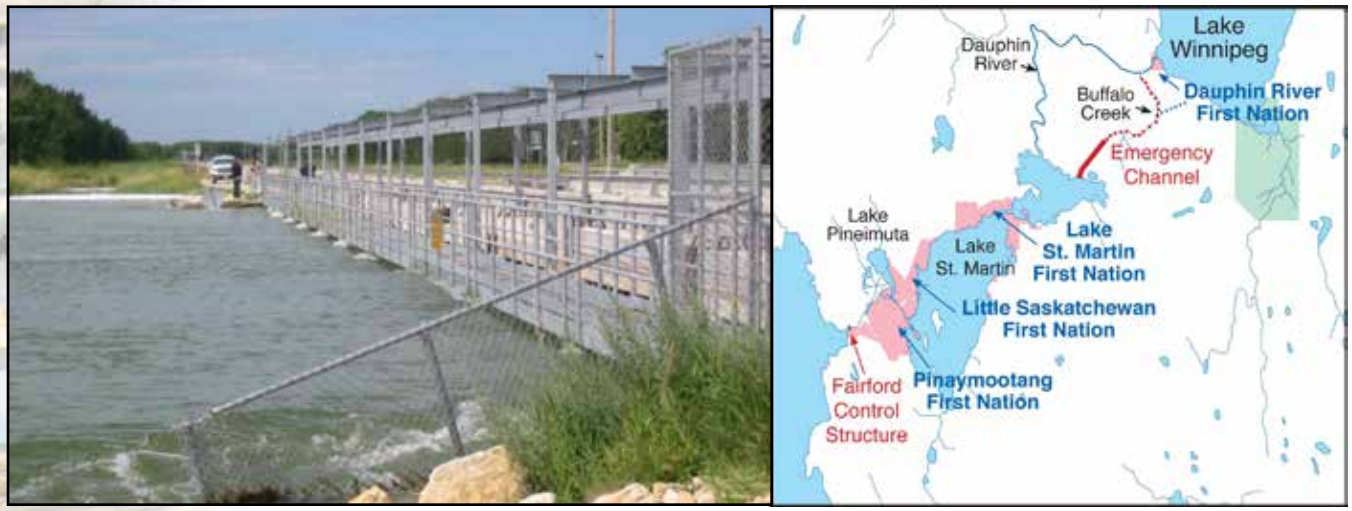
The recommended option was construction of an emergency channel (Lake St. Martin Emergency Outlet Channel or LSMEOC) from Lake St. Martin to Lake Winnipeg. It was estimated that the LSMEOC would lower Lake Manitoba and Lake St. Martin by 2 to 3 feet. This channel would provide direct benefit to Lake St. Martin through accelerated drawdown of the flood levels. It would also benefit Lake Manitoba, as it would avoid the need to reduce winter outflows to 5,000 cfs.

8.1 Operation in 2011

The initial target was to construct a 5,000 cfs capacity channel at Lake St Martin level of 801 feet by November 1, 2011. However, because of the remoteness of the project site and the difficulties associated with doing major earthwork in a marsh environment, it became clear that the full project could not be completed by November 1. Therefore, the LSMEOC, designed as three reaches, was scaled back to 4,000 cfs capacity.

Reach 1 extends 8 km from the northeast corner of Lake St. Martin to Big Buffalo Lake. This section was operational by November 1, 2011. Reach 2 follows Buffalo Creek for a further 9 km and did not require any construction. Reach 3 would divert the flow from Buffalo Creek in a north-easterly direction to Lake Winnipeg and would eliminate additional flow from entering the Dauphin River. In the absence of Reach 3, the flows would continue down Buffalo Creek, re-entering the Dauphin River 3.5 km above the mouth. However, a major concern with allowing the diverted flows to re-enter the Dauphin River was the possibility that frazil ice on the river would become trapped under the ice sheet on Lake Winnipeg and create a large accumulation called a “hanging dam”. A fully developed hanging dam would restrict the flow on the Dauphin River, causing extensive flooding of the Dauphin River First Nation. Blockage of the river would eventually have an impact on Lake St. Martin levels as well.

Figure 8 - Fairford River Water Control Structure and Location



While Reach 3 was designed to divert the emergency flows from Buffalo Creek to Lake Winnipeg to reduce the chance of frazil ice problems developing, the warm winter of 2011/12 – the warmest in many years – slowed frazil ice development such that when Reach 3 was largely completed in late winter, it was no longer required and never put into operation. Since the LSMEOC was constructed on an emergency basis with limited environmental reviews, closure was required once the emergency was over. It was closed in the fall of 2012.

The benefit to Lake Manitoba of keeping the Fairford River Water Control Structure wide open all winter was to lower the lake levels by an additional foot over the 2011/12 winter. The benefit to Lake St. Martin was to lower spring 2012 levels by more than 3 feet.

8.2 Operation in 2014

In late June of 2014, the level of Lake St. Martin exceeded 803 feet. This is the trigger level that the government of Manitoba had set for operation of the Lake St. Martin Emergency Outlet Channel (LSMEOC). On July 2, work began to open the LSMEOC and flows started on July 4. By then the lake level had risen to 803.6 feet. The intention was to fully open the LSMEOC so that Lake St. Martin levels could be drawn down before winter. However, a blockade by First Nations communities halted work before it was fully opened. The First Nations fishers were concerned that operation of the LSMEOC might have a negative impact on the Lake St. Martin fishery. Therefore, the work was halted with the LSMEOC operating at just over half its capacity.

MIT received agreement from the First Nations to complete the opening of the LSMEOC in October, but by then opening it would have aggravated the anticipated frazil ice buildup at the Dauphin River communities. As well there would have been fisheries concerns. Therefore, the decision was made to leave the LSMEOC running at 50% capacity over the winter. It is anticipated that the LSMEOC will be closed sometime in the summer of 2015 once the emergency has passed.

8.3 Operating Rules

As an emergency structure, the Lake St. Martin Emergency Outlet Channel's operation was permitted only under a state of emergency. The related guideline is to open the LSMEOC when Lake St. Martin levels rise above 803 feet, and close it when levels recede to 801 feet. Since 2011, the Manitoba government has announced the intention to make the LSMEOC permanent, which would require a licensing process.

8.4 Licensing Considerations

Construction of a major work like the LSMEOC normally requires licensing under Manitoba's *The Environment Act* (MEA) and consideration under *The Canadian Environmental Assessment Act*, 2012 (CEAA). Both acts, however, allow a project to be excluded from the application of the respective acts if, as in the case of the CEAA, the project is carried out in response to "an emergency, and carrying out the designated project without delay is in the interest of preventing damage to property or the environment or is in the interest of public health or safety."

In 2011, Manitoba declared a state of emergency under provisions of *The Emergency Measure Act.* As per the Act, upon declaration of a state of emergency, the minister responsible may "issue an order to any party to do everything necessary to prevent or limit loss of life and damage to property." Manitoba relied upon these provisions and the exemptions provided in the environment acts to proceed with construction of the LSMEOC. Manitoba met the regulatory requirements of Aboriginal Affairs and Northern Development Canada, Transport Canada and the Department of Fisheries and Oceans.

The significance of the foregoing is that once the state of emergency no longer existed, Manitoba lost the authority to operate the LSMEOC. The entrance was closed in November 2012. The government of Manitoba has announced the intention to make the LSMEOC permanent. Doing so will require a license under the MEA, a review under the CEAA, and consultation with First Nations, which will all take time. In the interim, the provincial government proposes to continue operating the LSMEOC to keep Lake St. Martin from exceeding 803 feet, as was done in 2014 on emergency basis.

Design studies for a permanent channel and control structure are underway. The Manitoba government is expected to apply for the necessary licenses to build and operate the works as soon as the design studies are completed.

9 REVIEW CRITERIA

Improving the operation of Manitoba's flood control system and its component structures is a complex exercise that must:

- Balance multiple, and often conflicting interests.
- Take into account evolving knowledge and understanding.
- Operate in circumstances and environments that differ for each flood.

As the Panel contemplated and evaluated possible operating guideline changes, it took into account the following criteria:

- Maximize benefits
- Minimize artificial flooding and negative impacts
- Balance interests
- Consider those who are negatively impacted
- Respect nature

Criteria 1: Maximize Benefits

Flood control structures are designed and operated as a system. The core objective of the system is to minimize overall damage from floods and maximize benefits.

However, there is a caveat. The priority for flood control is hierarchical. First priority is critical infrastructure (emergency services, power and critical access) and communities. While consideration is given to agricultural interests on the lower Assiniboine River, this only holds true until communities are threatened.

While the Fairford River Water Control Structure was built principally to control levels on Lake Manitoba, and the Portage Diversion has as an objective to provide benefits to the lower Assiniboine River, under flood conditions the system is operated to minimize overall damage. In practice, and by design, this means that Winnipeg receives the highest priority. Not because its homes are more valuable, but because there are more of them.

To deal with floods outside Winnipeg, the province has invested in significant flood mitigation measures in the Red River Valley and following the 2011 flood, also around Lake Manitoba.

The Panel has considered if there are opportunities within the operating guidelines to improve overall system benefits.

Criteria 2: Minimize Artificial Flooding and Negative Impacts

Artificial flooding is hard to distinguish from flooding that would have otherwise occurred. It is recognized that river flows have been modified by the effects of land drainage and land use changes as well as by the operation of flood control works. The Province often uses the terms regulated and unregulated and restricts the definition of artificial flooding to the impact of the operation of flood control works.

Computation of artificial flooding requires detailed analysis to arrive at a determination of what flooding is artificial. Certain operations of the Red River Floodway can cause artificial flooding upstream. The operation of the Fairford River Water Control Structure can cause artificial flooding downstream on Lake St. Martin. Portage Diversion can cause artificial flooding on Lake Manitoba if its diversion volumes are so high that they negate the increased volumes of water flowing through the FRWCS.

In looking at the structures under review, the Panel has considered artificial flooding and its effects in arriving at its recommendations.

Criteria 3: Balance Interests

Balancing interests is complicated. Flood control structures are designed and operated as a system. The objective of the system is to minimize overall damage from floods and maximize benefits.

Part of the problem with balancing interests is simply understanding the interests. This is compounded by lack of awareness of the problems faced by others within our own community. Manitobans are now largely an urban population. The objectives for the Portage Diversion include creating benefits for the lower Assiniboine River. The operating rules give consideration to agricultural interests. When the Portage Diversion was constructed, 40% of the population was rural; many people living in the city had recently migrated from “the farm” or had farm relatives they visited regularly. This has changed. Our rural roots are more distant and with it a lack of understanding of issues faced by our rural population and a moderation of empathy.

The Panel has recommended modifications to the operating rules for the Portage Diversion to give more consideration to Lake Manitoba, but under severe flood conditions the core objective of minimizing overall damage will continue to take precedence over local interests.

In extreme events, the flood control system cannot both balance interests and maximize benefits. If there is to be a balance of interests, it has to be achieved by other means.

Criteria 4: Consider Those Who are Negatively Impacted

The Panel heard a great deal about issues and concerns regarding the operation of flood control structures. The flood control system has saved the Province billions of dollars in flood-related damages. The benefits of the system seem to be taken for granted by those people protected by the system. Most of what the Panel heard was from those who have suffered flood damage from the 2011 and 2014 floods.

In this review, the Panel has tried to capture concerns of people who do not have full flood mitigation in place and may be adversely affected by the operation of flood control structures.

Criteria 5: Respect Nature

People like to live close to the water. And they would like lakes and rivers to accommodate that choice.

Prairie water systems, however, exhibit large variability within any given year and from year to year. While it might be technically feasible to keep our lakes and rivers within a narrow operating range, it is economically impractical and environmentally unsound.

We must find a way to live with variability and the Panel has adopted this perspective when considering operating guidelines.

10 POSSIBLE CHANGES TO OPERATING GUIDELINES AND PUBLIC COMMENT

The following potential changes to operating guidelines were presented to the public at open houses held in January 2015. They were presented to stimulate discussion. These "potential" changes were not recommendations but simply presented a wide range of options. The Panel recognized that some of these potential changes are contradictory.

10.1 Red River Floodway

Possible Change	Comments
Delete Rule 4 – emergency summer operation	• Upstream artificial flooding has been a concern
Add Rule 5 – summer operation to keep walkway open	• Flooding, damage to riparian vegetation and concerns about loss of roadways
Formalize practice of using target level of 0.5 ft below "natural" upstream	• Shares the benefit of the floodway upstream • Protects against unintended artificial flooding
Discretion to operate before ice is flowing freely	• 2009 experience shows ice will go down floodway once depth of flow is established
Permit operation above "natural" during initial operation to a maximum river level of 760 ft at the floodway entrance	• Allows for faster response to start of flood • Must not exceed peak level for the year

10.1.1 Public Response: Red River Floodway

Consistent with the pattern identified in past consultations, there are distinct differences in opinions and participation levels contingent on geographic location relative to the Floodway. For example, in communities located outside Winnipeg there is near unanimous opposition to the proposed addition of Rule 5 – summer operation to keep the Riverwalk dry whereas those from Winnipeg are supportive or neutral.

Potential Rule Change:

Delete Rule 4 – Emergency Summer Operation

By and large, most comments from outside Winnipeg (both upstream and downstream) are supportive of the deletion of Rule 4. Emergency summer operation of the Floodway to reduce basement flooding in Winnipeg is seen as contributing to overland flooding and the saturation of parcels of land making it impossible to seed crops, graze livestock, etc. The RM of Ritchot noted that, at 760 feet, St. Mary's Road is partially flooded. The flooding of Dunning Road and other future low level crossings of the Floodway are significant issues for the RMs east of Winnipeg, should summer operation occur. The City of Winnipeg noted that the sewer system may be overwhelmed by summer storms even when the rivers are low. It was noted that more homeowners need to install backwater valves and sewer pumps.

Potential Rule Change:

Add Rule 5 – Summer Operation to Keep Riverwalk Open

The proposed addition of Rule 5 was generally met with disapproval from municipal authorities and individuals outside Winnipeg. There was a widely held belief that the Floodway would be used to maintain the Riverwalk at the peril of landowners and residents outside Winnipeg and that was not palatable. This opinion was expressed by those upstream and downstream of Winnipeg, but the linkage to use of the Portage Diversion was also noted. One person at the Portage la Prairie open house stated, "I feel like a second-class citizen – we have to save Winnipeg and the walkway. I am 87 years old and lived on this farm all my life." Some wondered if another solution could be found that would not adversely affect Manitobans outside Winnipeg, such as raising the Riverwalk. As has occurred in previous public engagement processes, there were few specific comments of any kind from Winnipeggers who attended the open houses. However, a number of organizations see the ability to control summer water levels in Winnipeg as very positive. Their vision includes extensive use of and development along the riverbanks in downtown Winnipeg. It would increase quality of life and create economic benefits.

The flooding of Dunning Road and other future low level crossings of the Floodway were significant issues for the RMs east of the city, should summer operation occur.

Potential Rule Change:

Formalize Practice of Using Target Level of 0.5 feet Below 'Natural' Upstream

Changes to permit operation of the Floodway above "natural" and using a target level of 0.5 feet below natural upstream had several respondents suggesting there is no consistent definition of "natural". While many supported the idea of the 0.5 feet target, natural levels were viewed as debatable and changes based on natural were seen as arbitrary. The City of Winnipeg accepts this practice in light of uncertainties in calculating natural levels.

Potential Rule Change:

Discretion to Operate Before Ice is Flowing Freely

Of all the potential changes, many expressed greatest concern about the possibility that the Floodway would be put into operation before ice is flowing freely and the safety hazards this might impose. As one resident from the RM of Ritchot stated, "I have first hand experienced the power of ice moving in flood waters outside of riverbanks. Hydro and utility poles do not stand a chance nor do trees or any other obstacles. Losing power during a flood would be catastrophic...." Many cited losing power and property damage, including damage to the riverbanks, as a primary concern should the Floodway operate before ice is flowing freely and therefore were opposed to this rule change. However, the City of Winnipeg has suggested that earlier operation of the Floodway would provide considerable benefits in Winnipeg. They suggested that a small amount of ice will eventually push through any jam in the floodway channel.

Potential Rule Change:

Permit Operation Above "Natural" During Initial Operation to a Maximum River Level of 760 feet at Floodway Entrance

The proposed rule change to permit operation of the Floodway to a maximum river level of 760 feet during initial operation was cited by many as too high. Several felt this increase would create a premature flood upstream for which residents would not have enough time to prepare. This increase would also increase riverbank erosion, and damage riparian growth and wildlife breeding grounds. In contrast, the City of Winnipeg supported the rule change as the increase above

natural would provide considerable benefit to Winnipeg. The City indicated that the initial operation takes too long, as it takes 36 hours to make the multiple gate adjustments to reach natural (or 0.5 feet below). As a result, the City of Winnipeg has had to use ice cover hydraulic grade line to ensure properties in the south end are protected. If the City could be confident the gates were moved quickly, the benefit would be fewer properties needing to be sandbagged (estimated to be 20-25 properties based on 2011 and 2013). Sewer system control activities would be reduced as well. The City of Winnipeg believes this could happen with no adverse impacts upstream.

10.2 Portage Diversion

Possible Change	Comments
When Lake Manitoba is below 811.5 ft, maximum flow on lower Assiniboine would be set at 8000 cfs	• Adjust flows to keep Winnipeg below 18 ft
When Lake Manitoba is between 811.5 ft and 812.5 ft, maximum flow on lower Assiniboine would be set at 12,000 cfs	• Adjust flows to keep Winnipeg below 19 ft
When Lake Manitoba is above 812.5 ft, maximize flow on lower Assiniboine	• Adjust flows to keep Winnipeg below 20 ft
When Lake Manitoba is below 811.5 ft, use Portage Diversion in summer to keep Winnipeg walkway open	• Keep diversion flows below failsafe

10.2.1 Public Response: Portage Diversion

Similar to previous consultation processes, many comments regarding the operation of the Portage Diversion questioned why the structure is used so often and noted that the result is artificially high levels on Lake Manitoba. Several suggested that the operating rules and guidelines are not consistently applied. Others noted there is a poor understanding of the long-term consequences of running the Portage Diversion so frequently and at high volumes.

Few responded to each of the potential rule changes set out for consideration, however, many were clear that if the Portage Diversion must be used, it should be only after levels on the Assiniboine River are high. This suggestion was supported by interests on Lake Manitoba, but residents and farmers along the lower Assiniboine River were concerned that higher flows on the lower Assiniboine would result in considerable damage to high value agricultural crops, with limited benefit to Lake Manitoba. Homeowners between Baie St. Paul and Headingley were concerned about residential flooding.

The use of the Portage Diversion to save Winnipeg residents from basement flooding was viewed by some as not fair: "We keep getting flooded to save BASEMENTS. Our livelihood is at risk." Moreover, the potential use of the Portage Diversion in summer months to keep the Riverwalk open in Winnipeg was viewed with significant frustration and anger. One attendee at the open house in St. Laurent noted, "I am insulted to have to comment on the summer running of the Diversion for the walkway. We need help now!"

10.3 Fairford River Water Control Structure

Rule changes were recommended in the 2013 report of the Lake Manitoba/Lake St. Martin Regulation Review Committee (summarized in Section 7.2 of this report). These recommendations have been implemented by the Province. The Panel did not propose any changes.

10.3.1 Public Response: Fairford River Water Control Structure

At the open houses, the Panel asked for any suggested new rule changes, consideration of issues, and comments. No comments were received specific to rule changes, although many cited the need to "build the outlet" (on Lake Manitoba) for the Fairford River Water Control Structure to operate properly. Many believed that the outflow from Lake St. Martin to Lake Winnipeg should be considered and the emergency channel be made permanent. Other comments included increasing the capacity of the Fairford River Water Control Structure as soon as possible, including by dredging.

10.4 Other Comments Received during the Consultation

While there was not consensus around water level targets or rule changes, most comments could be characterized as stating that all water levels "need to be lower",

Manitobans most affected by flood control structures are knowledgeable about the technical and societal impacts of operations. With respect to the operation of all three flood control structures, many cited the need to apply operating rules and guidelines more consistently, and to improve communication with those affected by flood infrastructure operations. Specifically, residents upstream and downstream would like more advance notice regarding operating of the Red River Floodway in order to better prepare. It was alleged that the practice of 24-hour notice under Rule 4 before operation is not always followed.

Overall, it is understood that there is no easy or quick solution to the impacts from recent flood events or for future vulnerabilities. Compared to prior input from flood-affected communities, many residents, both at open houses and via written submissions, made it clear that they have had enough, that the uncertainty and unrelenting flooding is too much. As one affected person said, "The cycle needs to be broken at some point." It was proposed more than once that the Province should buy out vulnerable properties. While some explicitly stated that "flood us equals pay us," others suggested the need for a cost-benefit analysis or economic impact study of the operating impacts of all flood control structures, including proposed new structure(s), on agriculture, industry and commercial fishing.

An overall evolution in tone of comments and conversations at open house events during these consultations compared to previous processes was noted. While anger or frustration is still present, it is less raw and to some extent has been supplanted by resignation to flooding and a desire for resolution and solutions. There is a great desire for action.

Some of the other themes and issues raised by the public include:

- Systems approach: All three flood control structures should be operated as a whole system.
- Rural populations pay the price to protect Winnipeg.
- The health of Lake Manitoba is of great concern.
- Natural vs. artificial distinction is irrelevant. It is all flooding.
- Lasting effects on land: High water tables mean that land is wet longer, which has an enduring negative impact for farming and ranching.
- Frustration, lack of trust of government: Frustration with response from provincial government and lack of assistance (and visibility) from federal government. Many asked about the impact of Manitoba Hydro on lake levels.
- In order to implement some of the proposed changes, *The Red River Floodway Act* may need to be modified.
- Drainage is a huge issue for farmers because there is so much standing water.
- Watershed considerations: "Why bother worrying about operating rules and guidelines if none of these structures have enough capacity to handle flow coming from the west!" Some suggested that until Saskatchewan to the west and the U.S. to the south are part of the solution, Manitoba will continue to get more water than is manageable.

Lake Manitoba beach

11 ANALYSIS OF ISSUES

Several issues have emerged as particularly important to the review of operating guidelines for the Red River Floodway, Portage Diversion and Fairford River Water Control Structure. These include: artificial vs. natural flooding, impact of regulation on Lake Manitoba water levels, water quality, salinity and drainage. In considering these issues, the Panel has taken into account opinions provided by the public, meetings with local governments, First Nations, roundtable groups, government employees, technical and scientific reports, and analysis of alternative operating regimes.

11.1 Artificial vs. Natural Flooding and Compensation

The issues of artificial flooding and what defines "natural" are most frequently raised in relation to operation of the Red River Floodway. However, it is a common theme to the operation of all the flood control structures. It is found in statutes governing the Red River Floodway, but has been a much more serious issue for First Nations downstream of the Fairford River Water Control Structure.

The first rule of operation for the Red River Floodway is that, under "normal operation", the river level upstream from the inlet control structure must be maintained at or below natural. Only when there is a potential for flooding to overflow the primary dikes in Winnipeg can the level south of the control structure be raised above natural.

Artificial flooding is of particular concern to residents south of Winnipeg, particularly in the RM of Ritchot. Artificial flooding is permitted under Rule 2 typically in the spring and Rule 4 in the summer emergency operation. Rule 2 was invoked in the 1997 flood. Water levels were 2.2 feet above natural to hold water levels in Winnipeg from rising further. In the event of a 1-in-700 year flood, there would be 5.7 feet of artificial flooding.[27] Artificial flooding always occurs when non-spring operations are based on Rule 4. This happened in 2002, 2004, 2005 and 2010.

This definition of artificial appears to be reasonable for Red River Floodway operation, but it is more challenging to apply to the Portage Diversion. On Lake Manitoba, "natural" is not desirable to residents and ranchers around the lake. In their view, the Fairford River Water Control Structure was constructed in 1961 so that under flood conditions lake levels would remain well below natural. Optimum operation of the Portage Diversion from the perspective of Winnipeg and communities along the river east of Portage la Prairie, however, would be to maintain a normal flow in the river and send the rest of the flow into Lake Manitoba via the Portage Diversion. Lake Manitoba interests have a different view and would prefer that the Portage Diversion never be used, or as seldom as possible. They attribute much of their flood woes to the Portage Diversion.

Key concerns regarding artificial flooding relate to its necessity, frequency, the belief that a few are being "sacrificed" for the benefit of Winnipeg, and compensation provided to those impacted.

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[27] *Floodway Expansion Project Environmental Assessment, Supplemental Filing, Section 8, Floodway Operation, November 2004.*

11.1.1 Consideration of Compensation and Financial Assistance

The Panel received many comments about compensation and financial assistance related to the operation of flood control structures. While compensation is not in the Panel's terms of reference, the Panel is "expected to review and respond to the concerns raised by the public, and to consider these concerns in their review of the operating guidelines." In the public's mind, compensation and the operation of flood control structures are closely bound, requiring a consideration by the Panel that was unexpected at the outset of its work.

In Manitoba, compensation is mostly in the nature of reparations, i.e. "making amends for a wrong or injury."

Compensation

noun com·pen·sa·tion
\•käm-p•n-•s•-sh•n, -•pen-\

2a (1): something that constitutes an equivalent or recompense: something that is done or given to make up for damage, trouble, etc.

Source: Mirriam-Webster

While compensation and financial assistance are often used interchangeably, they are materially different. Financial assistance via the federal Disaster Financial Assistance (DFA) program, for example, addresses essentials for health and safety: "providing or reinstating the necessities of life to individuals, including help to repair and restore damaged homes." The DFA program is intended to address natural disasters resulting in extensive property damage or disruption of the delivery of essential goods and services. It is not insurance, does not deal with lost income, does not compensate for loss, and does not include recreational property.

In response to specific natural disasters, the Province has, at times, provided its own assistance programs. Components of these ad hoc programs have addressed property and agricultural issues not provided for under DFA.

Commercial insurance coverage for flood events is generally not available in Manitoba. Crop insurance, however, does provide producers coverage for flood damage for most crops, including forage crops. While many producers consider crop insurance an important aspect of farm risk management, it is not adequate to deal with the effects of flooding[28].

11.1.2 Compensation and Financial Assistance for Flooding in Manitoba

In Manitoba, flood damage caused by artificial flooding is the only case where the Province is obligated by statute to provide compensation. It is unique. Two provincial acts address this issue: *The Red River Floodway Act* and *The Water Resources Administration Act.* Regulations in the latter specifically cover artificial flooding resulting from operation of the Shellmouth Dam. And while compensation in these circumstances is intuitively reasonable, it is frustrating and contentious in practice.

[28] *In 2015, the Province appointed the Manitoba Agriculture Risk Management Review Task Force to examine possible changes to business risk management tools.*

A determination was made in 2004 with respect to the Red River Floodway that, under certain circumstances, flood damage would not have occurred except for the operation of the Floodway. This resulted in *The Red River Floodway Act* (2005), which makes specific provisions for compensation. The Act also limits the compensation with the following statement:

> *… only if all applicable floodproofing criteria in relation to the land, building or structure where the damaged property is located have been complied with at the time the loss occurs.*

The compensation for artificial flooding caused by operation of Shellmouth Dam is found in *The Water Resources Administration Act* with the sections on artificial flooding coming into force in 2011. Compensation respecting Shellmouth is mostly related to agricultural issues.

For the Red River Floodway, artificial flooding will typically manifest as a higher than natural water level upstream of the floodway gates. Thus, if the water level peaked at 763 feet instead of a natural peak of 761 feet then there was 2 feet of artificial flooding and the program will pay for any damage or loss incurred between those two elevations. Damages or losses caused by a water level less than 761 feet would be ineligible for artificial flooding compensation, may be eligible for other but financial assistance such as DFA.

While these Acts were introduced to deal with artificial flooding, they have not been the source of much joy. The principle of paying compensation for artificial flooding is to provide full compensation for any damages or losses that are caused or made worse due to operation of provincial flood control structures. In practice, this means that the Province needs to determine the incremental portion of flooding that is artificial, whether that increment is measured in additional flow/height of water, duration of flooding, or both. Both Acts are intended to provide for property damage and economic loss. These programs provide landowners with compensation for which the Province could be reasonably expected to be found liable. Compensation, however, depends on the definition of artificial flooding. The determination of artificial flooding generally requires complex calculations, the results of which often are not readily understood nor accepted.

Compensation under *The Red River Floodway Act* has been paid in four years for a total of $1.9 million. In addition to legislated compensation, the Manitoba government has provided substantial support to those affected by every major flood event in the province. After the 1997 Red River Flood, the governments of Canada and Manitoba entered into the “Canada-Manitoba Partnership Agreement on Red River Valley Flood Protection”. The agreement provided $130 million in enhancements for eight ring dike communities, the construction of 10 additional ring dikes, and supported flood protection for individual homes, farms and businesses. The Red River Floodway was expanded at a cost of $665 million.

In response to the 2011 flood event, the Province initiated the Building and Recovery Action Program (BRAP) and other assistance. Within one year of the flood, the Province and the federal government had paid out:

- $314 million under DFA
- $65 million under the BRAP
- $320 million in AgriRecovery programs

Many of the flood response programs include financial support to individuals to raise structures to flood protection levels, or to dike individual properties or entire communities.

While these are substantial sums of money, and by most measures would be seen as generous, the Panel heard the following:

- In a flood, people in Winnipeg typically receive the full benefit of the flood control system. At times this comes at the expense of others:
  - People around Lake St. Martin and Lake Manitoba believe they have been flooded to protect Winnipeg, but they do not receive compensation [excepting 2011] and pay out of pocket for flood protection benefits received by residents of Winnipeg (location factor).
  - At Hoop and Holler in 2011, 100% compensation was paid even though more flooding would have occurred under natural conditions (definition factor).
  - Ranchers received assistance for 2011, but have not been compensated for longer-term damages (temporal factor).
- The ad hoc nature of the response to individual flood events produces discrepancies in how flood victims are treated.
- Compensation related to artificial flooding takes too long.
- A clearer and simpler solution must be found to determine payments.

11.1.3 Panel Considerations

The issue of compensation and financial assistance is complex. The Panel offers the following observations and comments:

1. It is important to differentiate between Disaster Financial Assistance (DFA) – which is society's response to people affected by a natural disaster – and compensation for damages caused by actions of government. For DFA, the limits on assistance (a percentage of damage to a set maximum per household) provide essentials to get people back into a safe living environment. Compensation is different. Compensation for artificial flooding is full restoration and should be provided quickly. An example is described in the Floodway operating rules. Rules 2, 3 and 4 all involve flooding above natural level. Article 4.1 of *The Red River Floodway Act* states:

   > *4(1) A compensation award is to be based on the full value of the artificial flood damage to the claimant's eligible property or of his or her economic loss due to artificial flooding, as assessed by the Emergency Measures Organization, without requiring the claimant to bear a portion of the damage or loss.*

2. Although the reference for artificial flooding is normally the computed "natural" level, that is not always the case. For example, in 2011, the government of Manitoba fully compensated land owners downstream of the Hoop and Holler breach for all damages. There is little doubt that more water would have overflowed at Hoop and Holler if the flood control structures were not in place.[29] But because the government opened the dike at Hoop and Holler and permitted flows to inundate property, landowners were compensated as if the flooding were artificial. Through much of history, flooding in this area would have been expected. However, with the flood control structures it is no longer expected, and in this instance only occurred as a direct result of a decision to open the dike and divert the water. The same case can be made for Lake Manitoba levels in 2011. The Fairford River Water Control Structure (FRWCS)

[29] *2011 Flood: Technical Review*

was constructed to control high levels on Lake Manitoba. The *Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba*[30] estimated that, with the FRWCS and the Portage Diversion in place, the maximum lake level would be 813 feet. Furthermore, the experience of residents over the period when the flood control structures were constructed in 1961 until 2010 was that levels above 813 were rare and short lived. The exceptionally high levels experienced in 2011 were primarily a result of extreme inflows. However the flooding around the lake was aggravated by the government's decision to exceed the capacity of the Portage Diversion by 36%. The resulting incremental flooding could therefore be considered artificial in the same way that the flooding below Hoop and Holler was artificial.

3. Perhaps a different compensation plan could be considered for agricultural damage on Lake Manitoba, based on Manitoba Hydro's agreement with Cross Lake. Manitoba Hydro is confident Cross Lake levels will normally remain within a specified range. Therefore, Manitoba Hydro will automatically pay compensation whenever levels are outside the "normal" range, as specified in the agreement. This range changes throughout the year.[31] For Lake Manitoba, the calculation does not need to be as complicated.

We live in a prairie environment. Prairie rivers exhibit widely variable flows. If we can count on one thing, it is the eventual certainty of extreme flood conditions. Many people and communities throughout southern Manitoba have taken advantage of opportunities to raise structures to higher flood protection levels or build dikes. It is an important part of flood protection.

Flood protection is everyone's responsibility. Premier Duff Roblin was quoted in the Winnipeg Free Press in the period leading up to the decision to build the Red River Floodway that,

> *"in another disaster similar to the 1950 flood …. [we] could no longer count on patient contributions from the rest of the country. We need to now look after ourselves."*

Agriculture is a special case and is discussed in detail in the section below.

11.1.4 Balance of Interests: The Case for Agriculture

There are significant and diverse interests on the lower Assiniboine River and around Lake Manitoba. The Panel heard concerns about the effects of the Portage Diversion respecting water quality, salinization, potential impacts to the Lake Manitoba fishery, invasive species, and impacts to homes on the lower Assiniboine and to homes and cottages around Lake Manitoba. And, in particular, concerns about the effects on agriculture.

The impacts to agriculture are tangible, difficult to mitigate, and formed part of the rationale for construction of both the Portage Diversion and the Fairford River Water Control Structure. After the 2011 flood, the Province initiated the Individual Flood Proofing Initiative (IFPI) and other assistance programs to mitigate damage from floods. In general, these programs provide financial assistance to

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[30] *Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba, June 1958, Appendix 7, p. 9.*
[31] *Manitoba Hydro. Cross Lake Community Settlement Agreement, Schedule 3.4 Method of Water Level Calculation and Sample Calculation of Predetermined Compensation, 2010.*

communities and owners of flood-prone homes, farms, businesses and cottages throughout Manitoba to flood-protect their buildings and structures by raising, moving or diking them. Those around Lake Manitoba who have benefitted from these programs are effectively protected against a 2011-type flood. The vast ranch lands that extend up each side of the lake, however, cannot practically be offered the same type of mitigation.

Agricultural Background to Flood Control Structures

The Fairford River Water Control Structure (FRWCS) was built to control water levels on Lake Manitoba and reduce the risk of flooding. The principle beneficiary of the structure was seen to be agricultural interests. The benefit-cost analysis (1958) of the FRWCS determined that regulation of Lake Manitoba could be justified economically. This led directly to the decision to build the flood control structure. Notable in the 1958 analysis are the following:

- The benefits of the structure presented in the analysis were exclusively related to agriculture. While there may have been recreational properties on Lake Manitoba at the time, they would have been few in number and modest in construction.
- The benefit-cost analysis and engineering studies anticipated the construction of the Portage Diversion but concluded that the proposed FRWCS could maintain desirable lake levels (811 to 813 feet) even with inflows from the Portage Diversion (this conclusion turned out to be wrong as demonstrated in 2011 and 2014).
- Flood damage to agriculture starts at about 813 feet and escalates rapidly, as lake levels increase to 815 feet and higher.
- The greatest hardships to agricultural producers resulted from flood conditions that extended over multiple years. "They would rather move out than face that situation again." That is, lack of confidence would lead to disinvestment.

The Portage Diversion also had agricultural interests in mind, but for those along the lower Assiniboine River. One of the objectives of the Portage Diversion is "to provide maximum benefits to the City of Winnipeg and areas along the Assiniboine River downstream of Portage la Prairie."

At the time of the design and construction of the Portage Diversion, there was no awareness of any conflict between interests in the two regions. Both the FRWCS and the Portage Diversion served to provide benefits to agriculture and without any apparent conflict. Under most conditions that holds

true today. In extreme floods, however, it is not possible to achieve this outcome. There is too much water. To minimize overall flood damage and to avoid the risks associated with an uncontrolled flood, the Portage Diversion has to be used to prevent a breach in the Assiniboine River dikes. Under these conditions, more water flows into the Portage Diversion than anticipated by the designers and the flood control benefits of the FRWCS are effectively lost to Lake Manitoba and transferred to the lower Assiniboine and Winnipeg. This situation was recognized by the Province when assistance was provided to agricultural interests around Lake Manitoba following the 2011 flood.

While this is an important observation, it is also important to note that these circumstances are infrequent. The flood of 2011 was devastating for Lake Manitoba. The flows via the Portage Diversion were a contributing factor. However, the current wet conditions on the lake are mostly due to an unprecedented 10 years of high natural inflows and precipitation. The continued use of the Portage Diversion is part of a flood control system and in most years it operates as designed. As always with floods, it is the outliers that are problematic and difficult to deal with.

Ranching around Lake Manitoba

While there is a rich diversity of agriculture in the vicinity of Lake Manitoba, the lands bordering the lake are one of the dominant beef producing areas of Manitoba. Ranchers in the vicinity of the lakes note that this is "marginal farm land but incredible ranch land." These productive ranch lands are also the most susceptible to flooding.

In 2013, there were 460,000 beef cows on Manitoba farms, generating an estimated $620 million[32] in farm cash receipts. More than 7,000 farms reported having cattle (beef and dairy) that year. It is a significant industry that is predominantly composed of relatively small family farms.

Compared to most locations throughout North America, the ranch lands in the vicinity of Lake Manitoba are highly productive and associated with other attributes that make them an important component of Manitoba's agricultural economy.

By way of comparison these lands rate favourably with respect to:

- **Stocking Rates (animals per acre):** Lands near and around Lake Manitoba have stocking rates as much as eight times higher than ranch land in Alberta and southwest Saskatchewan.
- **Water:** Most Lake Manitoba areas have significant water supply even in extended dryer periods. In many parts of western Canada, cattle will walk up to 3.2 km (2 miles) daily for water.

At the time of design and construction of the Portage Diversion, there was no awareness of any conflict between interests in the lower Assiniboine and Lake Manitoba regions. Both the Portage Diversion and the FRWCS served to provide benefits to agriculture and without any apparent conflict.

[32] *Source: Manitoba Beef Producers*

Photo Credit: Mike Grandmaison

- **Dry Land Forage Production for Winter Feed:** Lake Manitoba tame and native forage productivity can easily be double that in western Canada. While Lake Manitoba ranchers are self-sustaining, many ranching areas of North America need to source additional winter feed supplies especially in dryer periods.
- **Natural Shelter:** The area provides virtually unlimited natural shelter for all types of extreme weather conditions.
- **Land Prices:** Lake Manitoba pasture land prices are much lower than other parts of North America due to lack of competition from non-agricultural land uses.
- **Reliability:** The area is extremely reliable for pasture forage production even times of drought. Ranching here is self-sustaining with ability to have enough pasture and enough forage production to maintain an economic herd within a single ranching operation.

In summary, ranching in the vicinity of Lake Manitoba is a valuable land use that supports families and communities.

In considering possible operating guideline changes the Panel took into account a number of criteria. These are more fully set out in Chapter 9 but are replicated in the report next to discussion and analysis where they are most pertinent. Criteria 3 below is pertinent to the agricultural discussion.

Criteria 3: Balance Interests

Balancing interests is complicated. Flood control structures are designed and operated as a system. The objective of the system is to minimize overall damage from floods and maximize benefits.

Part of the problem with balancing interests is simply understanding the interests. This is compounded by lack of awareness of the problems faced by others within our own community. Manitobans are now largely an urban population. The objectives for the Portage Diversion include creating benefits for the lower Assiniboine River. The operating rules give consideration to agricultural interests. When the Portage Diversion was constructed, 40% of the population was rural; many people living in the city had recently migrated from "the farm" or had farm relatives they visited regularly. This has changed. Our rural roots are more distant and with it a lack of understanding of issues faced by our rural population and a moderation of empathy.

The Panel has recommended modifications to the operating rules for the Portage Diversion to give more consideration to Lake Manitoba, but under severe flood conditions the core objective of minimizing overall damage will continue to take precedence over local interests.

In extreme events, the flood control system cannot both balance interests and maximize benefits. If there is to be a balance of interests, it has to be achieved by other means.

Agricultural Flood Effects – Lake Manitoba

The core issue with flooding in the vicinity of Lake Manitoba is the damage to pasture and forage. These effects are both immediate and long-term. Lake Manitoba ranchers make the point that flooding in a lake environment is different than flooding associated with the Red or Assiniboine rivers. In river environments, floodwaters typically recede quickly allowing cereal grain farmers to still plant a crop. Flooding in a lake environment lasts months and has long-term effects that can last years. It brings into question the viability of ranching and the motivation to plan for and invest in the future. [33]

Water and Plants

The length of time plants are under water is the determining factor in damage to both native hay/pasture and to tame hay.

Fluctuating water levels are a natural cycle beneficial to native hay/pastures. Periodic seasonal flooding with native hay under water for up to 60 days is actually beneficial for a productive native hay crop.

[33] *Some text in the section taken from: Lake Manitoba/Lake St. Martin Regulation Review, 2013.*

Once drowned out, however, native hay takes a long time to re-establish. The timelines for native hay to re-establish itself are uncertain but it could be in the order of five years to re-establish a diverse and productive forage crop. Invasive species and less productive plants will establish within a year, but they lack the nutrient value of a mature field of native hay. Foxtail barley, which is harmful to grazing animals, thrives where there has been too much water and where salinity is high.

Tame hay is more vulnerable to flooding than native hay. A shorter time under water can result in complete loss of tame hay vegetation. Tame hay can be re-established by conventional farming methods, but the cost is substantial and requires certainty before farmers are willing to make this type of investment.

A field that is lost to flooding in one year is often lost to cattails in the following year. Flood damage lasts after the water has receded.

Salinity

Soil salinity is the salt content in the soil. Salinization, increasing the soil's salt content, can occur as a result of flooding. While not typically seen in wet years, salinization is driven by moisture. "Wicking" of moisture to the surface draws up salts from below. Salts can be transported to the soil surface by capillary transport from a salt laden water table and then accumulate due to evaporation. Salinity has detrimental effects on plant growth and yield, and is an important land degradation problem. Some of the most productive forage crops have a low tolerance to saline conditions.

Farming on the Lower Assiniboine River

The lower Assiniboine River is the area from the Portage Diversion to Headingley. It is a distance of approximately 80 km (50 miles).

The *Manitoba Soil Survey Report* published in 1972 states, "The Portage la Prairie area has some of the most productive soil in the province on which excellent yields of cereals, special and horticulture crops are realized."

The predominant crops have changed since 1972. Today, in addition to cereals, canola and soybeans are the major crops. What has remained the same is that a variety of high value horticulture and speciality crops are grown in the lower Assiniboine.

The highly productive soils in this area, combined with the availability of the river as a source of irrigation water, has resulted in farm operations that produce horticulture crops. Vegetable and fruit producers grow asparagus, broccoli, cauliflower, lettuce, cabbage, carrots, strawberries, onions, shallots, and potatoes. There are also major tree nursery operations in the area that produce trees for landscaping. These operations market their produce throughout western Canada and the US at both a wholesale and retail level.

Agricultural Flood Effects – Lower Assiniboine River

Flood effects on the lower Assiniboine River are mostly a function of timing. Flooding and the associated backup of drains can delay seeding. Floods that come after seeding can take out a whole year's crop. In core respects, it is very different then flooding around a lake. Anecdotally, it was reported that even during the "flood of the century" (1997) the floodwaters receded early enough along the Red River to allow for reasonable cereal grain production. Floodwaters around a lake tend to recede much slower and have longer-term effects. Nonetheless, flooding along the lower Assiniboine River is expensive. Impacts include the following:

- A delay in seeding might cause high value vegetable/specialty crops to be replaced with cereals.
- Flooding after seeding could cause the loss of vegetable/speciality crops that have values of $8,000 to $20,000 per acre.

Agricultural Flood Effects – Vicinity of the Portage Diversion

Overtopping of the "failsafe" results in flooding on the west side of the Portage Diversion. This can involve about 2,500 acres where an entire crop year is lost and often leaves behind a debris problem.

Comparative Damages: Lower Assiniboine River vs. Lake Manitoba

Statistics on effects on agriculture are not readily available. In part this is because crop values are conditional on such a wide range of variables that there is not one clear answer that would apply to most years. Damage to agriculture on the lower Assiniboine River can be a function of the timing of inundation. If it's early in the year before seeding, the damage may be modest. And, as noted earlier, flooding on lakes is different, as floodwaters tend to rise and recede slowly. The longer the ground is flooded, the more susceptible even hardy species of grasses are to drowning. There are a lot more acres of agricultural land around Lake Manitoba, but production values per acre, on average, are much smaller.

With this in mind, the Panel has considered the following metrics:

- Flooding in 2011 resulted in about $20 million of damage to the ranching industry in the vicinity of Lake Manitoba.
- Flooding in 2014 (Lake Manitoba peaked at about 814.6 feet) resulted in about $10 million in damage to the ranching industry.
- Overtopping the failsafe of the Portage Diversion causes about $1 million in damage.
- A sustained flow of 18,000 cfs on the lower Assiniboine River may cause $25 million or more in damage.

While definitive numbers are hard to come by, there was consensus among agricultural interests on both Lake Manitoba and the lower Assiniboine River that potential flood damage on the lower Assiniboine is both immediate and of a substantially greater magnitude than damage around the lake.

In addition to these numbers there is a psychological effect. The 1958 benefit-cost analysis of the Fairford River Water Control Structure recognized that uncertainty causes producers to be cautious about investing in their enterprises or even to consider abandoning the area. In the current case of Lake Manitoba, just when market conditions suggest that producers should be expanding, herds are in contraction due to the effects of flooding and long-term uncertainty about availability of pasture and forage. The same would apply to lands on the Portage plains if they were subject to regular flooding.

How is this useful in decision-making?

Based on financial considerations alone, the rational approach is to protect the lower Assiniboine. In terms of agricultural production that is where the greatest dollar value of damage could occur. Adopting this rationale and protecting the lower Assiniboine is consistent with generally accepted flood protection principles of minimizing overall damage.

From a social perspective, however, this is difficult to accept. It has an element of protecting higher income operations at the expense of more modest enterprises around Lake Manitoba. There needs to be some accommodation. Based on its deliberations, the Panel has made a recommendation regarding agricultural interests on Lake Manitoba in Section 12.2.2.

11.2 Impact of Flood Control Structures on Lake Manitoba Levels

The most vocal complaint about the Portage Diversion is the impact on Lake Manitoba levels. Images of lost homes and other effects were given as evidence to the claim that levels are too high and are caused by the Portage Diversion flows. Lake Manitoba interests have frequently suggested that the Portage Diversion is operated to protect Winnipeg residents at the expense of Lake Manitoba residents. For example, an opinion piece in the *Winnipeg Free Press* published May 24, 2014, alleged that the Province creates flood victims on Lake Manitoba by diverting water to the lake to save a few city basements. The article states, "…you can't blame Mother Nature this time. The cause is the prolonged and gratuitous use of the Portage Diversion."

The issue of water levels on Lake Manitoba is complex and can be broken into four questions:

1. What was the intention of the infrastructure design and operation?
2. Are the operating guidelines being followed?
3. What has happened and why?
4. What if the infrastructure were not in place?

11.2.1 Intent of Infrastructure Design and Operation

The source of the wide divergence of opinion respecting Lake Manitoba is the question of whether operation of the Portage Diversion should be considered in isolation, or whether to include the combined effect of Portage Diversion and the Fairford River Water Control Structure. The answer lies in the fact that all flood control structures in Manitoba were designed to operate as a system. The Shellmouth Dam in western Manitoba, the Portage Diversion and the Red River Floodway were designed to function as a unit to reduce flood damages in Winnipeg. In the same way, the Portage Diversion and the Fairford River Water Control Structure were designed to operate together to control flooding on Lake Manitoba. This is clearly stated in the Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba (June 1958) and in Benefit-Cost Analysis Lake Manitoba Regulation (September 1958). The Fairford River Water Control Structure (FRWCS) and the Portage Diversion were designed at the same time, and the designers simulated the combined effect of both flood control structures when the FRWCS channel capacity was determined.

However, these studies determined that the impact of the Portage Diversion would be negligible. The Lakes Board Report discussed lower Assiniboine River regulation in Chapter VI. The report states:

> *"The amount by which the stages of Lake Manitoba are increased depends upon the volume of diverted water. The amount by which the maximum stages of Lake Manitoba are increased depends on the coincidence of diversion and high lake levels. Based on the assumption that the diversion had been in effect during the period of record, computations indicate that the lake levels would have been raised a few times by about 0.5 feet when they were below maximum, while they would have been raised by 0.1 foot when they were at their maximum.*[34]

and:

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[34] *Lakes Board Report, p. 50.*

[35] *Lakes Board Report, pp. 51-52 (58-20).*

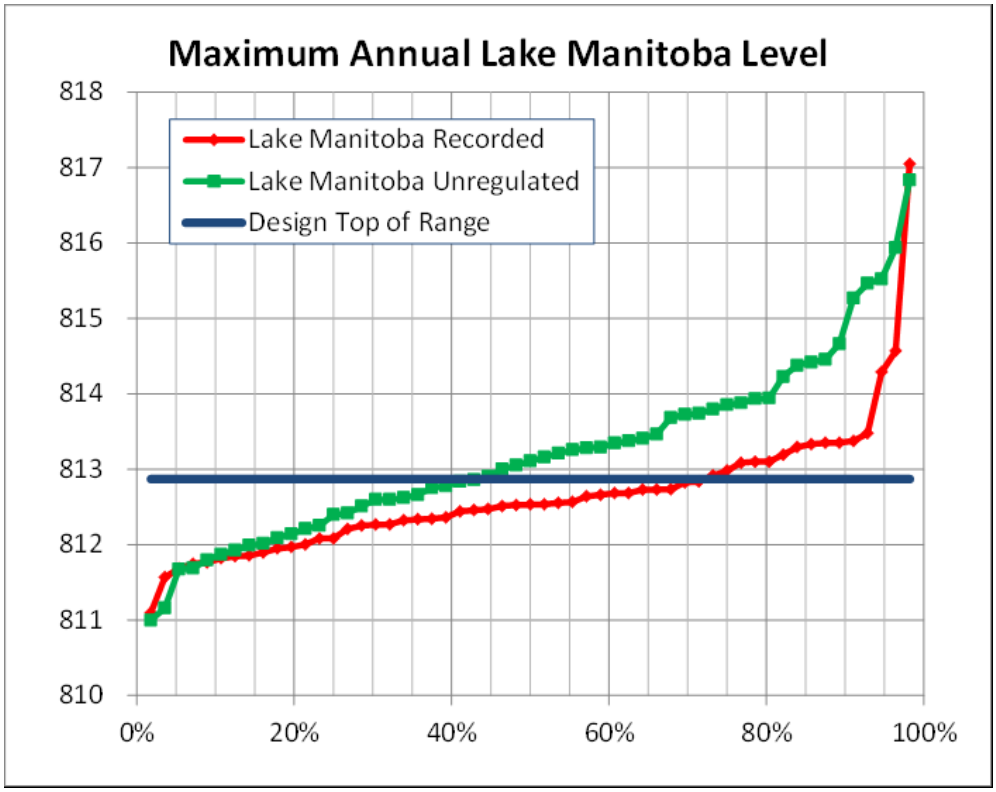
In the present investigation, consideration was given to the effect of the diversion upon the levels of Lake Manitoba, assuming the Fairford River control works, discussed in Chapter III, to be in effect. It was found that regulation of the lake level between 811 to 813 could have been maintained even with the diversion in effect. In the hypothetical case that the diversion with the largest volume of water had coincided with the largest natural inflow to the lake, the resultant maximum Lake Manitoba stage would have been 813.3. However this increase would have been removed and the lake stage reduced to 813.0 within a period of two months.

In view of the above studies the Board concludes that the Assiniboine River Flood Diversion would have no detrimental effect upon Lake Winnipeg stages in any case, and would have no detrimental effect upon Lake Manitoba stages, provided that this lake is controlled as set out in Chapter III.[35]

It is interesting to note that the conclusions of the Lakes Winnipeg and Manitoba Board were not based on a comparison with unregulated levels, but on the criteria of maintaining Lake Manitoba levels between 811 and 813 feet. However, Appendix 5 of the report shows that the extreme levels experienced on Lake Manitoba during 1954 and 1955 would have been reduced by 3 feet with the Fairford River Water Control Structure in place, so even in the case of coincident high lake inflows and maximum diversion flows the computed maximum lake level of 813.3 feet would still be well below the 1955 maximum of over 816 feet.

Figure 9 shows the maximum annual levels recorded on Lake Manitoba from 1961 to 2015, sorted from smallest to largest. It also shows what the maximum annual levels would have been without any flood control works. The red line indicates that the design criteria of maintaining the maximum monthly level below 812.87 feet has not been as successful as had been anticipated. Since the FRWCS was put into operation in 1961 the maximum annual level has exceeded the top of range 25% of the time. This is because both inflows to Lake Manitoba and Assiniboine River flows have tended to be higher since the control structures were completed. Nonetheless, the flood control system still provided considerable benefit to Lake Manitoba. The green line for conditions with no flood control works exceeded the top of range in 55% of the years.

Figure 9 - Maximum Annual Lake Manitoba Level



11.2.2 Adherence to Operating Guidelines

An article in the *Winnipeg Free Press* published May 24, 2014, was headlined, "Province creates flood victims." It stated that high levels on Lake Manitoba in 2014 were a result of "… the deliberate policy decision of Manitoba Infrastructure and Transportation to refill the lake even before its residents have recovered from the disaster of 2011 and 2012." The Panel is aware that there was a 12-day period in July when the Portage Diversion flows exceeded 25,000 cfs. While this action caused distress on Lake Manitoba it was an appropriate operating decision. During this period, the flows in the lower Assiniboine River were as high as could be sustained without risking dike failure. The additional volume from the Portage Diversion (above 25,000 cfs) was equivalent to 1.5 inches on Lake Manitoba. The government did try to provide some relief to Lake Manitoba in mid-May by increasing flows in the lower Assiniboine River above 12,000 cfs. This action caused considerable concern to farmers along the Assiniboine who had planted their crops on the understanding that the government would follow the operating guidelines and hold the lower Assiniboine flows at a maximum of 10,000 cfs.

In 2003, the Lake Manitoba Regulation Review Advisory Committee recommended that the Fairford River Water Control Structure be operated to permit more natural fluctuations on Lake Manitoba. They recommended that, when the lake is within the range from 810.5 to 812.5 feet, no adjustments be made to the stop logs. They also recommended that the control structure be opened only when the lake rises above 812.5 feet, and then be opened in such a way as to share the flood impact between Lake Manitoba and Lake St. Martin.

The Fairford River Water Control Structure (FRWCS) was fully open from the summer of 2005 until 2014, with the exception of winter flow reductions to prevent frazil ice development. The minimal operation scenario likely added somewhat to the peak level on Lake Manitoba in 2005, but would have had no impact for the years 2011 to 2014 since the FRWCS would be operated exactly the same under any previous operating guidelines.

11.2.3 Impact on Lake Manitoba Levels

The main reason for the persistent high levels on Lake Manitoba from 2011 to 2014 is the sequence of 10 wet years, two of which had the highest inflows ever recorded. Conditions existed that were beyond the original design parameters of the flood control structures.

Inflows into the lake are dominated by the Waterhen River, but in two recent years the inflows from the Portage Diversion have also been significant. From 2005 to 2014, the Portage Diversion contributed 18% of the total inflow to Lake Manitoba but in 2011, the Portage Diversion contributed 38% of the total inflow to Lake Manitoba.

Figure 10 shows annual total inflows to Lake Manitoba since the Portage Diversion was completed. The blue columns represent the total unregulated inflows to the lake for each year. This included recorded flows on the Waterhen and Whitemud Rivers, unmeasured local inflows from local drainage areas, and total precipitation minus evaporation over the lake surface. The red columns above the blue lines represent the additional annual inflows from the Portage Diversion.

The figure shows that the unregulated inflows over the past few years have consistently been among the highest observed for Lake Manitoba. But the occurrence of two or more high inflow years back to back augments the problem, as lake levels do not have sufficient time to recover from one flood event before the next flood occurs. This is particularly evident in the three-year period from 2010 to 2012. It

shows that the total inflow to Lake Manitoba in 2010 was one of the highest in recent years and lake levels rose to just below 812.9 feet. The extreme inflows in 2011 built on the elevated levels after the 2010 event to cause record flooding. The inflow in 2012 was considerably less, and there were no Portage Diversion flows. However, the lake still peaked at a level above 814 feet because of the combined effect of consecutive high inflow years.

Figure 10 - Lake Manitoba Annual Inflows

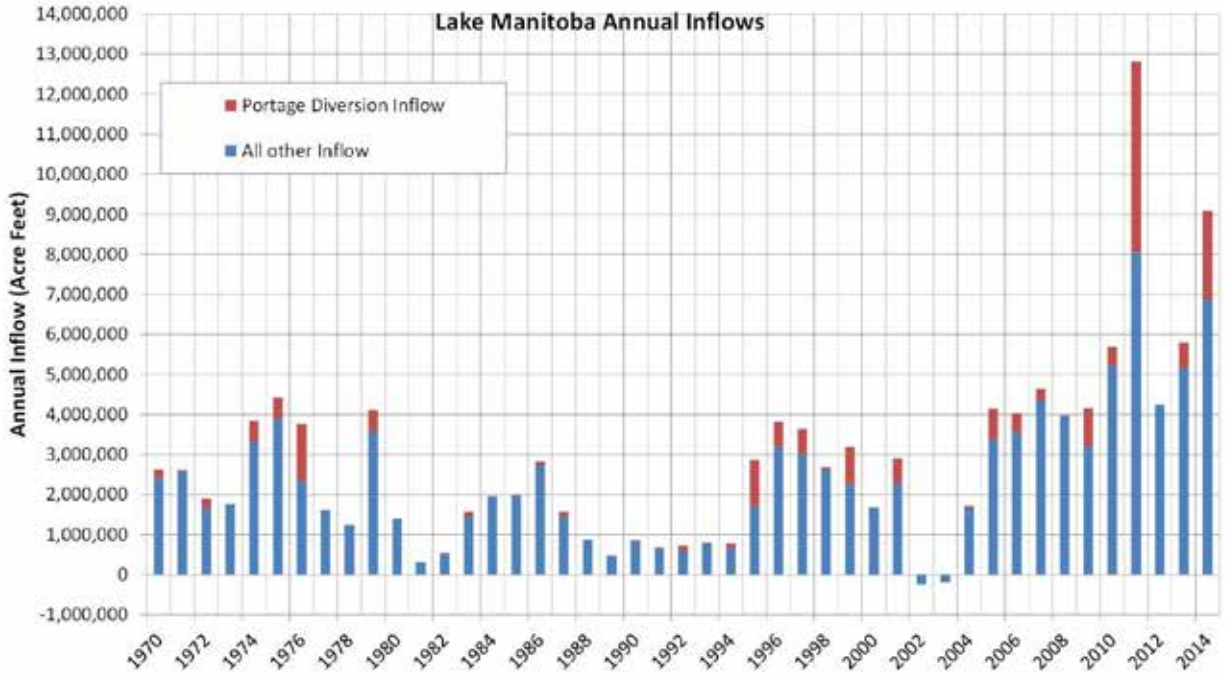
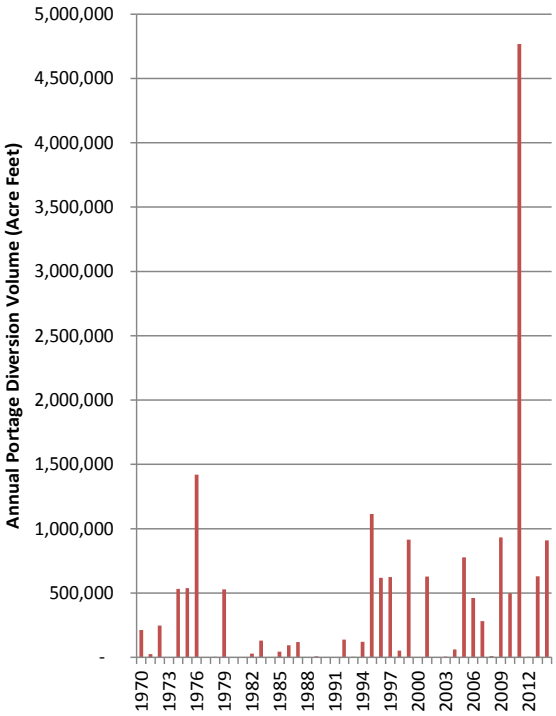


Figure 11 - Annual Portage Diversion Volumes

Figure 11 shows annual volumes diverted from the Assiniboine River into Lake Manitoba. The 2011 volume was more than three times as large as any other year. However, there was no water diverted in 2012, and the volumes in 2013 and 2014 were within the typical range of flows. It is clear that the flows diverted from the Assiniboine River aggravated flooding on Lake Manitoba in 2011, but had no impact in 2012, and similar impact in 2013 and 2014 to that experienced in the 1990s.

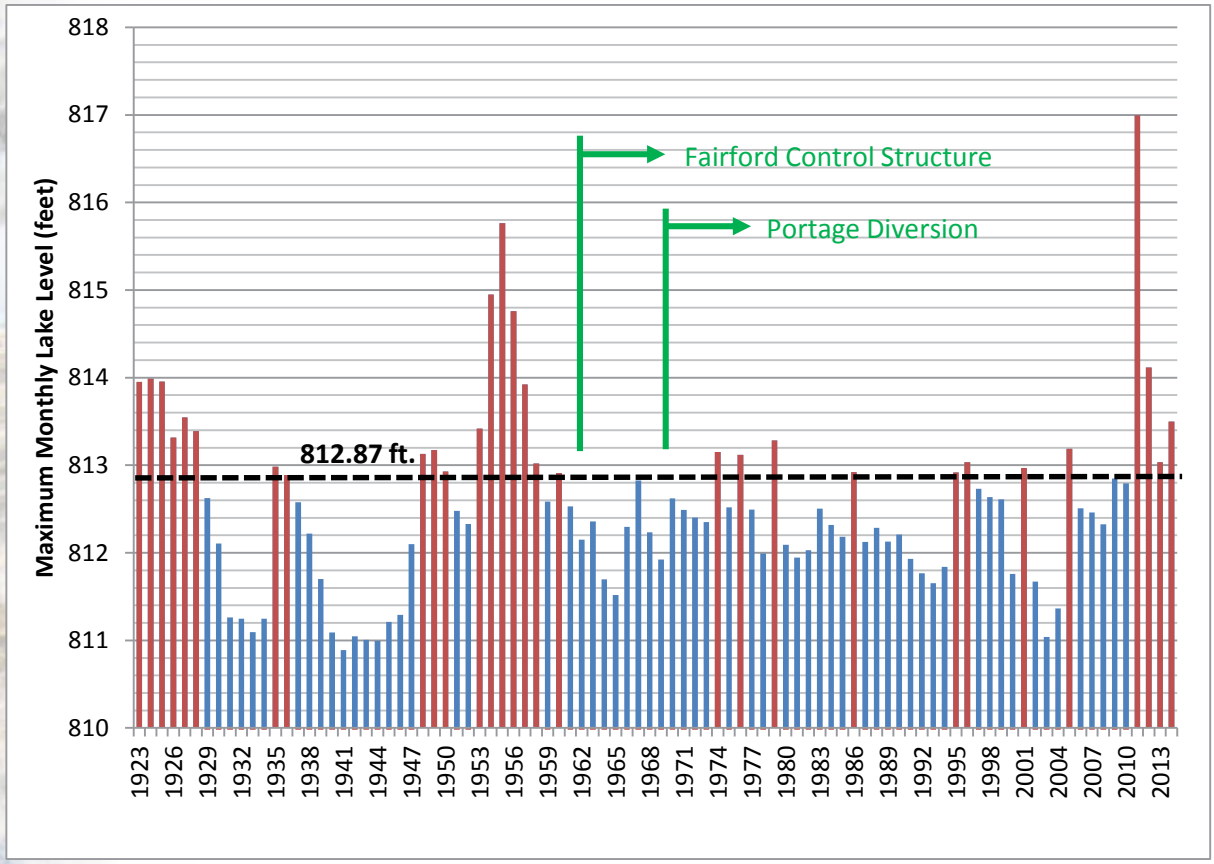
When the Fairford River Water Control Structure was designed, its capacity was selected so that the maximum monthly level would seldom exceed 813 feet.[36] With the current datum, that level is 812.87 feet.



[36] *Lakes Board Report, pp. 26-27.*

Figure 12 shows the monthly maximum recorded water levels on Lake Manitoba from 1923 to the present.

Figure 12 - Lake Manitoba Recorded Maximum Levels

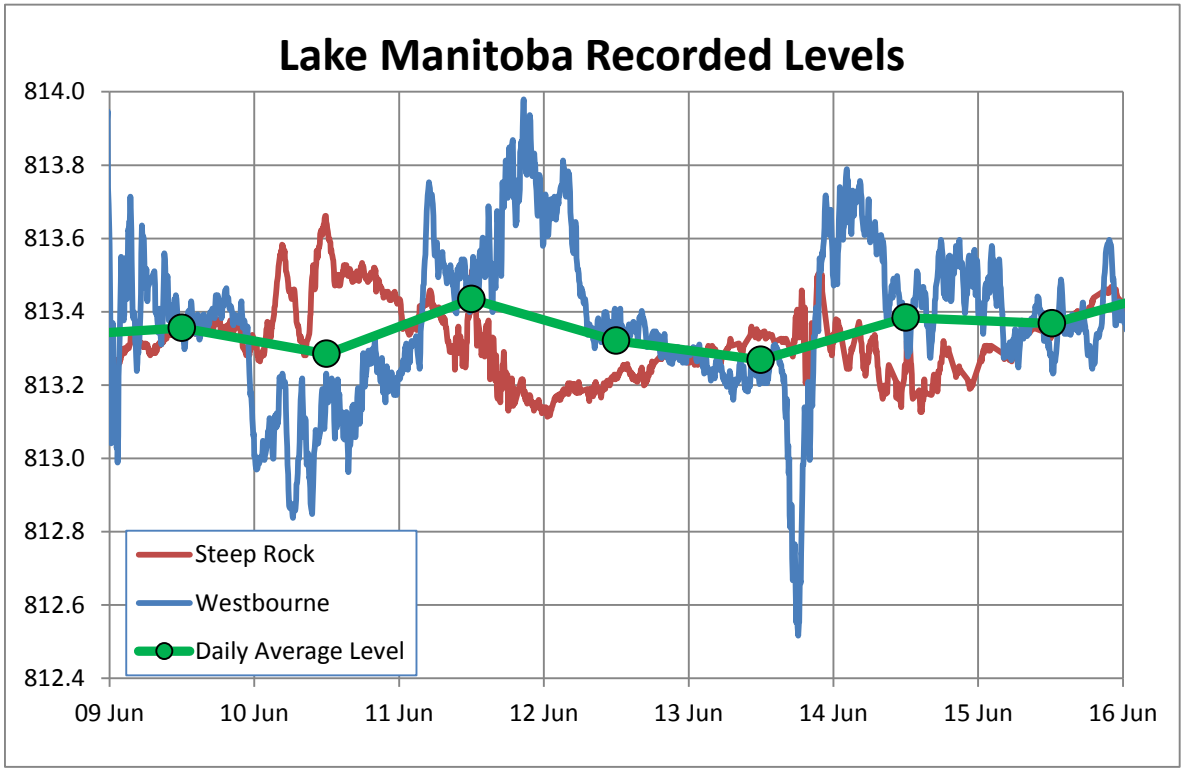


This figure shows that before the Fairford River Water Control Structure was built, the maximum monthly lake level exceeded 812.87 feet in 18 out of 39 years, or 46% of the years, with an average exceedance of 0.8 feet. From the time of construction to 2010, the lake only exceeded 812.87 feet in eight out of 49 years, or 16% of the years, and in those years the average exceedance was only 0.2 feet. However, from 2011 to 2014 the lake has exceeded 812.87 feet every summer, by an average of over 1.5 feet.

Forecasts for Lake Manitoba and Lake St. Martin are wind-eliminated levels rather than instantaneous levels. The wind-eliminated level is the average level over the whole lake. It is the level that would be observed if there was no wind over the lake. When there is wind over the lake, the level at specific points on the lake is always changing. One landowner was heard to comment, "Why give me the lake level without wind effects? It is the wind effects that cause me damage!"

Figure 13 shows the recorded levels on Lake Manitoba from June 9-15, 2014.

Figure 13 - Lake Manitoba Recorded Levels June 9-15, 2014



There are two water level gauges on Lake Manitoba that transmit real-time water level data. The Steep Rock gauge is located in the north basin of the lake on the east side. The Westbourne gauge is located on the southwest corner of the lake at the mouth of the Whitemud River. At both stations levels are recorded every five minutes.

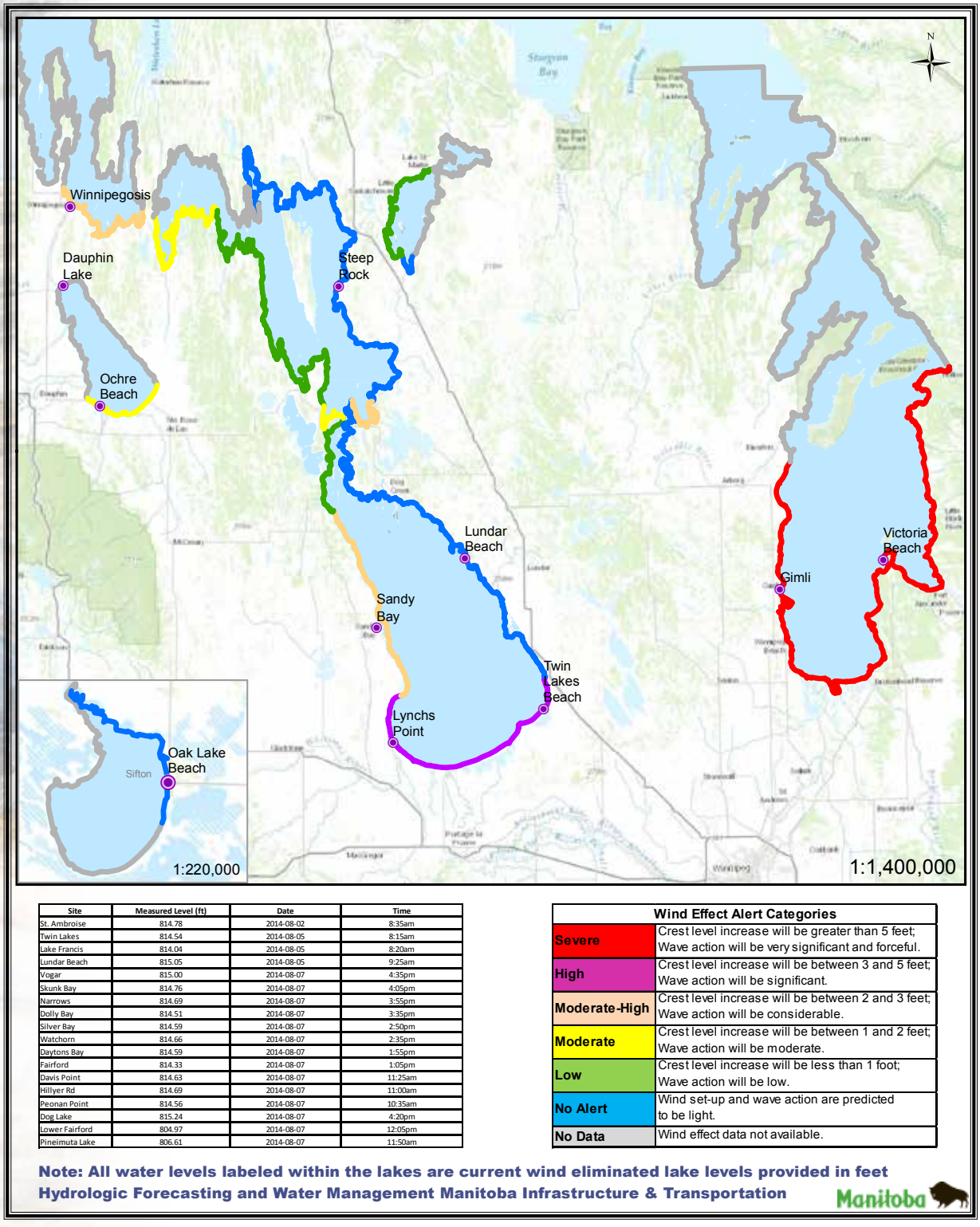
On June 10, 2014, a south wind moved water from the south end of the lake towards the north end. Therefore, the level at the Westbourne gauge dropped 0.4 feet while the levels at Steep Rock rose about 0.3 feet. The following afternoon the prevailing wind switched to the north and the levels at Steep Rock dropped while the levels at the south end rose. These fluctuations are referred to as wind set-up. This sloshing is sometimes referred to as the bathtub effect where the water sloshes from one end to the other. Whereas the level with wind setup is different all over the lake and is constantly changing, the wind-eliminated level is the same for all points on the lake.

The actual wind-eliminated level is difficult to determine precisely, so on Lake Manitoba it is approximated by averaging all the instantaneous levels for both gauges over each day. This gives one water level value per day. The green circles in Figure 13 show the daily average levels. The true wind-eliminated level would be almost flat during this period.

Wave effects are additional to wind setup. The height of the wave varies with wind speed, length of open water, and depth of the lake. The height of the wave run-up on the shore is a function of the wave height, shoreline slope and shoreline material. Therefore, the actual water level at a specific shoreline location is the wind-eliminated level plus the wind setup plus the wave run-up. During a wind event on Lake Manitoba, this level can vary from location to location by more than 5 feet.

MIT issues forecasts for the wind-eliminated level. This level is applicable to the entire lake. It would not be possible to accurately forecast wind patterns over the lake for the full forecast period, so forecasts of wind effects cannot be provided. However, to assist residents in addressing this problem, the government issues a Manitoba Lake Wind Effect Forecast when a significant wind event is forecast during periods of high water. An example for May 17, 2015 is shown in Figure 14.

Figure 14 – Manitoba Lake Wind Effect Forecast (example)



Site	Measured Level (ft)	Date	Time
St. Ambroise	814.78	2014-08-02	8:35am
Twin Lakes	814.54	2014-08-05	8:15am
Lake Francis	814.04	2014-08-05	8:20am
Lundar Beach	815.05	2014-08-05	9:25am
Vogar	815.00	2014-08-07	4:35pm
Skunk Bay	814.76	2014-08-07	4:05pm
Narrows	814.69	2014-08-07	3:55pm
Dolly Bay	814.51	2014-08-07	3:35pm
Silver Bay	814.59	2014-08-07	2:50pm
Watchorn	814.66	2014-08-07	2:35pm
Daytons Bay	814.59	2014-08-07	1:55pm
Fairford	814.33	2014-08-07	1:05pm
Davis Point	814.63	2014-08-07	11:25am
Hillyer Rd	814.69	2014-08-07	11:00am
Peonan Point	814.56	2014-08-07	10:35am
Dog Lake	815.24	2014-08-07	4:20pm
Lower Fairford	804.97	2014-08-07	12:05pm
Pinelmuta Lake	806.61	2014-08-07	11:50am

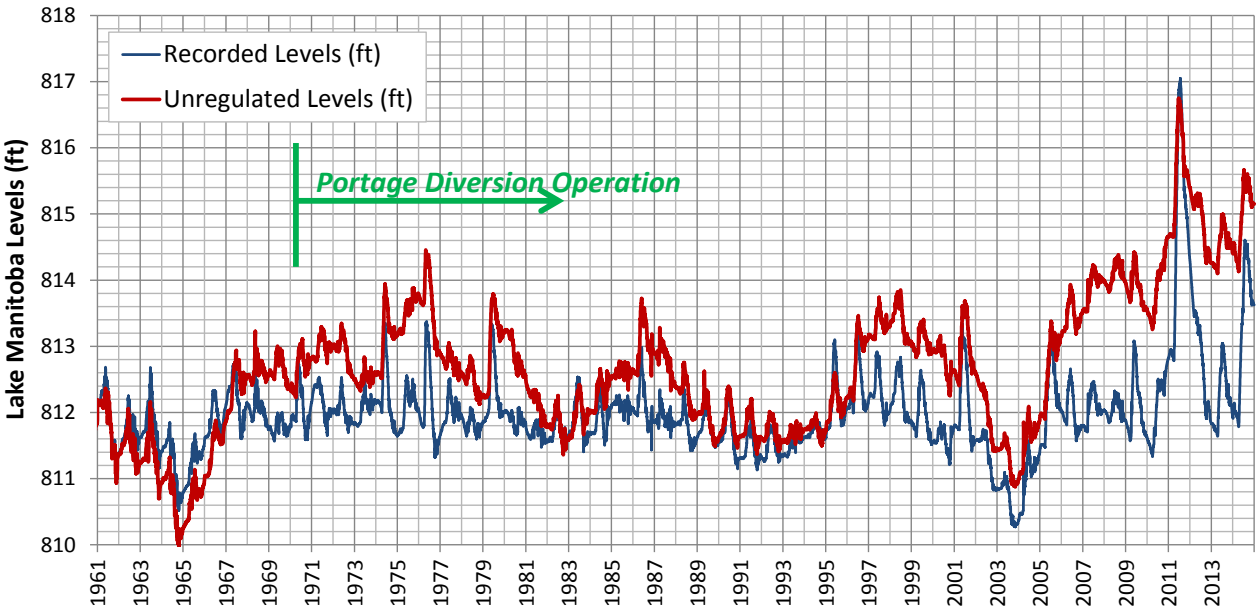
Wind Effect Alert Categories	
Severe	Crest level increase will be greater than 5 feet; Wave action will be very significant and forceful.
High	Crest level increase will be between 3 and 5 feet; Wave action will be significant.
Moderate-High	Crest level increase will be between 2 and 3 feet; Wave action will be considerable.
Moderate	Crest level increase will be between 1 and 2 feet; Wave action will be moderate.
Low	Crest level increase will be less than 1 foot; Wave action will be low.
No Alert	Wind set-up and wave action are predicted to be light.
No Data	Wind effect data not available.

Note: All water levels labeled within the lakes are current wind eliminated lake levels provided in feet
Hydrologic Forecasting and Water Management Manitoba Infrastructure & Transportation

11.2.4 Implications of Absence of Flood Control Structures

Figure 15 shows what the lake levels would have been on Lake Manitoba if neither of the flood control structures had been constructed.

Figure 15 - Recorded and Unregulated Lake Manitoba Levels



The Fairford River Water Control Structure (FRWCS) has moderated levels in Lake Manitoba, but that benefit is diminished when the Portage Diversion has high flows. In Figure 15, a comparison between the recorded levels (blue line) and the simulated unregulated levels (red line) shows that operation of the FRWCS has been effective in reducing the range of lake level fluctuations on Lake Manitoba. Over the 54-year period, from 1961 to 2014, the lake level would have exceeded 813 feet 34% of the time under unregulated conditions. Under actual recorded conditions, the lake exceeded 813 feet 5% of the time. Figure 15 also shows that Lake Manitoba levels would have continued to fluctuate widely, as they had in the first half of the 20th century. Finally, the figure shows that Lake Manitoba levels would have remained above 814 feet for most of the past decade if the FRWCS had not been in place.

11.2.5 Panel Conclusions

The Panel has concluded that the main reason for the persistent high levels on Lake Manitoba levels from 2011 to 2014 is the sequence of five unusually wet years. The inflows from the Portage Diversion added to the high levels, particularly in 2011. However, only in 2011 did the lake level briefly rise above what the level would have been in the absence of flood control structures. Regardless of the influence of the unregulated Waterhen River, the Panel has considered and ultimately is recommending changes to the operating guidelines to reduce use of the Portage Diversion while still respecting the need for protecting downstream damage reduction (see Section 12.2).

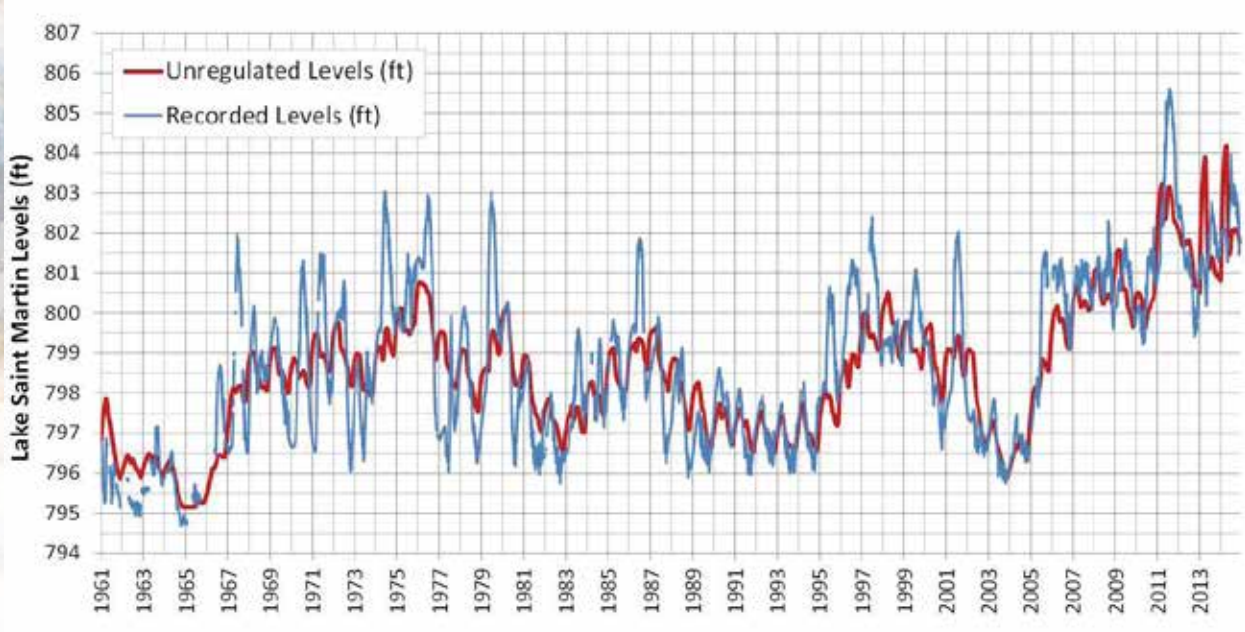
11.3 Impact of Regulation on Lake St. Martin Levels

The Fairford River Water Control Structure has increased the capacity of the Fairford River outlet from Lake Manitoba by a factor of about three times under full operation (when all the stop logs have been removed).

The studies conducted during the 1950s by the Lakes Winnipeg and Manitoba Board[37] and by Professor Kuiper[38] estimated that the impact on Lake St. Martin levels would be minimal. Their simulations suggested that controlling high levels on Lake Manitoba would reduce the frequency of high Fairford River flows. In other words, with lower Lake Manitoba levels, the Fairford River Water Control Structure flows would be no more than the unimproved channel capacity at higher Lake Manitoba levels.

As early as the 1960s and 1970s, it became clear that the operation of the Fairford River Water Control Structure was negatively impacting Lake St. Martin, where frequent fluctuations and more frequent flood levels were occurring. Post-construction records of levels on Lake St. Martin show that the lake experienced flooding much more frequently than it had before 1961. Furthermore, the record also shows that the day-to-day and month-to-month lake level fluctuations were much wider than before regulation. This is because the initial operating rules called for Fairford flows to be reduced to 50 cfs when Lake Manitoba is below 812.17 feet, but then increased as soon as Lake Manitoba rises above 812.17 feet to bring the lake back to the target level as soon as possible. This operation resulted in stable levels on Lake Manitoba, but considerable level fluctuations on Lake St. Martin, as shown in Figure 16.

Figure 16 – Lake St. Martin Levels



[37] *Lakes Winnipeg and Manitoba Board. Report on Measures for the Control of the Waters of Lakes Winnipeg and Manitoba. Appendix 5: Lake Manitoba Regulation for Flood Control. June 1958*

[38] *Kuiper, E. Benefit-Cost Analysis Lake Manitoba Regulation. September 1958*

The Lake Manitoba Regulation Review Advisory Committee examined this problem and in their 2003 report recommended a more balanced approach to operation of the Fairford River Water Control Structure that would take into consideration water levels on both lakes. However, since 2005 inflows to the lakes have remained so high that Lake St. Martin levels have been at or above flood stage for most of this period. In the extreme flood of 2011, the lake peaked at 805.6 feet, which is more than 2 feet higher than the previously recorded maximum lake level. The resulting damage was devastating and long-lasting.

11.3.1 Panel Conclusions

There has been a long-standing recognition by the Manitoba government that First Nations bordering Lake St. Martin have been adversely affected by the operation of the Fairford River Water Control Structure. Initiatives were taken in the mid-1970s to compensate for these effects with additional lands and agricultural support. The Panel is aware that there are ongoing discussions to provide substantial resources to deal with the effects of the 2011 flood in the form of improved flood mitigation, re-construction of communities and new housing. The proposal to make the Lake St. Martin Emergency Outlet Channel a permanent structure should reduce future flood risk.

11.4 Lake Manitoba Water Quality and the Portage Diversion

A significant issue raised by many concerned with the operation of the Portage Diversion is the impact of discharges from the Portage Diversion on water quality. Those concerns included the:

- Impact of phosphorus (and to a lesser extent nitrogen) leading to eutrophication, algal blooms, and loss of dissolved oxygen during decomposition leading to impacts on fish.
- Impacts of suspended solids and debris.
- Impacts of non-native biota on the fishery.
- Other potential toxic chemicals from flooded areas.

The concerns related especially to the delta area, but extend to all of Lake Manitoba and downstream lakes and rivers.

The issue of the water quality impacts of the Portage Diversion is not new. It was addressed in a 2003 report on the regulation of water levels on Lake Manitoba,[39] based on a relatively thorough study by Manitoba Conservation completed in late 2002.[40] With the major inflows in 2011, it again became of interest. Several related theses were undertaken under the direction of Dr. Gordon Goldsborough at the University of Manitoba.

2003 Lake Manitoba Regulation Review Report and Overview of Lake Manitoba Water Quality Report

The Water Quality study addressed microbiological characteristics, nutrients, dissolved salts, trace elements and toxic metals, water clarity, dissolved oxygen and pesticides. At that time, the largest inflow from the Portage Diversion had been 1,420,000 acre-feet in 1976 (2011 - 4,770,000 acre-feet,

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[39] *The Lake Manitoba Regulation Review Advisory Committee,* Regulation of Water Levels on Lake Manitoba and along the Fairford River, Pineimuta Lake, Lake St. Martin and Dauphin River and Related Issues*, July 2003.*

[40] *Hughes, C.E. and D.A. Williamson,* An Overview of Water Quality in Lake Manitoba*, Manitoba, Canada, December 2002.*

2014 – 2,244,000 acre-feet). Prior to 1991, there were no long-term monitoring stations so the lack of data makes it difficult to understand changes over time. The study found that the Portage Diversion was the major contributor of suspended solids in nine of 19 years, was the major contributor of phosphorus in seven of 18 years, and the major contributor of nitrogen in one of 18 years.

The study reported that the average phosphorus levels in the lake exceeded the objective (0.025 mg/L) and that phosphorus concentrations were higher in the south basin.

Elaine Page Master's Thesis 2011 [41]

This thesis reviewed data collected in 2005 and 2006. In those two years, about 20% and 10% of the total inflow into Lake Manitoba came from the Portage Diversion. Page reported that 75% (2005) and 67% (2006) of the total phosphorus load to the lake came from the Portage Diversion. For total nitrogen, the Portage Diversion contributed 40% and 28% respectively in 2005 and 2006, and 74% (2005 and 2006) of the total suspended solids. Overall, Page concluded that the lake would be classified as eutrophic based on phosphorous and chlorophyll a concentrations. Phosphorus concentrations were higher in the south basin. Chlorophyll concentrations were two to three times higher in the south basin compared to the north basin.

Page concluded that phosphorus concentrations had increased in the south basin from 1991 to 2008.

Kelsey Berke Thesis 2012 [42]

This undergraduate thesis was the first to use data from 2011, during which the Portage Diversion contributed more volume to Lake Manitoba than any year before or since.

Berke compared long-term water quality data for Lake Manitoba (200 or so samples since 1991) to 13 samples from 2011. Berke found lower conductivity, lower pH, increased chlorophyll a, and increased phosphorus (both particulate and especially dissolved phosphorous) comparing 2011 data to the long-term data.

Berke calculated that 62% of the total phosphorous load, 87% of the total suspended solid load, and 25% of the total nitrogen load for 2011 came from the Portage Diversion.

Michele Nicholson Thesis 2012 [43]

Nicholson studied phosphorus loads and phosphorous sequestration in Lake Manitoba from 2009 through 2011. Nicholson calculated that 87% of the total phosphorous load to Lake Manitoba in 2011 came from the Portage Diversion. This contributed to a record total phosphorous load to the lake of 3,863 tonnes.

As would be expected, Nicholson found that Lake Manitoba sequesters much of the phosphorus input in most years and in 2011, 93% of the total phosphorous input was retained by the lake.

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41 *Elaine Page,* A Water Quality Assessment of Lake Manitoba, a Large Shallow Lake in Central Canada*, Thesis 2011, Master of Science, University of Manitoba.*

42 *Kelsey Berke,* Water Quality in Lake Manitoba During the Flood of 2011*, Thesis 2012, Bachelor of Environmental Science, University of Manitoba.*

43 *Michele Nicholson,* Phosphorus Loading And Sequestration In Lake Manitoba From 2009 To 2011*, Thesis 2012, Bachelor of Environmental Science, University of Manitoba.*

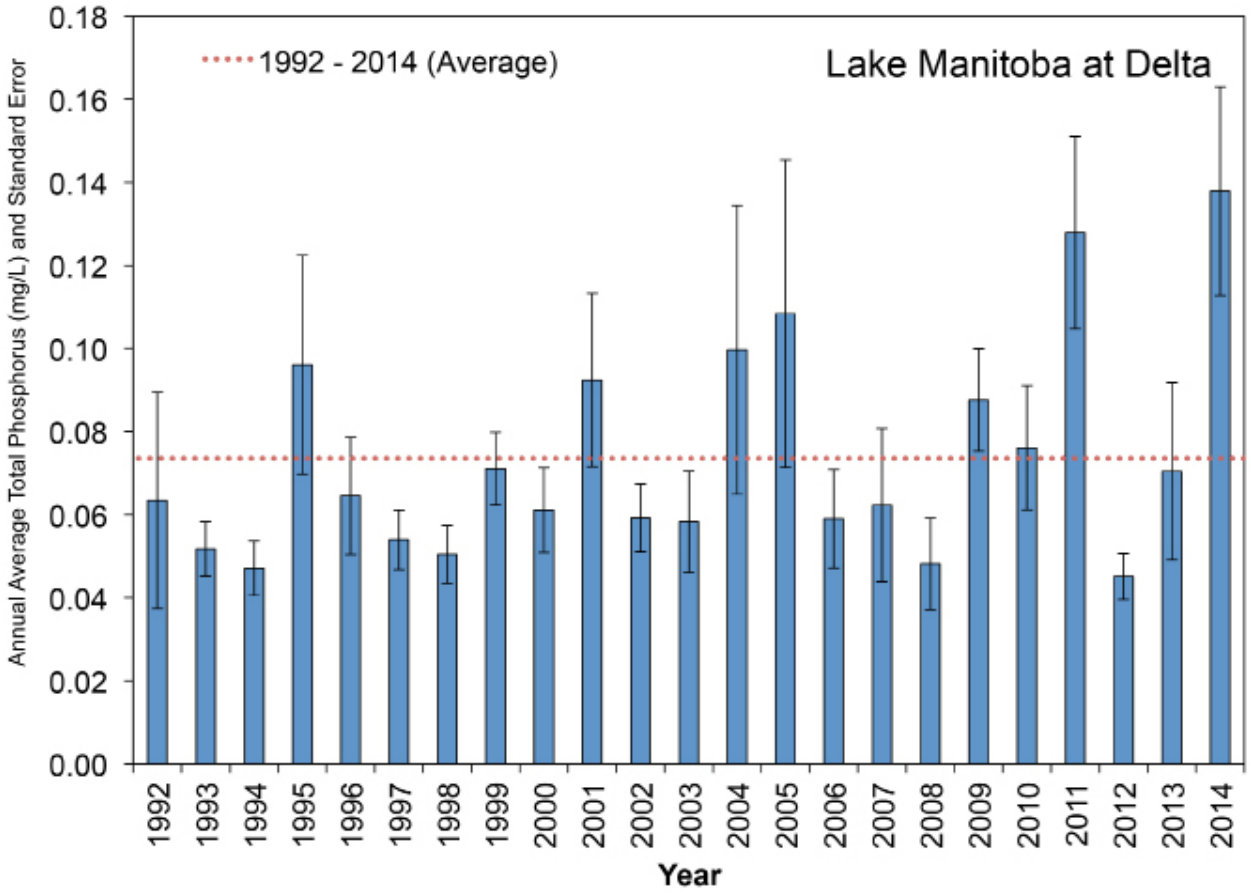
Diana Fred Thesis 2013 [44]

Fred studied nutrient loading and recycling from the sediment pool in 2009. Fred concluded that the Portage Diversion contributed 80% of the total phosphorus load into the lake in 2009. She calculated that the internal sediment pool can contribute 83% of the total nitrogen and 13% of the total phosphorous load to the lake.

Manitoba Conservation and Water Stewardship

Manitoba Conservation and Water Stewardship provided the Panel with total phosphorous and nitrogen measurements on samples from Lake Manitoba at Delta for the period of 1992-2014, as shown in Figures 17 and 18.

Figure 17 - Phosphorous - Lake Manitoba



Given the Portage Diversion can be a major source of phosphorous, it is not surprising that the 2011 record volume diverted from it would result in a high mean value of total phosphorous at Delta Marsh. What is surprising is that the phosphorus levels dropped so quickly that, in 2012, the value was well below the long-term average. This may be related to phosphorous dropping out of the water column to the sediment (sequestration). As stated by some researchers, phosphorus in the sediment can be a source of phosphorous in subsequent years. The highest annual value for phosphorus occurred in 2014.

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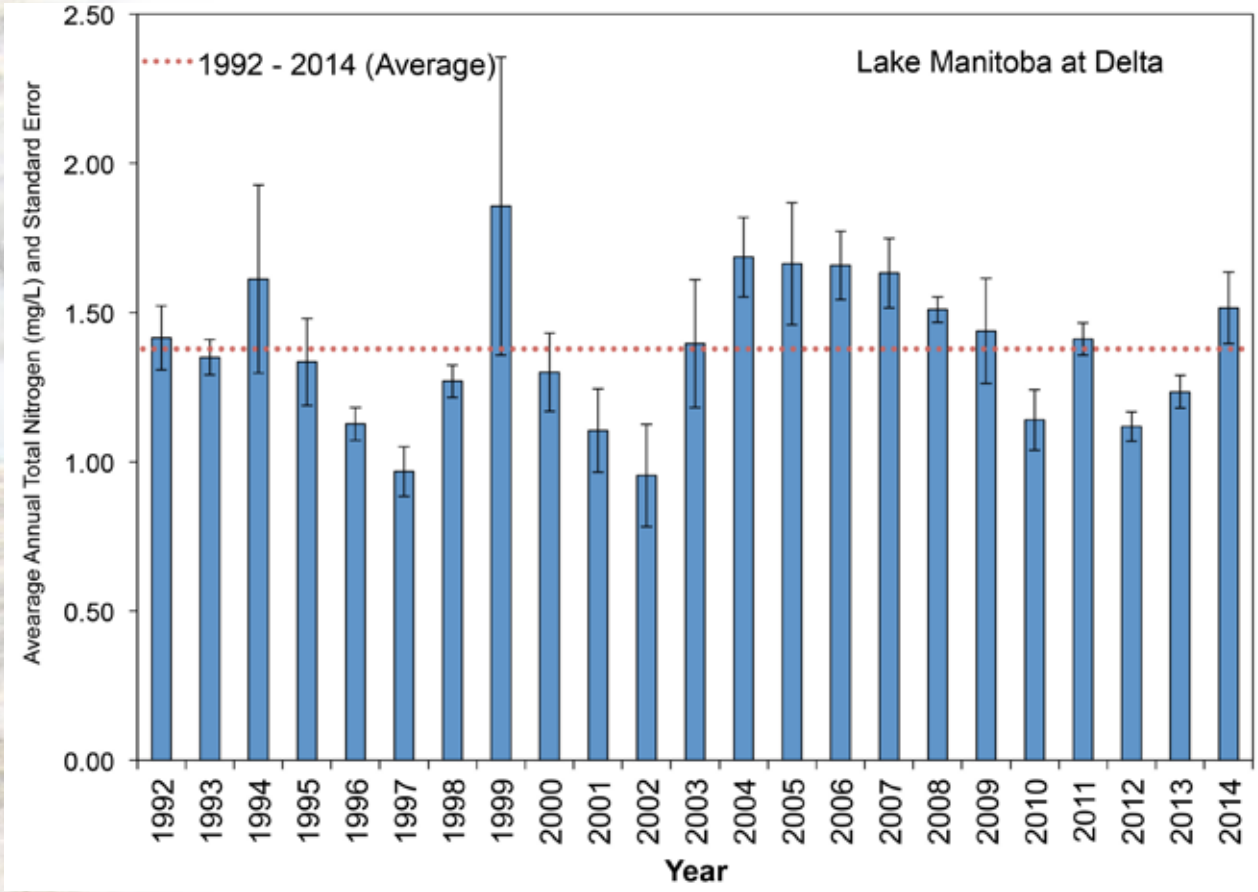
[44] *Diana Fred, Internal Nutrient Loading of the Lake Manitoba South Basin, Thesis 2013, Master of Science, University of Manitoba.*

Figure 18 - Nitrogen - Lake Manitoba



Nitrogen loading contributions from the Portage Diversion are less significant than phosphorus and suspended solids contributions. Accordingly, the data does not show a major change in nitrogen levels even in 2011 and 2014.

Impact on Fisheries

Lake Manitoba supports a small commercial fishery that is important to those involved, is an enduring part of the local economy and an important part of the cultural heritage of permanent residents. Commercial fishers told the Panel that the fishery has changed over time, from more valuable species (perch and walleye) to smaller catches of less valuable species (northern pike). Some attributed the issue to foreign species coming from the Portage Diversion. In 1985, Stewart reported in The Canadian Field-Naturalist that the Portage Diversion provided an access route for the Central Mudminnow, Bigmouth Buffalo, Black Bulhead and Tadpole Madtrom to reach Lake Manitoba.[45]

Others attributed issues in the Lake Manitoba fishery to net sizes and quotas that are too large to be sustainable.

Evidence of Fish Kills

At least one prominent opponent of the use of the Portage Diversion related water quality to evidence of fish kills. It is known that eutrophic lakes can lead to fish kills through low dissolved oxygen levels resulting from decomposition of algae following a boom and die-off cycle. The logic is that increased phosphorus from the Portage Diversion leads to algal blooms eventually leading to the death of fish.

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[45] *Stewart, Suthers and Leavesley. "New Fish Distribution Records in Manitoba and the Role of a Man-Made Interconnection Between Two Drainages as an Avenue of Dispersal,"* The Canadian Field-Naturalist*, Volume 99, p, 317, 1985.*

The Panel found one documented case provided by the Sandy Bay First Nation that took place on July 17, 2012. According to the report, dead fish were removed from the beach in 1,200 five-gallon pails. The days prior to this event were hot and the fish kill may have been simply the result of near-shore high water temperatures.

11.4.1 Panel Conclusions

There is significant evidence that the flow from the Portage Diversion affects water quality on Lake Manitoba, especially in years such as 2011 and 2014 when it is a major source of water to Lake Manitoba.

That is the "what".

The "so what" is more difficult to answer. Are the impacts short-term or long-term? While phosphorous loads can be a detriment to Lake Manitoba, is that transfer of load and sequestration beneficial to Lake Winnipeg, which is considered an endangered lake?

Finally, the "then what" from the Panel's perspective is: What should be done with respect to the operating guidelines for the Portage Diversion and the FRWCS? The use of the Portage Diversion cannot be discontinued, as the resulting economic damages would be huge. There is the argument that use of the Portage Diversion should be minimized at all times, to minimize artificial water quality impacts. Although the Panel is not convinced that the artificial water quality impacts are of such a magnitude that they warrant significant change to the operating guidelines, the Panel supports reducing use of the Portage Diversion to be consistent with the precautionary principle.

11.5 Potential Salinity Impacts from the Portage Diversion

Property owners along the Portage Diversion told the Panel that it causes salinity problems to soils. In one case, a farmer told the Panel about his inability to continue to grow his high value crop of shallots on his land due to salinity from the Portage Diversion. Ranchers along Lake Manitoba also talked about salinity issues that they contend resulted from the unprecedented high water levels of Lake Manitoba.

In simplified terms, salinity is an accumulation of salts in the root zone, typically related to the movement of salt laden water upward from the water table and evaporation at the surface resulting in salt accumulations. Capillary action or wicking can result in movement of water from well below the root zone, especially in clay soils. Salinity can also be increased through the application of fertilizers that contain salts.

Electrical conductivity of saturated extract is used to measure salinity; the more salt ions, the higher the electrical conductivity. Saline soil has an electrical conductivity greater than 4 mmho/cm. However, it is well known that many crops are sensitive to much lower electrical conductivity levels than this. The shallots mentioned above are said to tolerate less than 0.5 mmho/cm.

It is possible that leakage from the Portage Diversion and/or high water levels in Lake Manitoba have raised the groundwater levels and contributed to salinity. At the same time, salinity occurs naturally

and has been reported in soils in the region long before recent claims.[46] It is not possible to be sure how much of the salinity present is a result of natural processes. As far as the Panel is aware, there haven't been any studies of the ground water regime in the area to understand scientifically. Perhaps there should be.

11.5.1 Panel Conclusions

The question for the Panel is: Can and should the soil salinity concerns be addressed through the guidelines of operation for the flood control structures? If the answer were yes, it would lead the Panel to suggest minimizing the use of the Portage Diversion. As discussed elsewhere in this report, the Panel sees minimizing the use of the Portage Diversion while still respecting the need for protecting downstream damage reduction as a direction for its recommendations.

The Province should consider undertaking a study or a pilot project to understand water movements from the Portage Diversion and impacts on soil salinity in the vicinity.

11.6 Drainage

The Panel heard comments on the issue of uncontrolled drainage in every one of the public meetings. Many residents believe that the recent increase in flooding has been a direct result of increasing agricultural drainage and that a program of on-farm water retention, including in Saskatchewan and North Dakota, would be of considerable benefit to Manitoba. The Panel did not study this issue in any detail, as it was outside of the terms of reference. However, the Panel did note that annual flows on the Waterhen River were above average in all but one year of the past decade, and flow volumes in both 2011 and 2014 were the highest volumes ever recorded on the Waterhen River. The Waterhen River Basin is largely natural with little drainage or land use changes. This suggests that, at least for Lake Manitoba, the recent flooding is primarily due to wetter than normal climatic conditions rather than land drainage. The Panel notes, however, that Manitoba's Surface Water Management Strategy endorses "no net loss" in wetlands.

The Panel also heard that, at flows above 8,000 cfs on the lower Assiniboine River, local drainage channels start to back up. As river levels increase, it becomes difficult for runoff from the surrounding lands to flow into the river. In 2011, significant flooding was caused by the backup of drains due to high river levels. In 2014, some rural municipalities instituted a program of pumping water from the drains into the river. This reduced flooding of agricultural lands near the river. The Panel endorses such pro-active flood management activities.

In addition, several participants raised issues associated with the East Outside Drain, which is a drain on the east side of the Portage Diversion to divert water north to Lake Manitoba. The drain is not effective and results in periodic flooding of about four sections of land adjacent to the delta on the east side of the Portage Diversion, resulting in agricultural losses. The land begins to flood at 813 feet and in that respect is similar to many other properties around Lake Manitoba.

[46] *Manitoba Department of Agriculture,* Soils of the Portage la Prairie Area*, 1972.*

12 DISCUSSION AND RECOMMENDATIONS

Our physical flood control infrastructure has developed over time and will likely continue to develop with additional flood control works and mitigation measures. This flood control infrastructure is operated as a system to provide flood protection over a great part of southern Manitoba. Once built the physical infrastructure is fixed but the operating guidelines can be modified to reflect a greater understanding of the hydrological regime and changes to land use and societal interests.

The purpose of this report is to review and make recommendations on operating guidelines. Given the extreme floods experienced over the last few years the timing for the review is appropriate and has attracted significant interest, particularly in those areas worst affected by the floods of 2011 and 2014.

In considering changes to the operating guidelines for the Red River Floodway, Portage Diversion, Fairford River Water Control Structure and Lake St. Martin Emergency Outlet Chanel (LSMEOC), the Panel took into account: opinions provided by the public over a series of earlier studies; meetings with local governments, First Nations, roundtable groups and government employees; public comment at open houses; technical and scientific reports; and analysis of alternative operating regimes.

The Panel considered the following criteria (discussed in Chapter 9):

- Maximize benefits
- Minimize artificial flooding and negative impacts
- Balance interests
- Consider those who are negatively impacted
- Respect nature

12.1 Red River Floodway Operating Guideline Changes

12.1.1 Rule 4 – Emergency Summer Operation to Reduce Basement Flooding in Winnipeg

The Province instituted Rule 4 in 2002 based on a cost-benefit approach that follows this logic:

- The capacity of Winnipeg's combined sewer systems that depend on gravity flow to the rivers is reduced when river levels are high.
- Summer storms have often resulted in major instances of basement flooding in Winnipeg and this effect is aggravated when the river levels are high.
- The use of the Floodway can lower river levels and therefore mitigate the extent of basement flooding.
- If a major storm is on the horizon, it makes sense to use the Floodway to lower river levels in Winnipeg while recognizing that compensation must be paid to upstream property owners. Table 6 shows the compensation paid resulting from Rule 4 operations.

Table 6: Red River Floodway – Upstream Artificial Flooding

Year	Number of Applicants	Compensation Paid
2002	21	$308,976
2004	61	$366,158
2005	120	$1,114,930
2010	24	$76,017

- Rule 4 is implemented when summer water levels are forecast to exceed 14 feet James Avenue Datum in Winnipeg and there is risk of an intense rainstorm that could potentially result in basement flooding due to sewer backup. Rule 4 is used only to reduce water levels to a minimum of 9 feet in Winnipeg. As the Riverwalk is at 8.5 feet, Rule 4 is deliberately designed so it does not become Rule 5 (see below). Further, Rule 4 has the restriction that water levels upstream of the gates cannot be raised above 760 feet, which is considered to be "top of bank".

Arguments Against Rule 4

It is understandable that people upstream of the Floodway are opposed to its summer use. Even when promised compensation, they oppose Rule 4.

They do not accept that anyone can allow flooding in their community because Winnipeg's sewer system is inadequate. Upstream stakeholders are concerned that the City of Winnipeg does its part to reduce basement flooding of its residents and does not accomplish this by causing artificial flooding upstream. They suggest that the City of Winnipeg increase the capacity of the flood pumping stations as required. They further suggest that the City flood-proof homes by the use of proper backup valves and sump pumps.

The upstream property owners believe they have been artificially flooded to save Winnipeg in the past. The Province acknowledges that artificial flooding took place in the spring flood of 1997. The Province acknowledges some limited artificial flooding in the years that Rule 4 was invoked (2002, 2004, 2005, and 2010). However, the economic and social pain of flooding is significant and the level of trust so low that residents upstream do not accept the government's calculations.

Downstream stakeholders are also concerned with the use of the Floodway in summer. They alleged that, as soon as the Floodway is put into use, backwater effects from Lake Winnipeg result in higher water levels than without the Floodway use. In addition, the RM of St. Clements is particularly concerned with the loss of Dunning Road, a low level road that crosses the Floodway and is used whenever the Floodway is not in use. The RM provided information that there were 760 vehicle trips in 24 hours on the Dunning Road crossing on one day in January of 2015.

Reality of Reduced Basement Flooding Risk

In 2003, KGS studied the merits of managing Red River summer water levels in Winnipeg. The study concluded that basement flooding would be reduced. The average annual damages from basement flooding would be reduced by about $650,000 with control at 9 feet James Avenue Datum. They did not see much increase in this benefit if levels were controlled to 7 feet where the Riverwalk would be protected (see potential Rule 5 below). The cost of compensation to upstream interests was calculated at about $250,000 per year, resulting in a net benefit of about $340,000 when the actual cost of operation was included.

The KGS study considered the alternative of increasing the capacity of the flood pumping stations, which were originally designed for a spring storm event. The 2003 study indicated that it might be difficult to do because of tight site restrictions at the flood pumping station locations. Further, the pumping capacity increases required would be significant. They provided an example of upgrading the Baltimore Flood Pump Station from a spring storm to accommodate a two-year and five-year summer storm. They concluded that it would be necessary to increase the flood pumping station capacity from 92 cfs to 360 cfs and 750 cfs respectively. They concluded that the cost would be prohibitive.

The study concluded that, although use of the Floodway in summer would make conditions for fish passage worse, there would not be a significant difference as the structure acts as a barrier when flows are high in any case.

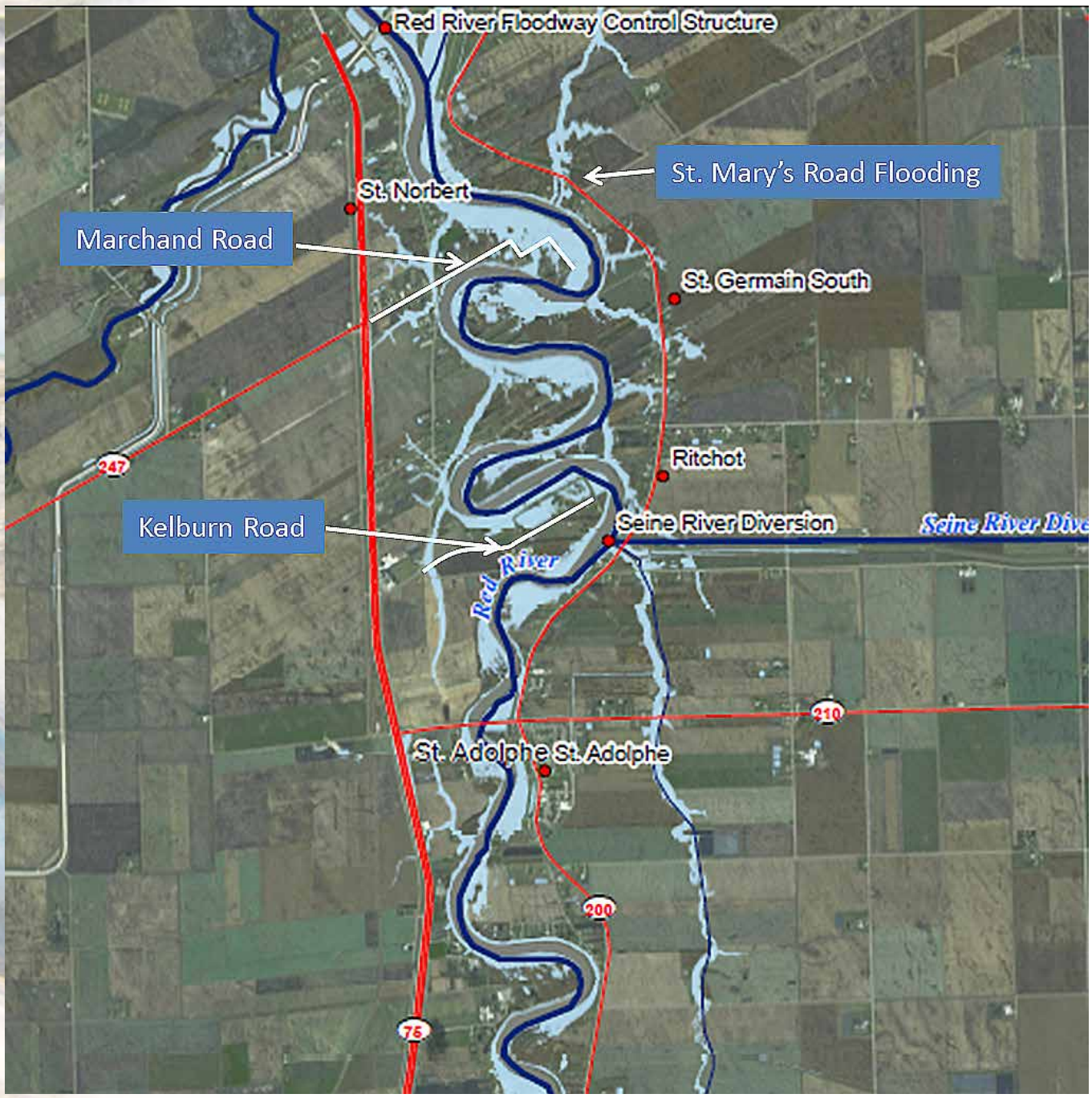
The most recent study of using the Floodway to reduce basement flooding is the *High River Level Related Basement Flood Damages Study* (KGS, 2013). This study was prepared for the City of Winnipeg and the Province of Manitoba. The study concluded that use of Rule 4 as has been implemented results in a benefit of $800,000 per year in reduced basement flooding damages. However, the study indicated that for any individual storm event, the benefits can be in the tens of millions.

Flooding Upstream of Inlet Control Structure

In 2010, under Rule 4, the river peaked on June 4. On that date, the level at the floodway entrance was 758.20 feet and the level at St. Adolphe was 759.84 feet. This represents a drop of 1.64 feet over the river distance of 15.9 km. The river flow was just under 40,000 cfs. This is pretty typical of summer operating conditions. Therefore, the water surface profile should be pretty typical. This suggests that with a maximum level of 760 feet at the floodway entrance, the river level on the south side of Marchand road would be 760.5 feet, and the level north of Kelburn Road would be 761.1 feet. Examples are provided below.

Flooding with 760 feet at floodway entrance: With the water level at 760 feet and considering the slope of the water surface, the Panel was made aware of three areas where flooding occurs below that maximum level: St. Mary's, Marchand and Kelburn roads.

Figure 19: Satellite view of the Red River from Ste. Agathe to the Red River Floodway Control Structure



St. Mary's Road: On St. Mary's Road, just north of Richardson Road, the maximum river elevation would be 760.3 feet when the elevation at the control structure is 760 feet. The photo shows St. Mary's Road on April 13, 2011. The level at the floodway inlet on that day was 759 feet. The southbound lane of St. Mary's road was covered by water at that level, as shown below.

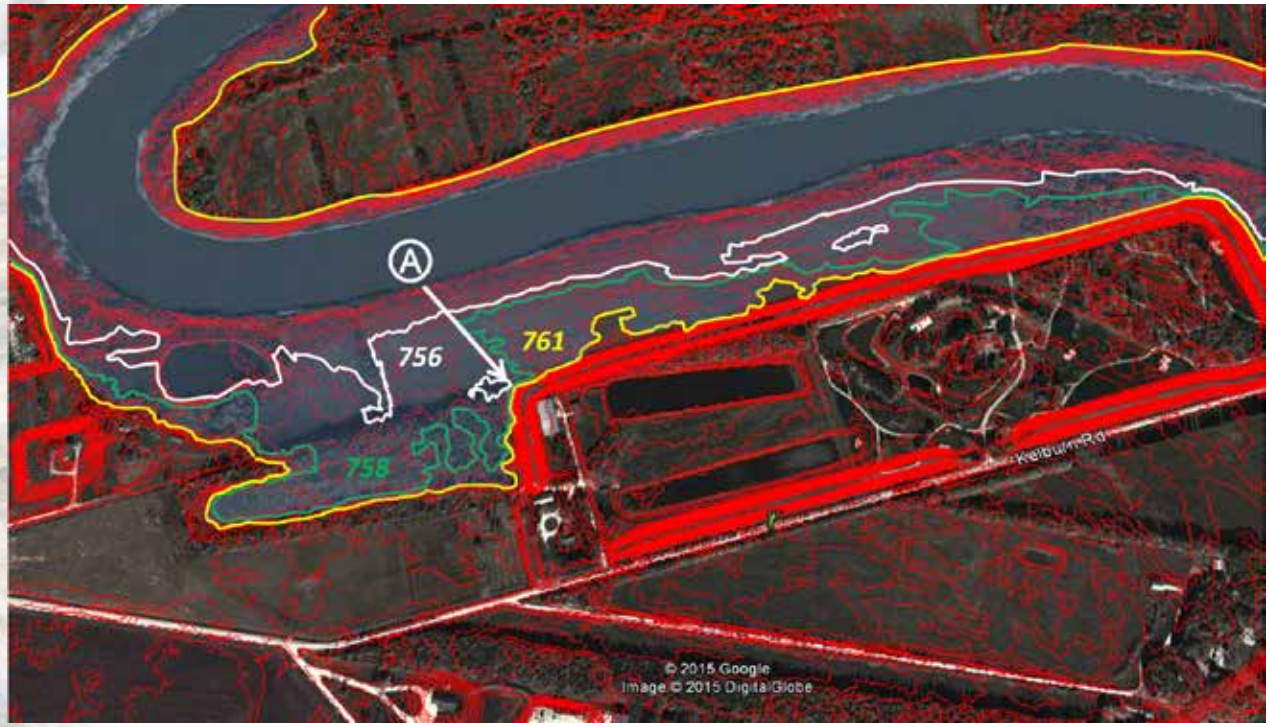
St. Mary's Road North of Richardson Road, Flooding April 13, 2011

Marchand Road: With a level of 760 feet at the floodway entrance, the river level at the eastern end of Marchand Road would be 760.5 feet. As shown in Figure 20, the elevation of the road is below 760 feet (yellow contour lines) and some of the driveways are below 758 feet (green contour lines).

Figure 20 - Marchand Road Elevations

Kelburn Road: The elevation of the land north of Kelburn Road is shown in Figure 21. At the northwest corner of the dike ("A" in Figure 21), the ground level is 756 feet. With a level of 760 feet at the floodway entrance, the river level at this location would be 761.1 feet. At that level, there would be 5 feet of water at the toe of the dike, and approximately 60 acres of the horse paddock between the dike and the river would be under water. The owner has reported that in 2009 he was unable to use his horse paddock and water was standing against the dike for a month, which resulted in dike slumping.

Figure 21 - Kelburn Road Levels



Panel Recommendations

Given the history and benefits of Rule 4, the Panel is not prepared to recommend it be removed. However, there remain some upstream issues that the Panel suggests the government needs to address to make the application of Rule 4 more equitable. The most critical issue is flooding that occurs upstream of the inlet control structure at the specified maximum level of 760 feet.

The river level upstream of the control structure should not be increased under Rule 4 so as to restrict access for residents. Therefore, the Panel recommends that either roads/driveways should be raised, including an adjustment for the slope of the river, or the maximum level established under Rule 4 should be reduced so as not to create access issues. At a river level of 760 feet, the Floodway will divert 23,500 cfs from the Red River. This would lower the level by about 6 feet James Avenue Datum. If the maximum level were reduced to 758 feet (a level at which access is not compromised), the Floodway would divert 17,100 cfs, resulting in a reduction of 4.3 feet James Avenue Datum.

Since the flooding is artificial under Rule 4 and is done by the Province to reduce the risk of basement flooding in Winnipeg, the Panel recommends that a process should be in place to compensate the affected parties promptly and without undue restrictions. There are only a few properties that are affected. A file could be kept on each potentially affected property and the owners should be approached individually by the government as soon as the Rule 4 operation is approved.

The Panel notes that the City of Winnipeg and the Province should continue to support installation of backwater valves and sump pumps, and improve lot grading to reduce property owner exposure to sewer backup.

In addition, the Panel believes that the need to prepare a report prior to Rule 4 operation, outlining the risks (including riverbank instability), costs and benefits, and mitigation measures hampers the decision-making process. In the Panel's view, the effort to prepare a formal report to defend a practice that is envisaged by the rule itself seems redundant and would take up valuable resources that could be better put to use communicating the situation with affected property owners. The Panel recommends the removal of the requirement under articles 4(4) to 4(5) for the preparation of a report before a decision is made to operate under Rule 4.

12.1.2 Potential Rule 5 - Summer Operation to Keep Riverwalk Open

A number of organizations see the ability to control summer water levels in Winnipeg as positive. The *Winnipeg Free Press* has supported summer use in its editorials.[47, 48]

The vision includes extensive use of and development along the riverbanks in downtown Winnipeg. The San Antonio River Walk in Texas is used as an example. The River Walk, with its concrete walkways along both sides of the San Antonio River, has become a top tourist attraction in the state with numerous hotels and restaurants located adjacent to the walkways and tour boats operating on the channel. It is recognized that a similar scale of development might not be possible in Winnipeg due to spring floods but reliable summer water levels would at least bring the riverbanks into use for those important summer months. It would increase quality of life, featuring the Red and Assiniboine rivers as Winnipeg's "front yard". The economic benefits would be significant.

The proponents recognized there would be some negative consequences in terms of artificial flooding upstream, but believe this could be mitigated with adequate compensation in favour of the overarching vision.

[47] Winnipeg Free Press, *Editorial, "A Vision Without A Paddle," January 4, 2014.*

[48] Winnipeg Free Press, *Editorial, "River Levels Must be Controlled," August 8, 2014.*

The San Antonio River Walk is often cited as the kind of development and tourism potential that may be possible if summer operation of the Floodway maintained river levels to keep Winnipeg's Riverwalk open.

However, the San Antonio River channel is about as wide as the Seine River. It is much smaller than the Assiniboine or Red rivers in Winnipeg. Neither is it subject to spring floods. It typically has low flows. With a smaller drainage basin, it responds quickly to rainstorms with much higher than normal flows but these high flows last only a day or so afterward. Hydrologists would term it a "flashy" river, as this quick and short duration response to rainstorms can result in flash floods.

The San Antonio River Walk is about 4 km (2.5 miles) in length with walkways on either side. It is below street level and has numerous hotels and restaurants along its length. It operates year-round. With gates on either end, it is possible and necessary to drain the channel to remove mud and debris annually. At the same time, repairs to the walls can be completed if required. The San Antonio River is controlled through a combination of structures.

The San Antonio River Walk

Those Upstream and Downstream Oppose Summer Operation of the Floodway

Similar to the discussion around Rule 4 - Emergency Summer Operation, those upstream and downstream of the Floodway were vehemently opposed to its summer use for tourism benefits in Winnipeg. They do not accept flooding in their community to keep the Riverwalk open. Even when promised compensation, they opposed that use.

When the economic benefits of the Riverwalk were mentioned, some demanded that any "profit" should be shared with those upstream communities that are negatively impacted.

Upstream stakeholders asked whether storing water on their land to provide a benefit elsewhere is even something the government could legally do under the Canadian Charter of Rights and Freedoms.

The potential Rule 5 generated more emotion and opposition than Rule 4. There was greater opposition to summer operation of the Floodway when it was discussed to keep the Riverwalk open than to reduce basement flooding in Winnipeg.

What is the Reality of Summer Operation of the Floodway?

A preliminary study of the feasibility of summer operation of the Floodway was completed in 2003.[49] It concluded that the economic benefits of summer use of the Floodway would be higher than the costs. The study determined that it would be significantly more cost-effective to use the Floodway to control water levels to reduce basement flooding in Winnipeg than the alternative of increasing the capacity of the flood pumping stations to handle summer rainstorms. It would also be more cost-effective to use the Floodway than the alternative of raising the level of the Riverwalk.

The study cautioned that more work needed to be done to resolve compensation issues for upstream stakeholders, to better understand bank stability issues, to resolve issues with fish passage, and to address concerns of downstream stakeholders associated with the changed flow regime.

Realities and Practicalities of Summer Use of the Floodway

There has been editorial and political support for summer use of the Floodway and strident opposition from those living upstream in an area that would be affected by its operation. On both sides of the debate, there have been some excesses.

However, the debate has lacked somewhat a framework around what would be achievable, in a practical sense, respecting summer use. Two important factors to consider are:

1. Controlling the water level of the Red River in the spring is a practical impossibility. There is too much water. Under normal spring runoff conditions, the level of the Red rises far above Riverwalk elevations at The Forks.
2. Outside of spring floods ***it is necessary to work with the Red River in all its natural attributes.*** It is a prairie river – somewhat volatile and unpredictable. If the Floodway were operated in summer so as to keep the Red River upstream within its banks, the hydrological record suggests there are two years out of 10 that the Riverwalk would still be under water for at least short periods of time.

[49] *Investigation of the Merits of Management of Red River Summer Water Levels in the City of Winnipeg, KGS 2003.*

Criteria 5: Respect Nature

People like to live close to the water. And they would like lakes and rivers to accommodate that choice.

Prairie water systems, however, exhibit large variability within any given year and from year to year. While it might be technically feasible to keep our lakes and rivers within a narrow operating range, it is economically impractical and environmentally unsound.

We must find a way to live with variability and the Panel has adopted this perspective when considering operating guidelines.

The Riverwalk would be submerged when the flow of the Red River at James Avenue, after the contribution of the Assiniboine River, is about 14,000 cfs. This occurs just about every spring but also in a number of summers. According to the 2003 study, using the Floodway to control water levels for the Riverwalk in summer would have occurred about 13 times in 31 years, and would have been successful in all but two years. It also would have reduced the duration of summer Rivewalk flooding from 275 days to 18 days. This assumes a maximum level of 760 feet upstream of the Floodway and a target level of 8 feet at James Avenue. If a maximum level of 758 feet is used upstream of the Floodway, the target level of 8 feet would have been exceeded in three years for a total of 36 days.

Of course, spring floods still would have invariably flooded the Riverwalk. While the Riverwalk is at 8 feet, a typical spring would see water levels of 15 to 18 feet, making permanent development at water's edge all but impossible.

Subsequent studies have provided further data around summer use of the Floodway as follows:

- *Conceptual Engineering Study for Fish Passage at the Red River Floodway Inlet Control Structure (KGS 2008)*
- *Riverbank Stability Evaluation and Monitoring – Potential Impacts of Summer Floodway Operation (KGS 2012)*
- *High River Level Related Basement Flood Damages Study (KGS 2013)*

While the KGS studies indicated that the channel would not be subject to erosion and that bank stability was a relatively small risk, Manitoba Infrastructure and Transportation (MIT) has concerns about the possibility of erosion of the floodway channel and upstream riverbank stability. MIT concluded that those costs could be $130 million under a worst case scenario, which would negate any benefits.

Can the Riverwalk be Raised?

While potential modifications to operating guidelines could be part of a decision-making process, other solutions also have been sought. Some advocated for raising the Riverwalk, so that it floods less frequently. Upon analysis of this idea, the Panel determined that the Riverwalk at The Forks would have to be raised by at least seven feet to significantly reduce the frequency of flooding. The likely cost and associated environmental and aesthetic issues make this an unrealistic solution.

Even raising the Riverwalk two or three feet from 8 feet James Avenue Datum to 10.5 or 11 feet James Avenue Datum would require substantial fill and shear key construction to maintain bank stability. In addition, many structures along the path would have to be modified.

Perspective:
The Riverwalk Argument

A critical comment made frequently about summer use of the Floodway is posed as the question: "Are we really prepared to flood upstream residents just so people in Winnipeg can use The Forks walkway?"

It makes a compelling argument. The visual imagery makes one cringe. But is it a reasonable way to view the problem or is it a glib comment that glosses over substantive discussion?

A confounding part of the issue is that the value of summer operation have not been reasonably quantified. This derives from the fact that most of the values of summer operation are intangible and near impossible to quantify.

There is abundant literature on what makes a great city great. The notions are conceptually simple but practically complex and also intangible. Two-thirds of our population live in an urban environment. We could create a city that has the lowest taxes in the world. Most of us would not want to live there. The best rated cities in the world have quality living environments that are safe, comfortable and interesting and have abundant green spaces, public art and aesthetic appeal.

The public sector has an obvious role in creating this environment.

"Are we really prepared to flood upstream residents just so people in Winnipeg can use The Forks walkway?"

It is beyond the ability of the Panel to try to put a value on the benefit of enhanced use of our river environment or to make firm recommendations in favour or opposed. It will be public consensus that ultimately bubbles up to the political decision-making level that will create this decision. As a precursor to that, however, initiatives need be taken to allow the public to see what the possibilities are. Pro and con. A recent Forks North Portage Partnership/City of Winnipeg document "Go to the Waterfront" provides a vision on summer use of our river systems. It will deepen the debate about summer use of the Floodway.

We will still need a decision, however, about adverse upstream effects of summer operations of the floodway. It can't just be about money. Improving Winnipeg by adversely affecting lands and property upstream is unpalatable. If improved use of our riverbanks is all about quality of life and economic development then that notion has to be extended upstream. We should all be benefiting from this vision.

Panel Conclusions

Summer operation of the Floodway is certainly possible and many are in favour of it. In response, the Panel included a potential Rule 5 in its possible scenarios for operating guideline changes presented at open houses. The Panel received an overwhelmingly negative reaction to the suggestion from both upstream and downstream stakeholders. The Panel did not hear from the general public in favour of a potential Rule 5, even at the open house held in Winnipeg. It did hear about the merits of keeping the Riverwalk open to make the rivers more accessible from representatives of The Forks and City of Winnipeg planners.

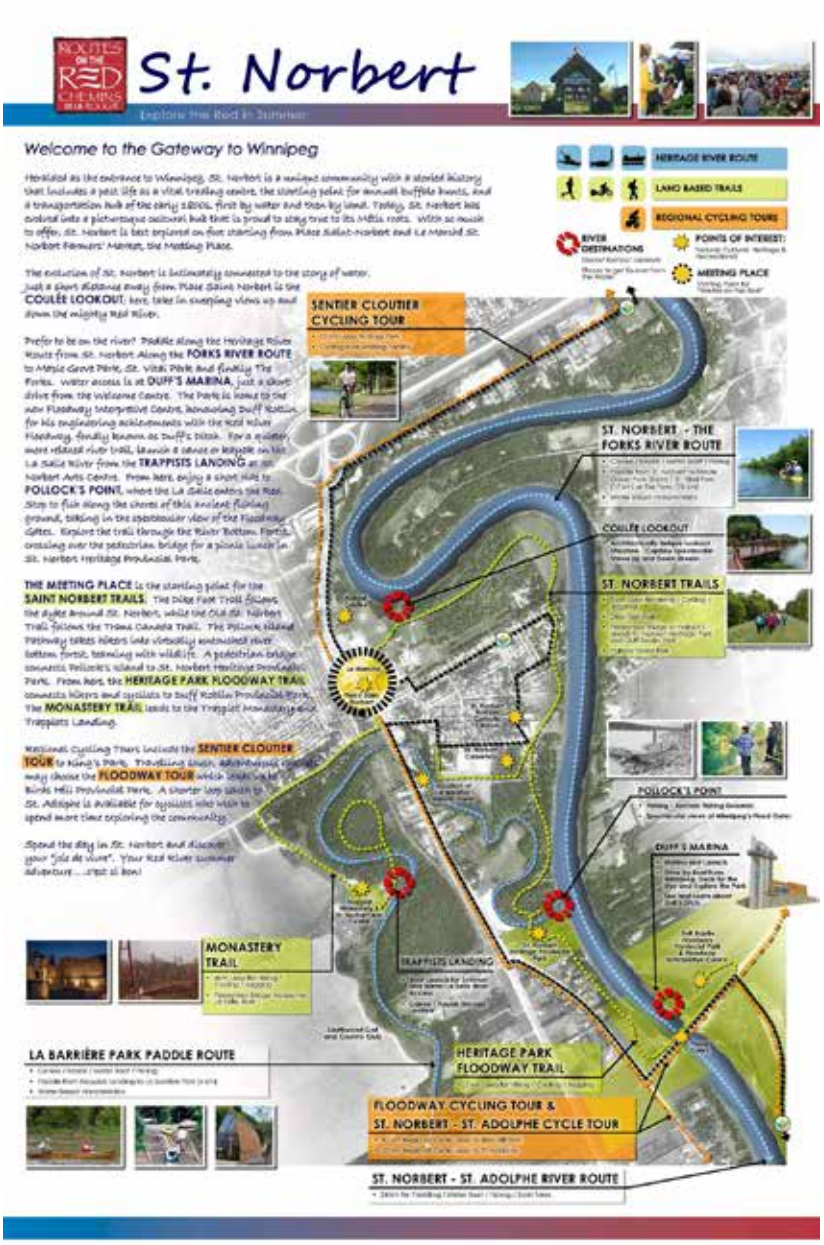
In reviewing potential changes to operating guidelines, one criterion considered by the Panel was to "maximize benefits". While this criterion might lead one to support a move to adopt a potential Rule 5, the other four criteria really speak to not adopting it. Accordingly, the Panel is not prepared to recommend a Rule 5 for Red River Floodway operations.

Resolving Summer Operation of the Floodway

The Panel is not recommending a new guideline for summer operation of the Red River Floodway. This does not mean that the Panel thinks summer use is a bad idea. The negative recommendation is due to the fierce public opposition, non-existent support at public meetings, and because summer operation violates three of the four criteria used to assess project effects.

The core issues respecting summer operation is upstream opposition. In the Panel's opinion, the summer use option has unintentionally been positioned as an "us vs. them", i.e. winners in Winnipeg with adverse effects/ losers upstream.

The only chance for summer operation of the Floodway to become a reality would be to bridge the differences between residents in Winnipeg and residents upstream. People upstream would need to see that their interests are being looked after and that ***measures are undertaken so they too might benefit from development of our river system.***



Rivers West and Economic Development Council for Manitoba Bilingual Municipalities (CEDM) has created their Vision 2030 – *Red River Corridor Master Development Plan.* The concept of Rivers West reflects the notion of "One River – One Vision". It follows in part the successful Société de la Rivière Saint-Charles, which is now the pride of Quebec residents.

The City of Winnipeg also has its visionary plan: ***Go... to the Waterfront.***

To realize these plans and maximize the benefit and potential of greater riverbank use will require action that includes upstream residents in the process and in shared benefits.

12.1.3 Formalize Practice of Operating 0.5 Feet Below "Natural" Upstream

One potential operating guideline change, as described in Chapter 10, is to formalize the practice of targeting river levels at the floodway entrance 0.5 feet below the computed natural. This practice was instituted by the Province to provide some safeguard against going above natural and triggering the compensation provisions of *The Red River Floodway Act.* The operators work with provisional data from water level gauges operated by the Water Survey of Canada. These data are subject to change when they are formalized several months later. This could result in a change in calculated flows on the Red River, the Assiniboine River, or the Portage Diversion, and thus a different result in the calculation of natural.

But while the practice has been adopted, it is not included in the operating guidelines. Formalizing the practice in the operating guidelines would provide some level of support and protect the operators from criticism that they should be operating the structure to its limits to protect Winnipeg and other areas within the floodway protection area.

This practice seems to be well understood and accepted by the public, even within Winnipeg, and also by City of Winnipeg flood control officials.

Panel Conclusions

Overall, the Panel thought that the practice of regulating river levels at the floodway entrance up to 0.5 feet below the computed natural level makes sense and in perhaps a minor way shares the benefit of the Floodway with those upstream who view it as a source of problems in their area. Accordingly, the Panel recommends that the practice be formalized.

12.1.4 Discretion to Operate the Floodway before the Ice is Flowing Freely

As discussed in Chapter 10, the operating guidelines say, "The floodway gates should not be operated until ice on the river is flowing freely, unless flooding in Winnipeg is imminent." We understand the concern is that ice in the Floodway can cause erosion and perhaps jam at the St. Mary's Road crossing, and reduce the ultimate capacity of the Floodway.

When the Floodway was built, it was expected that the ice would be gone before water levels became high. In recent years, we have experienced situations where floodwaters are leaking into the Floodway while ice is still present. The 2009 flood is an example. In practice, waiting until the ice moves has resulted in high levels in south Winnipeg, since in many years there also has been ice cover in

Winnipeg. The slope of the water surface profile is higher with ice cover, which causes the higher levels in south Winnipeg. Accordingly, the City of Winnipeg is anxious to see the Floodway operated as early as possible. However, the operators are still concerned about ice. In 2009, the Province had backhoes on the shore between the inlet and St. Mary's Road Bridge in an attempt to break the ice jam. Eventually, the water levels themselves moved the ice through the Floodway without further incident.

People upstream are also concerned with ice flows. They have seen ice cover their roads and prevent access.

Panel Conclusions

Overall, the Panel did not see enough evidence to recommend any change to the existing operating guideline. This may result in more sandbagging in Winnipeg, but without more definitive knowledge of the impacts and benefits, there is not enough evidence to make a firm recommendation.

12.1.5 Permit Operation Above "Natural" During the Initial Operation to a Maximum River Level of 760 Feet at the Floodway Entrance

The concern that gives rise to the idea of permitting operation above "natural" is the length of time it takes to put the Floodway into operation in the spring. To operate the Floodway, the river must be below natural upstream at the floodway entrance. Operation will bring the river level back to natural or to 0.5 feet below natural under current practice. The first operation of raising the gates out of their beds and allowing things to stabilize takes many hours and has little effect on the river level. Finally, if water levels are rising rapidly, the river level would be several feet below natural with corresponding higher levels in Winnipeg by the time the second and subsequent operations are initiated. The suggestion is to give operators leeway to start the operation as much as a day earlier if river levels are rising rapidly.

In addition, if the decision to operate is made late in the day, the operators wait until the morning of the next day. This allows the first operation to occur in daylight for the benefit of those upstream. However, it causes a further delay in river level reductions within Winnipeg.

The Panel initiated its analysis based on a maximum river level of 760 feet at the Floodway entrance. Through discussion at public meetings, the Panel has come to understand that some flooding occurs below 760 feet.

Panel Conclusions

The Panel concluded that purposely going above natural at any time is problematic and is avoided by the operators, as it could trigger compensation. It is suggested that more consideration be given to operating earlier, where possible. For example, the first operation of the gates could take place such that there is only a small (less than 0.5 feet) influence on water levels. For example, if this were done while the upstream river level is still below 755 feet, there would be no damage and no impact on access for upstream residents. This would allow the initial step of opening the gates to be completed and position the operators to respond more quickly to rising levels while still respecting the practice to stay 0.5 feet below natural above 755 feet.

The Panel recommends that the Floodway operators be given leeway to start the first operation(s) earlier. This could be up to a day earlier if river levels are rising rapidly. Rather than waiting until the next morning for daylight, better communication the day before may provide the necessary notice to upstream residents. When river levels are anticipated to rise rapidly, consideration should be given to making the initial gate operation in anticipation of an imminent increase in river levels, rather than waiting for the increase to start.

Another issue is the requirement to sound the horn before the first gate movement. Given the gate movement has little effect on water levels, sounding the horn seems an antiquated way to provide notice and has prevented the operators from completing this first operation in the evening or during the night. The Panel recommends eliminating the requirement to sound the horn before the initial floodway operation. The Panel is also recommending improved communication.

Criteria 2: Minimize Artificial Flooding and Negative Impacts

Artificial flooding is hard to distinguish from flooding that would have otherwise occurred. It is recognized that river flows have been modified by the effects of land drainage and land use changes as well as by the operation of flood control works. The Province often uses the terms regulated and unregulated and restricts the definition of artificial flooding to the impact of the operation of flood control works.

Computation of artificial flooding requires detailed analysis to arrive at a determination of what flooding is artificial. Certain operations of the Red River Floodway can cause artificial flooding upstream. The operation of the Fairford River Water Control Structure can cause artificial flooding downstream on Lake St. Martin. Portage Diversion can cause artificial flooding on Lake Manitoba if its diversion volumes are so high that they negate the increased volumes of water flowing through the FRWCS.

In looking at the structures under review, the Panel has considered artificial flooding and its effects in arriving at its recommendations.

12.2 Portage Diversion Operating Guideline Changes

Section 6.2 lists the current objectives and operating guidelines for the Portage Diversion. This review is the first for these operating guidelines since the Portage Diversion began operation in 1970. Generally, the Panel found the operating guidelines have been effective in controlling flooding in Winnipeg and along the lower Assiniboine River. However, residents around Lake Manitoba are convinced that much of the flooding over the past decade has been caused by overuse of the Portage Diversion.

Although operating objective 3 for the Portage Diversion (see Section 6.2) states that operation of the Portage Diversion should not increase Lake Manitoba levels above 812.87 feet, consideration of Lake Manitoba levels is not referenced in any of the operating guidelines. In the public meetings, the Panel proposed three potential operating guideline changes to add consideration of Lake Manitoba

levels into the operating guidelines (see Section 10.2). The suggested operating guidelines would tie the maximum desirable flow in the lower Assiniboine River to Lake Manitoba levels, as well as the river level in Winnipeg. The Panel proposed that if levels on Lake Manitoba are forecast to remain below 813 feet (see boxed text in Section 7.1) then maintain the current rule whereby flows in the lower Assiniboine River are held at 10,000 cfs, reduced as necessary to keep the river level below 19 feet James Avenue Datum. If Lake Manitoba levels are forecast to peak above 813 feet, the decision-making is based on a balance of interests. If Lake Manitoba levels are near or at flood stage then send as much flow down the lower Assiniboine as can be safely handled. This proposed change will undoubtedly aggravate flooding on the lower Assiniboine River, particularly through the backup of the drains that flow into the river. However, the proposed operating guideline recognizes that, under unregulated conditions, all the flow would continue down the Assiniboine River resulting in widespread flooding. This operating guideline change is an attempt to share the pain.

These suggested changes were generally supported by interests on Lake Manitoba, but residents and farmers along the lower Assiniboine River were concerned that higher flows on the lower Assiniboine would result in considerable damage to high value agricultural crops, with limited benefit to Lake Manitoba. Homeowners between Baie St. Paul and Headingley were also concerned about residential flooding. Lake Manitoba interests stressed the need to minimize Portage Diversion flows as much as possible to reduce water quality and fisheries impacts. The Panel has given consideration to each of these issues in developing recommended guidelines in an attempt to share the pain between Lower Assiniboine River interests, Lake Manitoba interests and the City of Winnipeg.

Criteria 4: Consider Those Who are Negatively Impacted

The Panel heard a great deal about issues and concerns regarding the operation of flood control structures. The flood control system has saved the Province billions of dollars in flood-related damages. The benefits of the system seem to be taken for granted by those people protected by the system. Most of what the Panel heard was from those who have suffered flood damage from the 2011 and 2014 floods.

In this review, the Panel has tried to capture concerns of people who do not have full flood mitigation in place and may be adversely affected by the operation of flood control structures.

During the spring runoff period the Panel recommends that if the peak level on Lake Manitoba is forecast to remain below 813.0 feet, then maintain the current rule whereby flows in the lower Assiniboine River are held at 10,000 cfs, reduced as necessary to keep the river level below 19 feet James Avenue Datum. If Lake Manitoba levels are forecast to reach a peak level greater than 813.0 feet the panel recommends increasing the flow on the lower Assiniboine River. If the diversion volume is forecast to be low to moderate (less than 590,000[50] acre feet) then maintain a flow of 12,000 cfs in the lower Assiniboine River, reduced as necessary to keep the river level below 20 feet James Avenue Datum. If the diversion volume is forecast to be greater than 590,000 acre feet then increase lower Assiniboine River flows above 12,000 cfs, reduced as necessary to keep the river level below 21 feet James Avenue Datum.

[50] *590,000 acre feet represents 0.5 feet of storage on Lake Manitoba*

The Panel also notes that the proposed guidelines include higher target river levels in Winnipeg. For example, under a moderate flow year the maximum level in Winnipeg has been raised from 17 feet James Avenue Datum to 19 feet. These higher river levels will result in additional flood fighting costs to the City, but the City has expressed a willingness to work with the revised target levels in the interest of "sharing the pain".

The above guidelines relate to a spring flood. However, at times, summer floods produce flows of such a magnitude that the Portage Diversion has been used to prevent flooding of seeded crops along the lower Assiniboine River. As noted previously, many of these are high value crops and the related flood damage can be significant. Also, summer flood volumes tend to be much smaller and of shorter duration than spring floods. Therefore, the Panel recommends that flows on the lower Assiniboine River not be increased during a summer flood event if the level of Lake Manitoba can be held at or below 813.0 feet with the forecast increased diversion volume, or if the forecast diversion volume will be less than 236,000 acre feet.[51]

The fourth potential operating guideline change would reduce summer flows on the lower Assiniboine River sufficiently to keep the Riverwalk open in Winnipeg as long as Lake Manitoba levels are below 811.5 feet. There was little support received for this proposal, and many interests on Lake Manitoba found the proposal to be offensive. Therefore, the Panel is not recommending this operating guideline change.

Although not listed in the proposed operating guideline changes at the public meetings, the Panel is recommending changes to some of the other operating guidelines:

- Rule 2 currently states, "The flow in the Diversion shall not be allowed to exceed 25,000 cfs (708 m3/s)." As this operating guideline has been ignored in recent years, the Panel recommends that it be deleted.
- Rule 6 limits flows on the lower Assiniboine River to 5,000 cfs when there is ice in the river channel. The Panel heard some suggestion that this flow could possibly be raised to 6,000 cfs, but no evidence was presented that this increase would not aggravate ice jamming. Also, a 1,000 cfs flow change over an ice cover period of no more than two weeks would have a negligible effect on Lake Manitoba levels. Therefore, the Panel recommends maintaining this operating guideline.
- Rule 8 specifies action that can be taken to prevent breaching of the failsafe section. The Panel determined that this operating guideline is unnecessary. Experience has shown that flow capacity of the Portage Diversion at the failsafe has changed over time, and the operators need to make ongoing operating decisions in an attempt to prevent overtopping the failsafe based on local conditions rather than flows specified in the operating guidelines.

12.2.1 Panel Recommendations

Based on the above considerations, the Panel recommends the following operating guidelines for the Portage Diversion:

Pre-Spring Break-up Operation

1. While there is ice on the Assiniboine River downstream of Portage la Prairie, it is desirable to limit flows to approximately 5,000 cfs in the river if there is a potential for ice jamming.
2. During the period that there is ice on the reservoir, the water level of the reservoir must not be allowed to exceed 865.0 feet to provide room for releases from breaching of upstream ice jams.

[51] *236,000 acre feet represents 0.2 feet of storage on Lake Manitoba*

3. If flow forecasts indicate that the Portage Diversion will likely be put into operation, the Diversion should be put into use as soon as practical to flush out snow blockages and in situ ice.

Spring Run-off Operation

4. During the spring run-off, after the ice has gone from the Assiniboine River downstream of Portage la Prairie:
    a. if the Lake Manitoba level is forecast to peak below 813 feet, maintain a maximum flow in the lower Assiniboine River of 10,000 cfs, reduced as necessary to keep the river level in Winnipeg below 19 feet James Avenue Datum if possible. Even when there is no risk of flooding on Lake Manitoba maintain a target flow of 10,000 cfs in the lower Assiniboine River to minimize the environmental impact of diversion flows on Lake Manitoba.
    b. if the Lake Manitoba level is forecast to peak above 813 feet, and the projected volume of water from the Portage Diversion into Lake Manitoba will be less than 590,000 ac-ft, maintain a flow in the lower Assiniboine River of 12,000 cfs, reduced as necessary to keep the river level in Winnipeg below 20 feet James Avenue Datum.
    c. if the Lake Manitoba level is forecast to peak above 813 feet, and the projected volume of water from the Portage Diversion into Lake Manitoba will be greater than 590,000 ac-ft, increase flows on the Assiniboine River above 12,000 cfs so as to balance impacts between the Lower Assiniboine River and Lake Manitoba, reduced as necessary to keep the river level in Winnipeg below 21 feet James Avenue Datum.

Growing Season Operation

5. On or after May 25th, if Lake Manitoba levels are below 813 feet the lower Assiniboine flow may be limited to 10,000 cfs if the forecast indicates that Lake Manitoba will not go above 813 feet or that the projected volume of water from the Portage Diversion (from May 25th on) will be less than 236,000 ac-ft. Otherwise operate the Portage Diversion so as to balance impacts between the lower Assiniboine River and Lake Manitoba.
6. In years that the spring thaw occurs early (ice clear from the Lower Assiniboine River prior to April 15), flows on the Assiniboine River can be limited to 10,000 cfs at an earlier date than May 25th, conditional on guideline 5.

General

7. The conduit of the spillway structure should be closed while there is water going over the bascule gates.

There may be circumstances in which adhering to the guidelines is determined to be impractical or unbeneficial. In such circumstances the Province shall provide a timely explanation for deviating from the guidelines.

12.2.2 Further study of agriculture uses

Balancing interests between the lower Assiniboine and Lake Manitoba is made difficult by a lack of detailed information about the areas potentially flooded in each of these regions. The lower Assiniboine is characterized by high value crops and the lands bordering Lake Manitoba by lower value forage crops and native hay. The lands bordering Lake Manitoba are valued for livestock production and are much more extensive than those lands on the Assiniboine. The farmland on the

lower Assiniboine produces very high value horticultural crops but on much smaller land base. It is not known, however, how much land in each of these areas are subject to flooding, what agricultural uses are involved and even notional values that might be associated with each.

Improved decision making requires improved knowledge. It is recommended that the agricultural uses of lands affectd by these structures be described, quantified and valued with a view to establishing relationships between water levels and agricultural damage.

12.3 Fairford River Water Control Structure Operating Guideline Changes

The Panel concluded that the main reason for the persistent high Lake Manitoba levels from 2011 to 2014 is the sequence of five unusually wet years. The inflows from the Portage Diversion reduced the benefit of FRWCS on Lake Manitoba, particularly in 2011.

12.3.1 Panel Conclusions

The Panel concluded that modifying the operating guidelines for the Fairford River Water Control Structure would make no difference to the recent high levels on either Lake Manitoba or Lake St. Martin.

The only addition to the operating guidelines that the Panel recommends is to formalize the current practice of reducing winter flows through the Fairford River Water Control Structure to 5,000 cfs. Over the years water management staff have observed that if winter flows in the Dauphin River exceed 5,000 cfs there is a potential for frazil ice to develop, eventually restricting flows in the river and causing flooding at the Dauphin River First Nation. Under extreme conditions the restriction can result in backup of water in Lake St. Martin. The LSMEOC was intended to augment the safe outflow capacity from Lake St. Martin by directing some of the outflow directly to Lake Winnipeg. However the last portion of the emergency channel was not completed, so in 2011 temporary diking was provided for the Dauphin River First Nation. In 2014 the emergency channel was again put into operation and winter flows through the Fairford Structure were held between 9,000 and 10,000 cfs. However these flows did result in considerable frazil ice development which threatened the Dauphin River First Nation. This experience reinforced the importance of cutting back the winter flows through the Fairford structure until a stable ice cover has developed on the Dauphin River.

Therefore the Panel recommends:

- To prevent development of frazil Ice in the Dauphin River the flow through the control structure should be reduced to a maximum of 5,000 cfs by November 1 unless Reach 3 of the Emergency Channel is put into operation or adequate protection is provided to the Dauphin River First Nation. The flow should not be increased until a stable ice cover has developed on the Dauphin River.

The Panel supports the construction of additional structures to reduce the frequency of flooding on Lake Manitoba and Lake St. Martin.

12.4 Lake St. Martin Emergency Outlet Channel Operating Guidelines Changes

As discussed in Chapter 8, in the fall of 2011 the government of Manitoba constructed an emergency outlet from Lake St. Martin to provide some relief to the lake and to permit the Fairford River Water Control Structure to be kept wide open during the winter of 2011/12 without generating extensive frazil ice on the Dauphin River. The Lake St. Martin Emergency Outlet Channel (LSMEOC) was closed in the fall of 2012, but reopened in the summer of 2014 when Lake St. Martin rose above 803 feet again.

12.4.1 Operational Considerations

The LSMEOC has been effective in alleviating the extreme levels experienced on Lake St. Martin in 2011 and in 2014. When it was first opened on November 1 in 2011, the lake was at 804.4 feet. In just over three weeks, the level dropped below 803 feet, and levels dropped below 802 feet by the following March. Similarly, in 2014, the lake level was at 803.6 feet on July 6 when the LSMEOC was partially opened, and dropped below 803 feet in two weeks.

The LSMEOC has two purposes. The first is to increase the total outlet capacity from Lake St. Martin to compensate for the increased outflows through the Fairford River Water Control Structure. This has been achieved. However, without the use of Reach 3 from Big Buffalo Lake to Lake Winnipeg, the LSMEOC has done little to eliminate the development of frazil ice on the lower Dauphin River. Therefore, winter flows must still be reduced at the Fairford River Water Control Structure to prevent ice buildup on the lower Dauphin River.

Based on the experience gained during the 2011 and 2014 operations, three issues should be taken into consideration for emergency operation:

1. Frazil ice is difficult to forecast, but the potential impact must be considered in operating the LSMEOC. Based on the 2014 experience, a total Dauphin River flow of 10,000 cfs from Lake St. Martin may be too high when there is a potential for frazil ice development. A maximum flow of 8,000 cfs during November and December likely would be more manageable.

2. The opening of the LSMEOC results in a surge of water out of Lake St. Martin. As an example, in mid-November 2014, the Fairford River inflow to Lake St. Martin was about 10,000 cfs, and the combined flow in the Dauphin River including the flow in the partially opened LSMEOC was 11,500 cfs. Lake St. Martin had been dropping slowly. But the opening of the LSMEOC increased total outflows to about 14,000 cfs for a couple of days. With the increase in total outflow, the level of Lake St. Martin dropped more quickly. Outflows stabilized in a few days, but coincident with the short-term increase in river flows was the sudden drop in temperature. This unfortunate combination of events added to the magnitude of the frazil ice development as shown in the photo.

   If the LSMEOC had been fully opened in July rather than partially opened, the levels on Lake St. Martin in mid-November would have been lower and the short-term surge in flows caused by the November plug removal would not have occurred. Therefore, the frazil ice jamming would have been less severe.

   This short-term surge can be reduced by a more gradual opening of the LSMEOC. If it were opened over a two-week period in three of four steps, the surge could be smoothed out.

3. Fisheries biologists have advised that the LSMEOC should not be opened or closed during the whitefish spawning run each fall.

12.4.2 Panel Recommendations

Continued Operation of the Lake St. Martin Emergency Outlet Channel

The Panel concluded that the LSMEOC has provided considerable benefits to Lake St. Martin, as well as Lake Manitoba, and supports its continued operation until a permanent outlet can be constructed.

Based on the above considerations, the Panel recommends the following:

1. When the level of Lake St. Martin is forecast to exceed 803 feet, the LSMEOC should be fully opened to ensure maximum benefit from the additional capacity.
2. The LSMEOC should be opened gradually over a period of 10 days to prevent a surge on the lower Dauphin River.
3. The LSMEOC opening should not be adjusted after mid-October unless there is a stable ice cover on the Dauphin River to minimize frazzle ice formation on the lower Dauphin River.
4. Adjustment should not be made to the outlet control structure during fish spawning periods, as defined by Department of Fisheries and Oceans staff.

Construction of a Permanent Lake St. Martin Outlet

The government has announced that a second outlet will be constructed from Lake St. Martin to Lake Winnipeg, but concern has been expressed that the process will take too long. The Panel supports this construction as soon as possible. This would prevent the lake from going much higher than 803 feet, and would permit continued draw down of Lake Manitoba after a high inflow year.

When a permanent channel is constructed from Lake St. Martin to Lake Winnipeg, the Panel recommends the following operating guidelines:

1. The permanent channel should be put into operation at a lake level of 801 feet, so that benefits can be achieved before significant flooding occurs.
2. Adjustment should not be made to the outlet control structure during the fish spawning periods, as defined by Department of Fisheries and Oceans staff.

12.5 Communications and Education

The public has repeatedly identified the need for improved communication in several ways:

- Advance notification of operations (especially for the Floodway).
- The rationale for operational decisions.

The Panel believes it is important for the public to have access to improved information about the flood control structures, their operating guidelines and the rationale for them, as well as the impacts of operation, both positive and negative. Additional knowledge and understanding by all stakeholders will enhance future discussions and decision-making, and will contribute to an ongoing and productive dialogue on a topic that affects most Manitobans.

12.5.1 Panel Recommendations

1. Improve information and education about floods in Manitoba and flood control structures. This could include:
    a) Enhanced information on the provincial website and the preparation of print material.
        i) Background on the structures such as history, objectives, description, operational history, etc.
        ii) Specifically, operating guidelines for each structure should be presented.
    b) Educational material such as interpretive panels and interactive displays.
2. Improve communications of operations:
    a) Be consistent in the type and frequency of communication for all structures.
    b) Ensure clear channels of communications with municipal officials and key stakeholders.
    c) Use social media to communicate with residents about upcoming gate changes for all flood control structures.
    d) Provide an annual report on the operation of each structure as a public document and share on the provincial website.

12.6 Regulatory and Review Processes

The Panel noted a lack of consistency in the management and documentation of the operating guidelines for the three flood control structures.

- The operating guidelines for the Red River Floodway are contained in *The Red River Floodway Act (*2004).
- The operating guidelines for the Portage Diversion are included in *The Red River Floodway Program of Operation* (October 1984).
- The current operating guidelines for the Fairford River Water Control Structure are described in *The Lake Manitoba Regulation Review Advisory Committee Report* (2003), and modified slightly in the *Lake Manitoba/Lake St. Martin Regulation Review Committee Report* (2013)

The Water Resource Administration Act sets out the concept that the Minister *"may approve operating guidelines for a water control work". An important concept in the act is that "In operating a water control work for which operating guidelines have been approved, the minister must have regard to, but is not bound by the guidelines."*

The use of the term guidelines rather than rules is consistent with the Act and is recommended by the panel. A rule, as commonly understood, defines which actions are allowed and which actions are not allowed without tolerance for judgement. Each flood, however, is different from previous floods in some respects, whether it is timing, duration, magnitude, ice, climatic conditions and state of readiness. The operators must take these challenging factors into account and do so under time pressure. The Act specifically allows this discretion. The term "rules" is not consistent with the Act and this is why the Panel recommends that "rules" be dropped and the Province only use the term "operating guidelines" as used the Act. The Panel has recommended that a clause to this effect be added for all structures.

At the same time, and also consistent with the Act, the Panel supports the concept of approved and published operating guidelines. For the public to know what the approved operating guidelines are, they must be published and readily available. Currently, this is not the case. In fact, even the panel had trouble finding the operating guidelines in one place for the Fairford River Water Control Structure. The Panel recommends that the approved operating guidelines for each water control structure be published and easily found on the provincial website.

The inclusion of the Floodway Operating "Rules" in *The Environment Act* licence is inconsistent with *The Water Resources Administration Act*. The minister must have the authority to approve the operating guidelines and in fact not be bound by them if the situation warrants it. The Panel recommends that the Floodway Operating guidelines be removed from *The Environment Act* licence and more clearly be brought under the authority of the Minister responsible, as are the other guidelines.

The licence for the Red River Floodway under *The Environment Act* requires that the operating guidelines be reviewed every five years, but there is no requirement to review the operating guidelines for the other structures. Also, since the operating guidelines form part of the licence, any changes require an alteration to the licence.

12.6.1 Panel Recommendations

1. Remove the "Rules of Operation – Red River Floodway Control Structure" from *The Environment Act* licence, and place them under the authority of *The Water Resources Administration Act.*
2. Remove the requirement for a five-year review from the licence, with future reviews undertaken as required at the discretion of the minister.
3. Post the currently approved operating guidelines for each structure on the provincial website.
4. Use the term "operating guidelines" instead of "operating rules" to be consistent with *The Water Resources Administration Act.*

13 SUMMARY OF RECOMMENDATIONS + KEY COMMENTS

The Panel met with the public and representatives from government, rural municipalities, First Nations and special interest groups, and reviewed an extensive amount of data, studies and other information. It considered a range of possible rule changes for the Red River Floodway, Portage Diversion, Fairford River Water Control Structure and the Lake St. Martin Emergency Outlet Channel.

This chapter summarizes recommendations arising from the work of the Panel regarding changes to operating guidelines and related topics. The Panel reached additional conclusions but if those conclusions were to not make a change, they are not listed here. Discussion and conclusions on these other considerations are found in Chapter 12.

13.1 Recommended Changes to Operating Guidelines

Red River Floodway

The Panel recommends the following changes to the operating guidelines, plus recommendations on related issues:

1. Formalize the practice of regulating river levels at the floodway entrance 0.5 feet below the computed natural level.
2. Give the Floodway operators leeway to start the first operation(s) earlier. This could be up to a day earlier if river levels are rising rapidly. This would include permitting in-channel river levels south of the inlet control structure to rise above natural, as long as levels at the Floodway entrance are below 755 feet. Changes in practice will be needed to provide the necessary notice to upstream residents.
3. Remove the requirement to sound the horn before the initial floodway operation.
4. Remove the requirement for the preparation of a report before a decision is made to operate under Rule 4 (articles 4(4) to 4(5)).
5. The river level upstream of the control structure should not be increased under Rule 4 so as to restrict access for residents. Therefore, either roads/driveways should be raised, including an adjustment for the slope of the river, or the maximum level established under Rule 4 should be reduced so as not to create access issues.
6. Since the flooding is artificial under Rule 4 and is done by the Province to reduce the risk of basement flooding in Winnipeg, a process should be in place to compensate the affected parties promptly and without undue restrictions. There are only a few properties that are affected. A file could be kept on each potentially affected property and the owners should be approached individually by the government as soon as the Rule 4 operation is approved.
7. There may be circumstances in which adhering to the guidelines is determined to be impractical or unbeneficial. In such circumstances the Province shall provide a timely explanation for deviating from the guidelines.

Portage Diversion

The Panel recommends that the operating guidelines be replaced with the following:

Pre-Spring Break-up Operation

1. While there is ice on the Assiniboine River downstream of Portage la Prairie, it is desirable to limit flows to approximately 5,000 cfs in the river if there is a potential for ice jamming.
2. During the period that there is ice on the reservoir, the water level of the reservoir must not be allowed to exceed 865.0 feet to provide room for releases from breaching of upstream ice jams.
3. If flow forecasts indicate that the Portage Diversion will likely be put into operation, the Diversion should be put into use as soon as practical to flush out snow blockages and in situ ice.

Spring Run-off Operation

4. During the spring run-off, after the ice has gone from the Assiniboine River downstream of Portage la Prairie:
    a. if the Lake Manitoba level is forecast to peak below 813 feet, maintain a maximum flow in the lower Assiniboine River of 10,000 cfs, reduced as necessary to keep the river level in Winnipeg below 19 feet James Avenue Datum if possible. Even when there is no risk of flooding on Lake Manitoba maintain a target flow of 10,000 cfs in the lower Assiniboine River to minimize the environmental impact of diversion flows on Lake Manitoba.
    b. if the Lake Manitoba level is forecast to peak above 813 feet, and the projected volume of water from the Portage Diversion into Lake Manitoba will be less than 590,000 ac-ft, maintain a flow in the lower Assiniboine River of 12,000 cfs, reduced as necessary to keep the river level in Winnipeg below 20 feet James Avenue Datum.
    c. if the Lake Manitoba level is forecast to peak above 813 feet, and the projected volume of water from the Portage Diversion into Lake Manitoba will be greater than 590,000 ac-ft, increase flows on the Assiniboine River above 12,000 cfs so as to balance impacts between the Lower Assiniboine River and Lake Manitoba, reduced as necessary to keep the river level in Winnipeg below 21 feet James Avenue Datum.

Growing Season Operation

5. On or after May 25th, if Lake Manitoba levels are below 813 feet the lower Assiniboine flow may be limited to 10,000 cfs if the forecast indicates that Lake Manitoba will not go above 813 feet or that the projected volume of water from the Portage Diversion (from May 25th on) will be less than 236,000 ac-ft. Otherwise operate the Portage Diversion so as to balance impacts between the lower Assiniboine River and Lake Manitoba.
6. In years that the spring thaw occurs early (ice clear from the Lower Assiniboine River prior to April 15), flows on the Assiniboine River can be limited to 10,000 cfs at an earlier date than May 25th, conditional on guideline 5.

General

7. The conduit of the spillway structure should be closed while there is water going over the bascule gates.

There may be circumstances in which adhering to the guidelines is determined to be impractical or unbeneficial. In such circumstances the Province shall provide a timely explanation for deviating from the guidelines.

In addition, the Panel notes that improved decision making requires improved knowledge. It is recommended that the agricultural uses of lands affected by these structures be described, quantified and valued with a view to establishing relationships between water levels and agricultural damage.

Fairford River Water Control Structure

The Panel recommends the following addition to the operating guidelines:

- To prevent development of frazil Ice in the Dauphin River the flow through the control structure should be reduced to a maximum of 5,000 cfs by November 1 unless Reach 3 of the Emergency Channel is put into operation or adequate protection is provided to the Dauphin River First Nation. The flow should not be increased until a stable ice cover has developed on the Dauphin River.

There may be circumstances in which adhering to the guidelines is determined to be impractical or unbeneficial. In such circumstances the Province shall provide a timely explanation for deviating from the guidelines.

Lake St. Martin Emergency Outlet Channel

For the continued operation of the LSMEOC, the Panel recommends the following:

1. When the level of Lake St. Martin is forecast to exceed 803 feet, the LSMEOC should be fully opened to ensure maximum benefit from the additional capacity.
2. The LSMEOC should be opened gradually over a period of 10 days to prevent a surge on the lower Dauphin River.
3. The LSMEOC opening should not be adjusted after mid-October unless there is a stable ice cover on the Dauphin River to minimize frazzle ice formation on the lower Dauphin River.
4. Adjustment should not be made to the outlet control structure during fish spawning periods, as defined by Department of Fisheries and Oceans staff.

There may be circumstances in which adhering to the guidelines is determined to be impractical or unbeneficial. In such circumstances the Province shall provide a timely explanation for deviating from the guidelines.

When a permanent channel is constructed from Lake St. Martin to Lake Winnipeg, the Panel recommends the following operating guidelines:

1. The permanent channel should be put into operation at a lake level of 801 feet, so that benefits can be achieved before significant flooding occurs.
2. Adjustment should not be made to the outlet control structure during fish spawning periods, as defined by Department of Fisheries and Oceans staff.

13.2 Other Recommendations Related to Operating Guidelines

Regarding Communications and Education

1. Improve information and education about floods in Manitoba and flood control structures. This could include:
   a) Enhanced information on the provincial website and the preparation of print material.
      i) Background on the structures such as history, objectives, description, operational history, etc.
      ii) Specifically, operating guidelines for each structure should be presented.
   b) Educational material such as interpretive panels and interactive displays.

2. Improve communications of operations:
    a) Be consistent in the type and frequency of communication for all structures.
    b) Ensure clear channels of communications with municipal officials and key stakeholders.
    c) Use social media to communicate with residents about upcoming gate changes for all flood control structures.
    d) Provide an annual report on the operation of each structure as a public document and share on the provincial website.

Regarding Regulatory and Review Processes

1. Remove the "Rules of Operation – Red River Floodway Control Structure" from *The Environment Act* licence, and place them under the authority of *The Water Resources Administration Act.*
2. Remove the requirement for a five-year review from the licence, with future reviews undertaken as required at the discretion of the minister.
3. Post the currently approved operating guidelines for each structure on the provincial website.
4. Use the term "operating guidelines" instead of "operating rules" to be consistent with *The Water Resources Administration Act.*

13.3 Key Comments

Although the focus of this review is on operating guidelines for the identified flood control structures, the Panel was also requested to consider and respond to issues raised in the public meetings.

Regarding Lake Manitoba Impacts

In big floods there are big consequences. People are going to suffer damage. It has been that way since people established permanent structures and farms in Manitoba. Especially structures close to lakes and rivers. It is a consequence of where we live.

Under certain circumstances, however, it is clear that people, farms and businesses along the lower Assiniboine River and in Winnipeg have benefited from the flood control system at the expense of others. To minimize overall flood damage and to avoid the risks associated with an uncontrolled flood, the Portage Diversion has to be used to prevent a breach in the Assiniboine River dikes. Under extreme conditions, more water flows into the Portage Diversion than anticipated by the designers and the flood control benefits of the Fairford River Water Control Structure are effectively lost to Lake Manitoba and transferred to the lower Assiniboine and Winnipeg. Under these conditions it is reasonable that some form of financial assistance to be provided to Lake Manitoba residents as a result of the operation of the Portage Diversion.

Guidelines need to evolve to reflect changing circumstances. A review and monitoring of the effects of operations, however, is hampered by lack of detailed information on the effects of flooding. The effects are well understood by individuals who are impacted but at a policy level improved decision making requires improved knowledge. Impacts are known as in how large the financial assistance bill was for any particular flood event, but lacking in specifics. For example – while we might know how many acres were inundated in 2011 – we do not know how many acres of forage crops are at risk bordering Lake Manitoba nor how many acres of high value crops are subject to flooding along the Assiniboine. Improving the performance of our flood control system requires a better understanding of our landscape.

Compensation for flood damages, particularly those damages which are aggravated by operating decisions related to the Portage Diversion, were raised frequently in Panel discussions (see sections 11.1.4 and 13.2.1). The Panel suggests that the government conduct a study on how to improve the financial assistance provided to Lake Manitoba residents to compensate for damage to structures and agricultural losses under specific circumstances. One option is to provide financial assistance in those years when:

- Lake Manitoba is above 813 feet; and
- Inflows from the Portage Diversion are greater than 1,000,000 acre feet.

The amounts and nature of the assistance would need to be determined. It would be necessary to undertake a complex review of potential damages, appropriate compensation, and program delivery. This review could involve considerations of:

- Personal responsibility – what is a reasonable expectation for people to mitigate flood damage on their own property given the assistance available to raise or dike structures.
- The likely nature of flood damage and remedies.
- Existing agricultural support programs.
- Availability of Disaster Financial Assistance.

While this may be onerous, it could prove easier than developing and managing ad hoc programs in the middle of future flood events.

Regarding Summer Operation of the Floodway

The Panel is not recommending a new rule for summer operation of the Red River Floodway due to fierce public opposition upstream and downstream (see Section 12.1.2). This does not mean the Panel thinks summer use of the Floodway to keep the Riverwalk open is a bad idea. However, the only real chance for summer operation of the Floodway to become a reality is to bridge the differences between residents in Winnipeg and residents upstream. To realize plans to maximize the benefit and potential of greater riverbank use, some action must be taken that includes upstream residents in the process and in shared benefits.

Regarding Salinity and the Portage Diversion

The Province should consider undertaking a study or a pilot project to understand water movements from the Portage Diversion and impacts on soil salinity in the vicinity.

APPENDIX A
TERMS OF REFERENCE

TERMS OF REFERENCE

Provincial Flood Control Infrastructure Operation Review Panel

Background

The Province of Manitoba owns and operates a number of water control structures throughout the province under the authority of *The Water Resources Administration Act*. Most of these structures are operated for the purposes of flood control in accordance with operating guidelines which are developed and approved for individual structures. Although each individual structure has operating guidelines, many of these structures are operated as a system and work in sync to provide flood protection to specific communities, such as Winnipeg, or bodies of water, such as Lake Manitoba. The operation of provincial water control structures is sometimes contentious, particularly during extreme flooding events or extended periods of high water. In some cases, the operation of water control structures benefits a geographic area or the interests of a specific stakeholder group while other areas or interests receive no benefit or, in some cases, are negatively affected by the operation of water control structures. In many cases, the nature or the effect of the operation of water control structures is misunderstood or is more complex than it appears.

Purpose & Objectives

The Government of Manitoba is appointing the Provincial Flood Control Infrastructure Operation Review Panel to review and make recommendations on updated operating guidelines for some of Manitoba's major water control structures. The three water control structures to be included in the review are the Red River Floodway, the Portage Diversion, Fairford River Water Control Structure.

The review is expected to include engagement with the public, First Nations, and stakeholders to identify concerns and questions about the operation of these structures, and to identify potential revisions to the operating rules and guidelines. The Panel is expected to review and respond to the concerns raised by the public, and to consider these concerns in their review of the operating guidelines. While public input is to be considered, the review is to be technical in nature and recommended guidelines should reflect the fact that the overall purpose guiding operation of the water control structures is to minimize overall flood impacts.

The recommended operating guidelines for the Portage Diversion and the Fairford River Water Control Structure are to be considered interim in nature, reflecting the realities of the current network of water control structures. New water control structures have been announced or are expected as a result of the Lake Manitoba and Assiniboine River Basins Flood Mitigation Study. Operating guidelines for the Portage Diversion and Fairford River Water Control Structure cannot be finalized until the new or upgraded infrastructure is designed and constructed.

The specific objectives of this review are:

1. Review of the operating rules for the Red River Floodway.
2. Review of operating guidelines for the Portage Diversion, and Fairford River Water Control Structure. The Emergency Channel has been added to the structures under review.

3. Engagement with the public, First Nations, stakeholders, and local governments to identify questions and concerns about the operation of these water control structures, along with an independent, summary response to the issues that are raised.
4. Improved public understanding of these water control structures and how they are operated as part of a system of provincial water control structures.

Scope and Guidelines

The review is to be conducted within the following parameters:

- Many of Manitoba's water control structures are operated as a system and therefore a system basis is the appropriate scale for review of operating guidelines.
- The appointed Operation Review Panel will complete their review by spring 2015.
- The Operation Review Panel will consider the results and recommendations from the Lake Manitoba and Assiniboine River Basins Flood Mitigation Study in the review.
- The Shellmouth Dam operating guidelines are not to be included in the Panel's review. However, the Panel must consider how the operation of the Shellmouth Dam affects the operation of the water control structures that are included in the review.
- Feedback from the public and stakeholders is to be considered in the review; however, the recommended operating guidelines must be technically defensible and must fulfill the original purpose of providing flood protection.
- Where possible, it is preferable for operating guidelines to be broad and objective-based, rather than prescriptive and focused on specific scenarios. The operating guidelines should embody principles of good stewardship and serve to minimize overall flood impacts.
- The review must consider ancillary flood protection and water control works, such as the Assiniboine River dikes, the Winnipeg Primary dikes, the West Dike, the Lake St. Martin Emergency Channel and the St. Andrews Lock and Dam (Lockport).
- The operating guidelines must consider the necessity to sometimes operate water control structures on relatively short notice and sometimes with imperfect or provisional hydrometric and flood information available.
- Provincial government officials will cooperate with the Panel to provide information to ensure that work is completed on a timely basis. In some cases this may extend to departments completing discrete pieces of research and/or planning, providing mapping support, or providing administrative support. All requests from the Panel for support from provincial officials must be approved at senior levels.
- A public review of the Red River Floodway's operating rules is required every five years under the terms of the Floodway's Environment Act licence. The next review must be completed by July 8, 2015. The review by the Operation Review Panel must meet the requirement for a public review as stipulated in the Environment Act licence.
- Public meetings are expected to be held in affected geographic areas, in order to ensure representative engagement with the public. The following areas are expected to be included.
    - The City of Winnipeg
    - The Red River Valley north of Winnipeg
    - The Red River Valley south of Winnipeg
    - Portage la Prairie
    - Interlake area

- A consultant may be engaged to lead the consultations. The Province of Manitoba may also appoint persons to lead the public outreach and engagement in specific geographic areas or with specific stakeholders.
- The Panel is expected to engage with First Nations in conducting its review. Engagement with First Nations is not intended to take the place of Crown-Aboriginal consultations.

Deliverables

The following products are expected as a result of the review:

1. A Consultation report, summarizing the engagement process and feedback on each structure's operation and operating guidelines. The information and feedback may be presented by geographic area or by interests affected.
2. A response document, which addresses the issues raised during consultations.
3. A Draft Report, including recommended interim operating guidelines and the reasons for any proposed changes.
4. A Final Report, including recommended interim operating guidelines for each water control structure.

APPENDIX B
RED RIVER FLOODWAY OPERATING RULES

RED RIVER FLOODWAY OPERATING RULES

Extracted from:

Attachment 1
To *Environment Act* Licence No. 2691

Rules of Operation — Red River Floodway Control Structure

Source: Red River Floodway Operation Report - Spring 2005, Manitoba Water Stewardship, June, 2005.

Rule 1 - Normal Operation.

Maintain "natural"[52] water levels on the Red River at the entrance to the Floodway channel, until the water surface elevation at James Avenue reaches 24.5 feet (7.46 metres), or the river level anywhere along the Red River within the City of Winnipeg reaches two feet below the Flood Protection Level of 27.83 feet (8.48 m).

Rule 2 - Major Flood Operation.

Once the river levels within Winnipeg reach the limits described in Rule 1, the level in Winnipeg should be held constant while levels south of the Control Structure continue to rise. Furthermore if forecasts indicate that levels at the entrance to the Floodway channel will rise more than two feet (0.6 metres) above natural, the City of Winnipeg must proceed with emergency raising of the dikes and temporary protection measures on the sewer systems in accordance with the flood level forecasts within Winnipeg. The levels in Winnipeg should be permitted to rise as construction proceeds, but not so as to encroach on the freeboard of the dikes or compromise the emergency measures undertaken for protecting the sewer systems. At the same time the Province should consider the possibility of an emergency increase in the height of the Floodway embankments and the West Dike. At no time will the water level at the Floodway channel's entrance be allowed to rise to a level that infringes on the allowable freeboard on the Floodway west embankment (Winnipeg side) and the West Dike.

Rule 3 - Extreme Flood Operation.

For extreme floods, where the water level at the Floodway channel's entrance reaches the maximum level that can be held by the Floodway west embankment and the West Dike, the river level must not be permitted to exceed that level. All additional flows must be passed through Winnipeg.

Initial Gate Operation with Ice.

The Floodway gates should not be operated until ice on the river is flowing freely, unless flooding in Winnipeg is imminent.

Final drop of Gates.

To minimize bank slumping along the river in Winnipeg and at the same time reduce the probability of sewer backup problems, final gate operations, once the level at the entrance to the Floodway Channel recedes to elevation 752 feet (229 metres), shall be carried out in consultation with the City of Winnipeg.

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[52] *The term "natural" refers to the level that would have occurred in the absence of the flood control works, with the level of urban development in place at the time of the construction of these works.*

Operation of Horn.

The horn at the Floodway Structure shall only be operated once, before the first gate operation of the year. The horn should be sounded a half-hour before the first gate operation to alert residents that the Floodway Structure is being put into operation. For ongoing information a 1-800 number should be established that would provide current information of gate operations, potential impacts on water levels, and forecasts for the next few days. The information should also be included on the existing Water Stewardship internet site.

Rule 4 - Emergency Operation to Reduce Sewer Backup in Winnipeg

4(1) This rule defines the circumstances under which the Minister of Water Stewardship ("the Minister") may determine that emergency operation of the Floodway is necessary to prevent widespread basement flooding and resulting risk to health and damage to property within the City of Winnipeg.

4(2) This rule applies after the spring crest from snowmelt runoff at Winnipeg, whenever high river levels substantially impair the capacity of Winnipeg's combined sewer system.

4(3) As long as the Department of Water Stewardship ("the Department") forecasts that river levels for the next 10 days will be below 14 feet James Avenue Pumping Station Datum (JAPSD), the Department will not operate the Floodway Control Structure.

4(4) When the Department forecasts that river levels for the next 10 days are expected to rise to 14 feet JAPSD or higher, the Department will prepare a report that describes:

(a) The basis of the Department's river level forecasts and its risk assessment;

(b) The risk of basement flooding in Winnipeg, including the following factors:

(i) The predicted peak river level in the next 10 days;

(ii) The length of time the Department forecasts the river level will be at 14 feet JAPSD or higher;

(iii) The risk of an intense rainfall event in Winnipeg in the next 10 days;

(c) The benefits and costs of Floodway operation, including:

(i) The extent of basement flooding and damage to property expected from various combinations of intense rainfall events and high river levels;

(ii) The risk to the health of Winnipeg residents from sewer back-up;

(iii) Economic loss and damage caused by artificial flooding south of the Inlet Control Structure;

(iv) Impacts of operation on fish and wildlife and their habitat and on water quality;

(v) The risks and potential costs of riverbank instability that may be caused by artificial river level changes, both upstream and downstream of the Inlet Control Structure;

(vi) During construction of the Floodway expansion, costs and risks associated with any resulting delays of that construction, including the potential average annual expected damages associated with an additional period of risk of a flood event that would exceed the current capacity of the Floodway;

(vii) Such other benefits and costs of operation of which the Department is aware at the time of the preparation of the report, excluding benefits associated with recreational or tourism activities or facilities; and

(d) measures that may be taken to mitigate the costs and impacts of the operation under consideration, including:

(i) minimizing the rate at which river levels are changed both upstream and downstream of the Floodway Inlet Control Structure;

(ii) providing means to assure fish passage.

4(5) The Department will present a draft of the report prepared under rule 4(4) to the Floodway Operation Review Committee and provide an opportunity for the Committee to provide input, before finalizing the report and making recommendations respecting Floodway operation.

4(6) The Department will not recommend operation of the Floodway unless the expected benefits of doing so clearly and substantially outweigh the expected costs.

4(7) The Department will present its report and recommendations to the Minister, who, subject to rule 4(8), will make a decision respecting Floodway operation based on his consideration of the report.

4(8) The Department will not operate the Floodway control structure under this rule:

(a) to raise river levels immediately upstream of the control structure to an elevation higher than 760 feet above sea level;

(b) to achieve a river level of less than 9 feet JAPSD; or

(c) except in circumstances of extreme urgency, to lower river levels more than one foot per day.

4(9) The Department will issue a news release announcing a decision to operate the Floodway at least 24 hours before commencing operation.

4(10) The Department will ensure every reasonable effort is made to personally notify landowners who may be directly affected by flooding due to Floodway operation in advance of the operation.

4(11) The Department will sound the horn at the Floodway Inlet Control Structure one-half hour before operation commences.

4(12) The Department will maintain a program of compensation for damages suffered by landowners arising from flooding caused by Floodway operation under this rule.

APPENDIX C
PORTAGE DIVERSION OPERATION GUIDELINES

PORTAGE DIVERSION OPERATION GUIDELINES

Extracted from:

Red River Floodway Program of Operation, October, 1984

The Portage Diversion has a capacity of 25,000 cfs (708 m3/s) at full supply level of 769.0 feet (234.39 m) However, there is a failsafe section which will breach at 15,000 cfs (425 m3/s).

Operation Objectives

The Portage Diversion will be operated to meet these objectives:

1. To provide maximum benefits to the City of Winnipeg and areas along the Assiniboine River downstream of Portage la Prairie
2. To minimize ice jams forming along the Assiniboine River.
3. Not to increase the water level in Lake Manitoba beyond the maximum regulated level of 812.87 feet (247.76 m), if possible.
4. Prevent overtopping of the failsafe section in the Portage Diversion, if possible.

Emergency Operation

The Assiniboine River dykes between Portage la Prairie and Headingley have a capacity of about 20,000 cfs (566 m3/s). Therefore, an emergency situation exists when the inflow into the reservoir is 45,000 cfs (1274 m3/s). When the inflow exceeds 45,000 cfs (1274 m3/s), it is the policy to maintain 25,000 cfs (708 m3/s) in the Portage Diversion with the remainder allowed into the Assiniboine River downstream. When the Assiniboine River dykes are overtopped, adjustments must be made to the computed natural flow in Winnipeg. This is discussed under the section Assiniboine River Dykes Overtopped.

Operation Rules

1. Except as provided for under Rule 8, the Portage Diversion shall be utilized to its maximum capability to keep water levels in Winnipeg below 17.0 feet (5.2 m). City Datum.
2. The flow in the Diversion shall not be allowed to exceed 25,000 cfs (708 m3/s).
3. If flow forecasts indicate that the peak inflow into the reservoir to be 20,000 cfs (566 m3/s) or more, the Diversion will be put into use as soon as possible to flush out snow blockages and insitu ice.
4. During the period that there is ice on the reservoir, the water level of the reservoir will not be allowed to exceed 865.0 feet (263.65 m) to provide room for releases from breaching of upstream ice jams.
5. The conduits of the Spillway Structure shall be closed while there is water going over the bascule gates.

6. While there is ice on the Assiniboine River downstream of Portage la Prairie it is desirable to limit flows to approximately 5,000 cfs (142 m3/s) in the River if possible. Flows of this magnitude appear to be optimum flows required to assist in flushing the ice down river without causing major ice jams or flooding to adjacent farm lands through local drainage inlets. This procedure provides additional capacity, if required, on the River downstream of Portage la Prairie when the second peak arrives. The level of Lake Manitoba should not be taken into account while there is ice on the Assiniboine River, as the period during which there is ice on the River during the spring runoff is only a few days, and diverted flows for this short a period of time have a negligible effect on the level of Lake Manitoba.

7. After the ice has gone from the Assiniboine River downstream of Portage la Prairie, it is desirable to maintain flows less than 10,000 cfs (283 m3/s) in the River if possible. Flows greater than 10,000 cfs (283 m3/s) are above the natural bank stage of the River, and backup of local streams which outlet into the Assiniboine may occur at this level. There also may be seepage problems through the dyke, leakage under the dyke through gated culverts and flooding of cultivated land between the dykes.

8. For flows of up to 30,000 cfs (850 m3/s) under open water conditions, the failsafe section of the west dyke of the Portage Diversion should not be breached if the peak stage in Winnipeg will not exceed 18.0 feet (5.5 m).

Source: Red River Floodway Program of Operation, October, 1984

APPENDIX D
FAIRFORD RIVER WATER CONTROL STRUCTURE OPERATING GUIDELINES

FAIRFORD RIVER WATER CONTROL STRUCTURE OPERATING GUIDELINES

Extracted from:

- Lake Manitoba/Lake St Martin Regulation Review (2013)
- Manitoba 2011 Flood Review Task Force (2013)

Lake Manitoba shall be operated based on the Minimum Log Change Model:

- When water levels on Lake Manitoba are between 810.5 feet and 812.5 feet and levels on Lake St. Martin are between 797 feet and 800 feet permit the lakes to fluctuate naturally without stop log changes.
- Any variances 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.
- The minimum flow on the Fairford River should be 800 cfs with a desirable flow of 1,000 cfs as often as possible.
- During recovery from flood conditions on Lake Manitoba, the Fairford Control Structure is kept wide open until Lake Manitoba recedes to the middle of the range;
- For recovery from drought, the Fairford Control Structure is kept at 800 cfs until Lake Manitoba levels increase to middle of the range; and
- Under normal operating conditions, once outflow reaches normal, there are no further stop-log adjustments, as long as Lake Manitoba remains within the range.

In response to a recommendation in the 2013 report of the Lake Manitoba/Lake St. Martin Regulation Review Committee a temporary adjustment of the rule was adopted in 2013 as follows:

- the range be lowered from the current range of 810.5 to 812.5 feet by half a foot to 810.0 to 812.0 for a period of five years.

APPENDIX E
PUBLIC CONSULTATION REPORTS

1. What You Told Us Previously

2. What Was Heard – Report on Public Consultation for the Provincial Flood Control Infrastructure Review of Operating Guidelines

WHAT YOU TOLD US PREVIOUSLY

The Provincial Flood Control Infrastructure Review Panel recognizes that Manitobans have participated in previous public events for panels, task forces, Environment Act licencing hearings and other studies. As part of those processes, ideas, comments and questions have been contributed and recorded regarding the provincial flood control structures under review now. This is important information for the Panel to take under consideration in its analysis and the development of recommendations.

This document presents a synopsis of what has been said previously by Manitobans regarding the structures identified in the Panel's Terms of Reference, and particularly any commentary regarding the operating rules or guidelines. Impacts associated with the operation of the flood control structures are also noted.

Prepared by Marr Consulting International Ltd.
with First Persons Strategies and Barb Hicks Graphic Design

General

During the work of the 2011 Manitoba Flood Review Task Force, comments on the operation of flood control infrastructure were the most frequent among all public responses. Through a Task Force survey, 23 out of 27 respondents indicated that they were not given the opportunity to provide input into the operation of structures that affect them, and the majority felt that local interests were not well represented in decisions made regarding control structure operation in their area. A consistent belief was that people affected by water control structures must be given more consideration. The Task Force often heard that the major control structures are used for the protection of communities located relatively far away downstream, in particular Winnipeg and Portage la Prairie, despite the fact that this causes problems for people in the vicinity of the structures.

There were calls for more research regarding the impacts arising from use of the flood control infrastructure, and questions were asked about the basis for decisions to operate all three of the structures. Some comments referred to the unpredictability of the operation of the structures.

While much of the input received during previous public consultations focussed on one structure or another, the needed for a systems approach was raised by some. For example, a comment was made that it appears that existing water management structures, including the emergency channel, the Portage Diversion and others, were built either to address emergencies or satisfy local concerns. As such, these were seen as piecemeal solutions lacking coordination. Upstream solutions, such as holding water on land for longer, were also understood to affect the need to use flood control structures downstream.

Most comments from previous consultation processes were related to the impacts caused by the operation of flood control structures, as opposed to specific suggestions or comments on operating rules or guidelines. Some comments were directed to the rationale for the rules or guidelines, the circumstances under which they were applied, and the implementation process. The Panel understands that the benefits of flood protection tend not to be identified in these types of forums.

Member of the 2011 Flood Review Task Force at the Portage Diversion

Red River Floodway

Consultation regarding the Red River Floodway occurred during the following studies and associated reports:

- Manitoba 2011 Flood Review Task Force (2013);
- Rural Municipality of Ritchot Artificial Flooding Study (2012)
- Red River Floodway, Public Review of the Rules of Operation (2010)
- Manitoba Clean Environment Commission; Red River Floodway Expansion (2005)
- MFA Environmental Assessment for Floodway Expansion (2005)
- Federal Screening document for Floodway Expansion(2005)

Of the three control structure under review by the Panel, there are the greatest number of comments regarding the operation of and impacts from the Red River Floodway. Given the history of flooding in the Red River valley and the recent annual operation of the Floodway, this flood control structure is probably the best understood by the public, with strongly held and often divergent options expressed.

There are distinct differences in opinions and in participation at public events depending on the geographic location relative to the Floodway. Winnipeggers tend to have relatively low participation rates. There has been strong participation in public engagement events by residents upstream of the Floodway. For example, one consultation report stated “Flooding and artificial flooding remain an extraordinary important topic for the participants in the public consultation event. Detailed presentations and written submissions indicated not only the level of concern, but also the high state of understanding and knowledge of the participants.” Downstream of the Floodway outlet, there is also heightened concern and engagement.

As noted in the 2010 review of the Floodway operating rules: “In general, those residents north of the floodway have concerns about flooding due to ice jams and concerns about the regular loss of the Dunning Road Crossing. People resident south of the floodway have concerns about artificial flooding and the impact to property, lifestyle and peace of mind. Residents within the floodway’s protection are most concerned about high water levels that affect bank stability and the use and enjoyment of the Red River during the summer.”

Comments on Operating Rules

Specific consultation on operating rules has occurred previously. Comments typically do not differentiate among Rules 1, 2 and 3, which address operation of the Red River Floodway during spring flood events. However many comments focus on non-spring or summer operation and these are summarized separately.

Spring Operation

The definition of natural water levels in the rules and the basis for its measurement has been questioned by residents in the RM of Ritchot. Some residents and associations within the City of Winnipeg recommended that the floodway be operated as soon as possible in the spring and that the clause stating that the Floodway gates should not be operated until ice on the river is flowing freely should be removed from the operating rules.

One comment expressed concern that a change (now in place) to Rule 1 reducing the maximum water surface level at St. James to 24.5 from 25.5 ft. would be a detriment to the residents living in the forebay (or upstream) area. Reference was made in one report to technical presentations by The City of Winnipeg and others regarding the operating rules. In particular, The City of Winnipeg requested additional interpretation on how the province will operate the floodway under Rule 2 as it impacts the City's flood preparedness.

Most other public comment have tended not to suggest changes to these rules themselves, but have focussed more on the implementation or application of the rules and on impacts from operation and associated mitigation. Particularly among residents upstream of the Floodway control structure, there is a history of mistrust of the provincial government and specifically Manitoba Floodway Authority. Various commitments have been attributed to the authorities, with residents feeling that these have not been carried out, or that their concerns are not adequately taken into account.

Reservations have also been expressed about The Red River Floodway Act, and there appeared to be a lack of clarity about the status and its associated regulations. Residents felt that appeals to compensation decisions made under its provisions should be heard by a neutral third party. The operating rules were described as not being hard and fast, but fast and loose. The opinion is that whatever rules exist, they should

be enforceable and enforced. There were calls for increased participation by residents, including granting community organizations direct representation on anybody reviewing the Floodway operating rules. People also identified that there were gaps in the research that had been done on Floodway operation.

The amount of warning given to residents upstream of the Floodway and the speed with which water levels rise was a particular operational concern. Municipalities downstream of the Floodway outlet were critical of notification procedures. There was no requirement to notify municipalities north of the floodway that it has gone into operation. As the floodway typically goes into operation during the day, it is dark when the floodway waters reach the outlet in St. Clements, heightening the stress on residents. A suggestion was made to have the floodway go into operation around midnight. Conversely, the municipality upstream of the control structure requested that the gates be operated in the morning, when rising water would be visible and could be dealt with during daylight hours.

Summer Operation

Strong opposition to emergency summer operation (Rule 4) has been expressed by residents and municipalities upstream and downstream of the Floodway, particularly in the RM of Ritchot. Benefits are viewed as been attributable only to Winnipeg and that the need for Rule 4 has not been established. Residents felt summer operations had been imposed on them without consultation, assessment of its impact, or an appropriate compensation and mitigation plan being in place. A number of presenters requested that the non-spring emergency operations be banned; failing that, they requested a variety of forms of financial mitigation including buyouts and easements.

The City of Winnipeg and The Forks have stated their support for Rule 4 and for increased summer operation under non-emergency circumstances. The City "would be supportive if the Province would review their summertime operation to see if there is potential to operate the Floodway to keep the river walkways at the Forks open as long as possible." The Forks "are encouraging the Province to continue to look to ways of using the floodway for summer control levels to 7-feet James ...so Winnipeg's premier tourist destination can flourish."

Comments on Impacts

The type or relative importance of impacts associated with use of the Floodway tended to vary with geographic location and the stakeholders' experience with flooding. One submission indicated that flooding impacts had three components: water level, duration and timing (i.e. normal spring flood season or otherwise). The frequency of flooding (potentially year after year) with associated impacts and need for mitigative action influences the severity of the impacts. There is a greater challenge if non-spring operation and artificial flooding occurs in the same year as spring floodway operation.

There is also considerable debate about what are the "natural" effects of flooding vs. effects caused by operation (or not) of the floodway. The term "artificial flooding" is used in different ways in public comments: in some cases it means water levels that go above the natural level, while in other cases it is used as a more generic term for summer operation of the floodway.

Impacts or concerns identified during consultations did not always distinguish between those caused by Floodway operation linked to artificial flooding and impacts from natural flooding. Comments can be summarized into the following:

- Financial, physical and emotional toll experienced by those impacted by flooding, particularly artificial flooding. This is aggravated by the feeling that residents outside of the Floodway protection are stigmatized and viewed as whiners, when in fact, they have endured hardships. There is also the opinion that property and possessions had been flooded, not by acts of nature, but by acts of government policy.
- Dissatisfaction was expressed about compensation programs, including the process and amounts.
- Loss of use of Dunning Road during floodway operation, including potentially increased response times for emergency vehicles.
- Ice jamming was thought to be caused by operation of the floodway before ice on the river is flowing freely.
- Flooding of roads affects access to properties and business. Damages may occur which require extra repairs.
- Impacts on market gardens, especially from non-spring flooding. Also loss of use of personal gardens and property.
- Significant economic losses at The Forks due to high water levels: maintenance cost, lost tourism opportunities and damage to reputation.
- Riverbank erosion from non-spring operation: this included within Winnipeg if the Floodway is not operated; within the Floodway channel if it is operated. Non-spring emergency operations could erode dykes and riverbanks that are less susceptible to these problems in the spring when they are frozen. Associated impacts could be increased sediment loads and impacts on fish habitat.
- Death of riverbank trees and loss of vegetation, which will further weaken riverbanks.
- Negative impact of non-spring emergency operations on wildlife, which may have nests established and be more vulnerable.
- Increased mosquito breeding and concern about elevated West Nile disease levels.
- Inhibited drainage of farmland because of elevated river water backing up into the drainage system and causing increasing economic hardship to the farming community during the summer operations.
- Septic fields that are flooded in Ritchot cannot be used for an extended period of time after waters recede.

The need for additional studies to better understand the impacts and associated costs and benefits was identified. Several mitigation measures were discussed to address these impacts, including the need for education about how the Floodway is operated and implications.

Portage Diversion

Consultation regarding the Portage Diversion (PD) occurred during the following studies and associated reports:

- The Lake Manitoba Regulation Review Advisory report (2003);
- Lake Manitoba Lake St Martin Regulation Review Committee (2013);
- Manitoba 2011 Flood Review Task Force (2013); and
- Assiniboine and Lake Manitoba Basins Flood Mitigation Study (ongoing) .

Comments on Operating Guidelines

Recent consultation processes heard quite a few comments regarding the operation of the PD including the circumstances or rationale under which it is used. Many of those consulted by the 2011 Manitoba Flood Review Task Force felt that the PD is over used, and that it was intended to only be used in emergencies but instead is used to keep Lake Manitoba levels artificially high and/or as a first response to any potential flood water problems. Some people questioned the validity of the reasons given for operation of the Diversion in recent years, including in the months leading up to the 2011 flood. Questions were asked regarding why the Diversion was used to the extent that it was in 2010, raising the lake level of Lake Manitoba, rather than running the Assiniboine River to its full capacity, which some people believed was an option. Multiple comments linked the operation of the Portage Diversion to outflow via Fairford Control Structure or other potential outflow structures. A common comment was that inflow had to match outflow for Lake Manitoba.

Survey respondents suggested that the Diversion flows should be capped at a more manageable level if outflows from the lake are not increased.

Comments regarding the operation of the PD are usually in the context of appropriate Lake Manitoba water level. The Lake Manitoba Lake St Martin Regulation Review Committee specifically sought input on this topic. "Comments received from residents around Lake Manitoba were quite consistent in suggesting that Lake Manitoba has been kept too high over the past few years, but that "natural variability" is necessary for the health of the lake. Many also suggested that after the recent high water period levels need to be held in the lower part of the range, so that marshes and shoreline vegetation can be re-established and natural beach ridges can re-develop. The most common recommended top of range was 812.0 feet." Multiple reasons were given as to why the lake needs to be regulated at particular levels, related to the impacts of either too high or too low levels. One recommendation made to the Lake Manitoba and Lake St. Martin Regulation Review Committee was to provide a regulatory framework (i.e. a statute and regulatory board) to direct future generations on the transparent management of the lake.

Different stakeholder groups had more specific suggestions for operation. For example, ranchers suggested closing the Diversion earlier in the season to allow high water to recede in time for the hay harvest. Tourist operators, both at the Narrows expressed a desire for stable lake levels in a range where they could have good access to their docks for boating. Cottage owners had divergent views, often linked to where their cottage was located and whether they were consulted during a period of low water (early 2000's) or after the 2011 flood. Some participants concerned with ecosystem health suggested that the Diversion should only be operated when absolutely necessary and should be managed in such a way as to avoid spillover from the channel into Delta Marsh.

Comments on Impacts

As with the Red River Floodway, impacts and concerns identified during consultation did not necessarily distinguish between those associated with flooding generally and those related to the operation of the PD and associated lake levels. Comments included:

- Loss of and damage to homes from flooding
- Loss of and damage to recreational properties from flooding.
- Financial, physical and emotional toll experienced by those in the Lake Manitoba area during and after the 2011 flood.
- Decline in water quality, notably from higher sediment loads (leading to siltation) and increased levels of phosphorous.
- Siltation has reduced the capacity of the PD channel as well as affecting other areas of the lake.
- Large amounts of debris, including hazardous wastes, which accumulates in the marshes and on the beach. Note that some debris and waste comes from flooded cottages, but these are attributed to the use of the PD.
- Flooded wells and holding tanks. Municipal water supplies and sewage treatment facilities were also impacted.
- Impacts on Lake Manitoba fishery from high water levels and reduced water clarity.
- Damage to ranch land significant, including increased salinity levels, lack of access and lack of sufficient pasture.
- Alterations to the natural environment, most often cited and loss of marsh habitat due to reduction in natural fluctuations, with associated impacts on fish and wildlife.
- Recreational opportunities were impacted by too high water levels and too low water levels.

Fairford Control Structure

Comments from consultation regarding the Fairford River Water Control Structure (FCS) were found in:

- The Lake Manitoba Regulation Review Advisory report (2003);
- Lake Manitoba Lake St Martin Regulation Review Committee (2013); and
- Manitoba 2011 Flood Review Task Force (2013).

Comments on Operating Guidelines

Many comments were in relation to the use of FCS to manage Lake Manitoba levels. Fewer comments were received regarding the operation of FCS relative to Lake St. Martin water levels. Recent consultations occurred when both lake levels were particularly high, and there were calls from residents around Lake Manitoba to match outflows to inflows, particularly inflows from the Portage Diversion, and that the FCS should operate at full capacity. There was a concern by the Lake Manitoba Lake St Martin Regulation Review Committee that people commenting on the guidelines are not aware that the guidelines contemplate the lake rising above 812.5 ft. asl, and that the complete guidelines have not often been fully communicated to the public.

Quite a few comments indicated that consideration must be given to the impact on the people around the water bodies and communities downstream, including Lake St. Martin, and on managing outflow capacity from there to Lake Winnipeg. It was suggested that this has not previously been taken into account sufficiently.

There were comments or questions regarding the timing of the operation, primarily with the aim of maximizing output. Winter operation was advocated, or beginning operation early in the spring. Improved communication around the operational status during summer months was requested. There were divergent comments regarding the benefit of operating to achieve stable and consistent water levels of both lakes versus some fluctuation to mimic natural cycles.

Comments on Impacts

As with the other flood control infrastructure, impacts and concerns identified during consultation did not necessarily distinguish between those associated with flooding generally and those related to the operation of the FCS and associated lake levels. Impacts on Lake Manitoba and Lake St. Martin were identified and were often but not always consistent. Comments about the FCS frequently referenced use of the Portage Diversion. Impacts noted for Lake Manitoba included:

- Loss of and damage to homes from flooding.
- Loss of and damage to recreational properties from flooding.
- Financial and emotional hardship experienced during and after the 2011 flood.
- Decline in water quality and also of groundwater during flood periods. This has affected wells and drinking water, and also the use of septic tanks and fields.
- Impacts on wildlife along the shores of Lake Manitoba.
- Decline in health of the marshes, particularly Delta Marsh including loss of vegetation. This is attributed to the lack in level fluctuations.

- Loss of fishing revenue from reduced yields, equipment loss, lack of access to infrastructure and safety concerns due to debris during high water periods.
- Damage to ranch land significant, including increased salinity levels, lack of access and lack of sufficient pasture.
- Loss of tourism revenue when water levels too high or inconsistent.
- Alterations to the natural environment, most often cited and loss of marsh habitat due to reduction in natural fluctuations.
- Reduced access by roads and also loss of recreational opportunities during floods.

Impacts noted for Lake St. Martin included:

- Loss of and damage to homes from flooding.
- Financial and emotional hardship experienced during and after the 2011 flood, particularly for those evacuated to Winnipeg.
- Decline in water quality and also of groundwater during flood periods. This has affected wells and drinking water, and also the use of septic tanks and fields.
- Impacts on fall spawning and fish migration patterns.
- Loss of fishing revenue from reduced yields and equipment loss.
- Loss of tourism revenue when water levels too low or inconsistent.
- Creation of greater areas of swampland due to higher water levels.
- Reduced access by roads during floods.

WHAT WAS HEARD

Report on Public Consultation for the Provincial Flood Control Infrastructure Review of Operating Guidelines

Spring 2015

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1.0 Introduction

Open House - RM of St. Laurent

In the fall of 2013, the Provincial Flood Control Infrastructure Review of Operating Guidelines Panel was established by the Government of Manitoba. The Panel's mandate was to review the operating rules and guidelines of several of Manitoba's major flood control structures: the Red River Floodway, Portage Diversion and Fairford River Water Control Structure.

Public input was an important part of the Panel's review process. The Panel's review was intended to build on input received from Manitobans in previous public consultations, while offering opportunities for Manitobans to share input directly through a public engagement process held in late 2014 and early 2015. The Panel's commitment to direct dialogue with citizens, stakeholders, municipalities and First Nations affected by the operation of the control structures under review, ensured that the ideas, suggestions and feedback of Manitobans would be considered in the preparation of their final report along with technical data, analysis and the experience of Panel members.

This "What Was Heard" document has been prepared as a record of consultation undertaken, and to summarize and present the input received via open house and online comment forms, emails, letters and open house and stakeholder meeting notes.

A significant amount of information was received during public and stakeholder consultations, with diverse perspectives offered on the operation of flood control structures, potential rule changes, and the impacts of operation. The conversations, questions, comments and ideas shared through this process were invaluable to the Panel's work. The Panel appreciates the effort made by those who participated in the process, whether by attending meetings and open houses, or by emailing in submissions. The Provincial Flood Control Infrastructure Review Panel recognizes that Manitobans have been engaged in previous public events for panels, task forces, Environment Act licencing hearings and other studies. The ideas, comments and questions gathered as part of those processes were also reviewed and taken under consideration by the Panel in preparing its report.

2.0 Objectives and Approach

The objectives for this consultation process were to:

- Help increase public understanding about flood control structures under review, how they are operated together as a system, and the rules of operation for each.
- Hear from and meet with Manitobans affected by the operation of the Red River Floodway, Portage Diversion and Fairford River Water Control Structure.
- Gather feedback and ideas on the operating rules and key issues for each structure under review.

The Panel wished to provide Manitobans with multiple opportunities to provide input and participate in an open, responsive process and sought out input from stakeholders on the design of consultations. This feedback, which was reflected in the final design of the consultation process, included:

- Bring what has been said previously by Manitobans in consultations with past panels, task forces, Environment Act licencing hearings and other studies into the process.
- Ensure the number and location of public consultations adequately addresses the large geographic scope covered by the operation of the Red River Floodway, Portage Diversion and Fairford River Water Control Structure.
- Provide multiple opportunities to participate, both in-person and online.
- Provide an opportunity for question-and-answer with Panel members at public events so that everyone can hear and receive the same information.

The consultation process was designed to include a variety of engagement activities and methods to achieve the objectives set out for the consultation process, reflect the feedback received, and ensure opportunities to participate were as accessible as possible for Manitobans. Key aspects of this approach included:

Summary of "What You Told Us Previously": In advance of the process, the consultation team prepared a summary of past consultation results regarding the structures identified in the Panel's Terms of Reference. The document presents commentary regarding operating rules or guidelines, as well as impacts associated with the operation of the flood control structures. The document was available in hard copy at consultation events, and electronically on the Panel's website. The information was also incorporated into the presentation boards prepared for consultation events.

Open House - City of Selkirk

In-person meetings: The panel met with officials from flood-affected communities to discuss related issues specific to each geographic region, possible rule changes, and to seek advice in advance of the open houses.

Open houses with Q&A: Six drop-in style open houses were held in Ashern, Portage la Prairie, Selkirk, St. Adolphe, St Laurent and Winnipeg. At each open house (held from 4:00p.m. – 7:30p.m.) attendees could review information, meet with panel members and participate in question-and-answer sessions. Information on operating rules, historical information, proposed rule changes and information on issues related to operation of

each structure under review was presented at the open houses (the same information was available at all open houses). Participants were encouraged to complete comment forms. They could also post their ideas for rule changes directly onto presentation boards using large post-it notes.

Open House -City of Winnipeg

Online engagement:
The Panel's website, www.floodinfrastructurereview.ca, provided information about the Panel's terms of reference, related reviews and reports, and opportunities for public input. For those unable to attend the open houses in-person, open house materials were available on the website, along with an online comment form.

3.0 Summary of Activities and Participation

Manitobans were encouraged to participate in the public consultation process in a variety of ways:

- **Individually addressed introductory letters** were sent by email, fax and/or regular mail to 33 affected municipalities and First Nations.
- **A press release** was issued to media outlets across the province at the launch of the consultation period announcing the website and open houses.
- **Public services announcements** were submitted to radio and television stations prior to public consultation events.
- **Newspaper ads** were placed in the Winnipeg Free Press (2 ads), Interlake Spectator, CP Herald Leader, Selkirk Journal, Selkirk Record, Steinbach Carillon to announce open houses and the Panel website.
- **Online calendars and bulletin boards** were used to post open house information where possible.
- **Email notices, posters and signage** were used to supplement promotion of public open houses, depending on the location and with input from local officials.

Meetings

Between November 2014 and February 2015 the Panel met with officials from 22 municipalities and First Nations. The objective of the meetings was primarily to listen to and learn from local officials.

City of Portage la Prairie
City of Winnipeg
RM of Alonsa
RM of Coldwell
RM of Macdonald
RM of Ritchot
RM of St. Andrews
RM of St. François Xavier
RM of Tache
RM of Westlake-Gladstone
RM of Woodlands
City of Selkirk
Dakota Tipi First Nation
RM of Cartier
RM of Headingley
RM of Portage la Prairie
RM of Springfield
RM of St. Clements
RM of St. Laurent
RM of West Interlake
RM of West St. Paul
Sandy Bay First Nation

Open Houses

More than 360 people participated in six open houses held in January 2015. In several cases local media also attended, reporting on the open houses and opportunities for public input.

Date	Location
January 13, 2015	Selkirk – Gaynor Family Regional Library
January 14, 2015	Portage la Prairie – PCU Centre
January 15, 2015	St. Laurent – Rec Centre
January 19, 2015	St. Adolphe – Community Centre
January 20, 2015	Winnipeg – CanadInns Polo Park
January 21, 2015	Ashern – Centennial Hall

Submissions and Comments Received

In total, the Panel received 236 sets of comments and/or questions for consideration through the consultation process. Comments and input from the public was received in several ways: completed comment forms and post-it notes at open house events; feedback provided and recorded during question-and-answer sessions and in one-on-one conversation with Panel members at open houses and meetings; and emailed, written or online submissions. Comments received are summarized in sections 4.0 to 8.0 of this report.

4.0 What We Heard: General Themes

The degree of awareness about both the technical and societal benefits and impacts of operating the flood control structures under consideration is very high amongst Manitobans most affected. With respect to the operations of all the three Flood Control Structures, many commenters cited the need to apply the rules and guidelines consistently and that better communication about decision-making with those affected by flood infrastructure operations is needed. And while there was not consensus around water level targets/rule changes most comments could be characterized as stating that all water levels "need to be lower".

Open House - City of Portage la Prairie

Overall there is an understanding that there is no easy or quick solution to the impact from recent flood events, nor for future vulnerabilities. Compared to prior input from flood affected communities, many residents, both at open houses and via written submissions, made it very clear that they have had enough, that the uncertainty and unrelenting flooding is too much. *"The cycle needs to be broken at some point."* It was proposed more than once that the Province should buy-out vulnerable properties and be done with it. Some commenters were explicit in stating "Flood us=Pay us". Others suggested the needed for a cost-benefit analysis or economic impact study for the operating impacts of all flood control infrastructure, particularly on the agriculture industry and commercial fishing. It was suggested that for proposed new structures, i.e. Lake Manitoba outlet, the cost of flooding on Manitobans should be quantified in order to better inform decision making about infrastructure operation, investment and flood compensation.

An overall evolution was observed in the tone of comments received and conversations at open house events during these consultations as compared to those in previous processes over the past several years. While anger or frustration is still present, it is less raw and to some extent has been supplanted by resignation to flooding and a desire for resolution and solutions. There is a great desire for action.

Other over-arching themes and issues:

- **Systems approach:** All three flood structures should be operated as a whole system. As one commenter put it, *"there is ...a need for a comprehensive water management strategy in Manitoba. This should include, but not be limited to: constructing a second outlet on Lake Manitoba in order to better regulate lake levels; better management of water throughout the Assiniboine River Basin, including the Shellmouth area; judicious use of the Portage Diversion, and, addressing concerns around flooding around the Shoal Lakes and other areas facing similar challenges."*

- **Paying the price for Winnipeg:** Many residents up and downstream believe they are paying the price for Winnipeggers comfort, and that access to the Riverwalk at the Forks and negation of basement flooding are not reasons to operate the Portage Diversion and/or the Red River Floodway.
- **The health of Lake Manitoba is paramount:** Water quality is a growing concern as a result of flood effects on Lake Manitoba and beyond. As one commenter put it, *"there is no vision for Lake Manitoba."*
- **Natural vs artificial distinction is irrelevant:** Many commenters expressed frustration with the term "natural" level, describing it as a false term, or suggesting a lacking of consistent definition. As one commenter put it, *"there are no natural levels as a result of agricultural land development with today's technology. Laser leveling and GPS leveling has provided farmers with the technology to drain farm land at a rate well beyond natural flows. Controlled spring run off may be our only long terms solution to "UN"natural flooding."*
- **Lasting effects on land:** High water tables mean that land is wet longer which has an enduring negative impact for farming and ranching.
- **Frustration, lack of trust of government:** Frustration with response from Provincial government and lack of assistance (and visibility) from federal government. Many asked about the impact of Manitoba Hydro on lake levels.

5.0 What We Heard: Red River Floodway

5.1 Comments on operation and potential rule changes

There are currently four rules that guide the operation of the Red River Floodway. Changes and additions to these rules under consideration by the Panel were presented for feedback through the consultation process.

In keeping with the pattern identified in past consultations, there are distinct differences in opinions and participation levels contingent on geographic location to the floodway. For example, in communities located outside of Winnipeg there is near unanimous opposition to the proposed addition of Rule 5 – summer operation to keep the Riverwalk open – whereas those consulted at the Winnipeg open-house event were mostly in support or neutral. Where there is consensus, however, is with regards to notification when the Red River Floodway goes into operation – residents up and downstream would like more notice in order to better prepare. It was noted that the 24-hour notice before operation is not always followed.

Potential rule change: Discretion to operate before ice is flowing freely

Of the potential changes, many expressed great concern at the possibility of the Floodway being put into operation 'before ice is flowing freely' and the safety hazards this might impose. As one resident from the RM of Ritchot stated, *"I have first hand experienced the power of ice moving in flood waters outside of riverbanks. Hydro and utility poles do not stand a chance nor do trees or any other obstacles. Losing power during a flood would be catastrophic."* Many commenters cited losing power and property damage, including to the riverbanks, as a primary concern should the Floodway operate before ice is flowing freely and were therefore opposed to this rule change.

Potential rule change: Delete Rule 4 – emergency summer operation

By and large, most commenters from outside of the City of Winnipeg (both upstream and downstream) are supportive of the deletion of Rule 4 –emergency summer operation. Emergency summer operation of the Floodway is seen as contributing to overland flooding and the constant saturation of parcels of land making it impossible to seed crops, graze livestock etc. as well as requiring overuse of the Portage Diversion.

Potential rule change: Add Rule 5 – summer operation to keep walkway open

The proposed addition of a Rule 5 – to operate the Floodway in order to keep the Riverwalk at the Forks open - was met with a negative response by and large from commenters outside of Winnipeg. The idea that the Floodway would be used to maintain the Riverwalk at the expense of landowners and residents outside of Winnipeg and around Lake Manitoba was not palatable. One commenter from the Portage La Prairie open house stated, *"I feel like a second-class citizen – we have to save Winnipeg and the walkway. I am 87 years old and lived on this farm all my life."* Some wondered if another solution could not be found, i.e. raising the Riverwalk.

Potential rule change: Formalize practice of using target level of 0.5 feet below "natural" upstream

Changes to permit operation of the Floodway using a target level of 0.5 feet below 'natural' upstream had many commenters suggesting that there is no consistent definition of 'natural'. While many supported the idea of the 0.5 feet target, 'natural' levels were viewed as debatable and changes based on "natural" seen as arbitrary.

Potential rule change: Permit operation above "natural" during initial operation to a maximum river level of 760 feet at the floodway entrance

The proposed rule change to permit operation of the Floodway during initial operation to maximum river level of 760 feet. was cited as too high by many. Many commenters felt this increase would create a premature flood upstream that residents would not have enough time to prepare for. This increase could also increase riverbank erosion, damage riparian growth and wildlife breeding grounds. In contrast, the City of Winnipeg supported the rule change as the increase above natural would provide considerable benefit to the City.

5.2 Comments on impacts

Comments and concerns shared at the open houses, in meetings, and via written submissions not only focused on the proposed rule changes, but also on impacts. In many instances commenters did not always distinguish between those impacts caused by Floodway operation or those impacts resulting from natural flooding. Comments can be summarized into the following:

- People are tired. The emotional, physical and financial toll experienced by those impacted by flooding is real and on-going.
- Buyouts. Some residents up and downstream just want to be bought out and move on as they see no end in sight.
- Unpredictability of flooding. Many cited the fact that they 'never know' when more water is coming and that this instability is extremely difficult to manage.
- Frustration, dissatisfaction with compensation. Dissatisfaction was expressed concerning compensation programs, criteria and the amount of time it takes to process claims.

- Too much water to drain. As one commenter put it, *"There is too much water. I now watch places that flood now that did not in the past, I attribute this to disappearing wetlands, increased drainage and urban sprawl."*
- Consultation fatigue. One commenter suggested that more money has been spent on studies and consultations that lowering water levels.
- Negative impact of summer operation. Impacts noted for riverbanks, land, riparian trees, wildlife, residents and business owners.
- Loss of use of Dunning Road during operation. Residents expressed concern about the lack of access for emergency vehicles as a result.

5.3 Other ideas and suggestions

Through the consultation process members of the public were asked for their ideas and suggestions for changes to operating rules or guidelines for the Red River Floodway. The following summarizes suggestions put forward in response:

- Raising the Riverwalk at the Forks
- Allow for flooding of designated low lands, but compensate for lost income
- Dredge the mouth of the Red
- Restrict building on riverbanks edge, create buffer zone
- Buy out property that is vulnerable
- Only operate Floodway to keep downtown (James Ave.) below 24 feet.
- Retain water in wetlands or in drainage ditches so that it arrives at the Red River more slowly
- Use Floodway even when there is ice

6.0 What We Heard: Portage Diversion

6.1 Comments on operation and potential rule changes

Similar to previous consultation processes, many comments regarding the operation of the Portage Diversion questioned why the structure is used so often, suggesting that the result is that Lake Manitoba levels are artificially high. Several commenters suggested that operating rules and guidelines are not consistently applied. Others noted the long-term consequences of running the Diversion so frequently and at high volumes are poorly understood and that the Diversion should only be operated in a manner that will maximize the ability of the land flooded by the diversion to return to its pre-flood state.

Few responded to each of the potential rule changes set out for consideration, however many commenters were clear that if the Portage Diversion must be used, it must only be after levels on the Assiniboine are high. The use of the Diversion to save Winnipeg residents from basement flooding was viewed by some as not fair: *"We keep getting flooded to save BASEMENTS. Our livelihood is at risk."* Moreover, the potential use of the Diversion in the summer months to keep the Winnipeg Riverwalk open was viewed with significant frustration and anger. As put by one attendee at the open house in St. Laurent *"I am insulted to have to comment on the summer running of the Diversion for the walkway. We need help now!"*

It was suggested that the Diversion should never be allowed to run past late spring, while the ground is still frozen except in emergency situations, as this minimizes seepage and salinity from the diversion. One of the most frequent comments made concerned the need to balance flow of water in and out of the Diversion, as more than one respondent put it "cup of water in, cup of water out."

6.2 Comments on impacts

The majority of comments received focused on impacts of the use of the Diversion, or on specific issues presented by the Panel for consideration and response.

Of the issues presented, many commenters expressed concern for the impact of water flowing from the Portage Diversion to Lake Manitoba, the quality of water flowing into Lake Manitoba and the overall capacity of the Portage Diversion. Residents from Portage La Prairie cited the Diversion as directly contributing to excessively high levels on Lake Manitoba, and that the quality of the water flowing from the Diversion is damaging to lake tourism, beaches and fish. Some commenters noted that jackfish are taking over Lake Manitoba and therefore perch levels are decreasing which is challenging for commercial fisherman. Some commenters noted the increased pressure on Diversion results in higher water tables and seepage through dikes.

Many suggested the need to get an outlet built at Lake Manitoba to minimize water levels everywhere and that in the meantime, equal flow of water in and water out should be the rule of thumb: *"Lake Manitoba levels are too high for my ranch to sustain itself. There is too much water coming in Portage Diversion and not enough going out of Lake Manitoba."*

6.3 Other ideas and suggestions

Through the consultation process members of the public were asked for their ideas and suggestions for changes to operating rules or guidelines for the Portage Diversion. The following were put forward in response:

- Buy affected homeowners out
- Slow down flow of Assiniboine (into diversion) so that it will not flood downstream

Open House - RM of Ritchot

7.0 Fairford River Water Control Structure (FRWCS)

7.1 Comments on operation and potential rule changes

Operational changes were recommended in the 2013 report of the Lake Manitoba and Lake St. Martin regulation review committee. These have since been implemented by the province and as such further rule changes for the operation of the Fairford River Water Control Structure are not being proposed by the Panel. Instead, the Panel asked for any suggested new rule changes, consideration of issues and comments.

Many commenters cited the need to 'build the outlet' on Lake Manitoba and that the outflow from Lake St. Martin to Lake Winnipeg should be considered. As well, more than one commenter suggested that the control structure must be operated throughout winter in order to allow for draw down of Lake Manitoba.

7.2 Comments on impacts

Comments about the impacts of the operation of FRWCS often cited the pollution coming from the Portage Diversion as contributing to the same negative impacts noted for Lake Manitoba, especially with respect to a decline in water quality and groundwater which affects wells, drinking water and creates damage on ranch lands due to lack of sufficient pasture. Many comments indicated that it may take years to totally drain the land due to the higher water tables.

Several commenters noted that, as a result of increased water coming from the Diversion to Lake Manitoba and Lake St. Martin, there continues to be loss of homes and recreational properties, economic opportunities, wildlife habitat and safety concerns along the shores.

7.3 Other ideas and suggestions

Through the consultation process members of the public were asked for their ideas and suggestions for changes to operating rules or guidelines for the Fairford River Water Control Structure. The following were put forward in response:

- FRWCS requires more capacity as soon as possible.
- FRWCS requires dredging to allow for proper flows into Lake St. Martin.
- *"Focus the money – don't spread it around a little here and little there. Spend it all in one place and really make a difference. Double or triple the outlet capacity from Lake Manitoba."*

8.0 What We Heard: Beyond the scope of this review

Several issues were identified, and suggestions made that fall beyond the scope of the Panel's review. Key issues and themes heard during consultations are noted below.

- The Floodway Compensation Act may need to be modified.
- Drainage is a huge issue, because there is so much standing water.
- There was a troubling dead fish incident at Sandy Bay in 2012.
- The operation of the Shellmouth Dam has significant impact on what occurs along the Assiniboine River.
- Consideration should be given to *Tomorrow Now: Manitoba's Green Plan* that speaks to enhancing the capacity for flood protection with upgrades to structures such as the Red River Floodway.
- The perceived delay in constructing the second outlet from Lake Manitoba is considered unacceptable. Specific suggestions included:
  - Increase flow from Lake St. Martin to Lake Winnipeg and decrease water in Lake Manitoba and lower Assiniboine.
  - Recognize emergency status, allowing early build of outflow rather than 2020.
  - Build a second outlet at Lake St. Martin.
- Until Saskatchewan to the west and the U.S. to the south are part of the solution, Manitoba will continue to get more water than is manageable. As one commenter put it, *"Why bother worrying about operating rules and guidelines if none of these structures have enough capacity to handle flow coming from the west!"* Specific suggestions included:
  - Meet with Saskatchewan officials for consistent and appropriate water management and drainage/contamination issues.