

**Analysis of Options for Emergency Reduction of  
Lake Manitoba and Lake St. Martin Levels  
Report from KGS Group and AECOM  
July 2011**



# OPTIONS FOR EMERGENCY REDUCTION OF LAKE MANITOBA AND LAKE ST. MARTIN LEVELS

## REPORT FROM KGS GROUP AND AECOM

**NOTE** – all lake level forecasts in this report are based on Manitoba Water Stewardship's July 21, 2011 forecast and assume average weather conditions. With favourable or unfavourable weather conditions throughout the late summer, fall and winter of 2011 and early 2012 the estimates could range lower or higher.

### BACKGROUND

Lake Manitoba's main inflows come from the Whitemud River, Waterhen River (including Lake Winnipegosis and Dauphin Lake) and the Portage Diversion. Outflows from Lake Manitoba travel downstream through the Fairford River to Lake Pineimuta and Lake St. Martin, then through the Dauphin River to Lake Winnipeg.

Since 1961, Lake Manitoba levels have been regulated through use of the Fairford River Water Control Structure (FRWCS). Typical flood flows are approximately 6,000 cubic feet per second (cfs) down the Fairford River and are normally restricted to approximately 3,500 cfs in the winter to prevent flooding on Lake St. Martin as a result of frazil ice formation on Dauphin River. Up to 2011, this regulatory system has been generally effective in managing Lake Manitoba levels within a prescribed range, which currently has an upper limit of 812.5 feet above sea level. Downstream of Lake Manitoba on Lake St. Martin, regulation has not been able to mitigate ongoing high water levels and frequent flooding issues. The Portage Diversion has mitigated flooding on the lower Assiniboine River and the City of Winnipeg since 1970.

In 2011, widespread record flooding has been seen across much of southern Manitoba, resulting in unprecedented high inflows into Lake Manitoba through the Waterhen River, Whitemud River, Portage Diversion and from saturated groundwater storage. These prolonged high flows overwhelmed the capacity of the existing regulatory system. As a result, Lake Manitoba is predicted to crest this summer at 817.3 to 817.5 feet, approximately five feet higher than the upper end of the desirable regulatory range.

Flooding on Lake Manitoba has already caused significant damage to hundreds of properties around the lake, particularly during a storm in late May when winds reached over 100 km/h, wind set-up raised the lake up to 5 feet, and waves as high as 7 feet were reported in some places. Preliminary analysis indicates that the cumulative impact of high water from all systems flowing into Lake Manitoba combined with the major wind storm in May approaches the range of a 1 in 2000 year event on the lake. To put this in context, the typical flood protection standard is to a 1 in 100 year event. As a result of the high Lake Manitoba levels, the flow through the FRWCS has been over 20,000 cfs since mid-June, and has been above 10,000 cfs for over 3 months.

On Lake St. Martin, the summer peak is expected at approximately 806 feet, almost 3 feet higher than the historic peak of 1955 and well above the desirable operating range of 798 to 800 feet. This year's flooding on Lake St. Martin has prompted the need for emergency construction of dikes up to 8 feet high (elevation 809 feet). Road access has been severely limited to several communities and widespread long-term evacuation from the four First Nations around the lake and the Dauphin River has been required.

If no action is taken, extremely high water levels on Lake Manitoba and Lake St. Martin are expected to continue for an extended duration, leaving communities, homes, cottages and farms at high risk of further damage from flooding, wind and waves. The spring break-up of lake ice at such elevated water levels also has the potential to cause devastating damage to properties around the lakes. At that time, spring runoff will cause another rise in water levels and further extend the duration of flooding.

Currently there are approximately 2000 people evacuated from communities on the shores of Lake St. Martin and Lake Manitoba. The long term evacuations of these people will potentially be drawn out until summer 2012 or later if no action is taken.

## **OVERVIEW OF OBJECTIVES:**

The Province of Manitoba commissioned KGS and AECOM to urgently 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 sought 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.

To meet the complex challenges associated with this project, KGS and AECOM assembled a team of around 30 senior engineers and technical specialists, including hydraulic and geotechnical experts. In cooperation with the Departments of Infrastructure and Transportation and Water Stewardship, significant resources have been devoted to assessing the viability of several different emergency channels and other options that would lower the levels on the lakes as quickly as possible.

This review has concluded that:

- Lake Manitoba and Lake St. Martin are part of a single watershed that drains through the Dauphin River into Lake Winnipeg. To lower levels on the lakes, it is necessary to first address the hydraulic restriction on the Dauphin River.
- Action must be taken to reduce the level of Lake St. Martin in order to
  - protect communities around Lake St. Martin from the ongoing risk of flood and wave damage; and
  - allow for the reduction of Lake Manitoba's water level to protect communities around that lake from a similar ongoing risk.
- Emergency construction of a channel is the preferred option to reduce the level of Lake St. Martin. This project, however, presents significant timing and constructability challenges due to extremely wet and isolated conditions, as well as remote construction access.

- Enabling maximum flows through the FRWCS through the winter is the lowest cost, most immediate and technically feasible way to reduce the level on Lake Manitoba on an emergency basis as compared to building any new emergency channels.

## RECOMMENDATIONS

KGS and AECOM reviewed potential options to achieve the objective of lowering water levels on Lake Manitoba and Lake St. Martin as quickly as possible. This review involved investigations including site visits, topographic analysis, seismic bedrock investigation, aerial photography, LIDAR surveying, geotechnical investigation and surveys, which are still ongoing. Based on this review, KGS and AECOM recommend the following course of action to the Province of Manitoba:

- Begin immediate work on construction of an additional emergency channel from Lake St. Martin towards Lake Winnipeg to address the hydraulic flow restrictions out of Lake St. Martin and to accommodate additional Lake Manitoba outflows over the winter; and
- Allow unrestricted maximum outflow of water from Lake Manitoba through the FRWCS throughout the winter of 2011/2012, allowing for several times more outflow than past typical winter flows.

**TABLE 1**  
**RECOMMENDED OPTIONS**

PROJECT DESCRIPTION	CONSTRUCTION COST	COMMENTS
Construct Lake St. Martin emergency channel*	\$100M	<ul style="list-style-type: none"> <li>- Investigation and design of final route is ongoing</li> <li>- Substantial constructability challenges for fall completion</li> <li>- Potential need for additional flood protection on the lower Dauphin River</li> </ul>
Maximize Fairford River Water Control Structure flows	No construction cost	<ul style="list-style-type: none"> <li>- Provides for effective and timely draw down of Lake Manitoba levels</li> <li>- Some rehabilitation work will be required after flows return to normal</li> </ul>

\* Represented as Route L on Figure 1

Any further action to expand Lake Manitoba outflows should only proceed subject to the successful implementation of the above recommendations. At that point, KGS and AECOM also recommend that the Province of Manitoba consider:

- Constructing a bypass channel around the north side of the FRWCS to allow additional outflow from Lake Manitoba; and
- Expanding the emergency channel from Lake St. Martin to offset the additional inflows from Lake Manitoba on the principle of no net addition to Lake St. Martin.

**TABLE 2**  
**CONDITIONALLY RECOMMENDED OPTIONS**

PROJECT DESCRIPTION	CONSTRUCTION COST	COMMENTS
Fairford Control Structure Bypass Channel* in conjunction with Lake St. Martin emergency channel expansion	\$60M	<ul style="list-style-type: none"> <li>- Bypass channel capacity would be limited by the Fairford River capacity downstream</li> <li>- Bypass construction site would be on private land</li> <li>- Site investigation and design work still required</li> </ul>

\* Represented as Lake Manitoba Emergency Channel E on Figure 1

## DESCRIPTION OF PROJECTS

The Lake St. Martin emergency channel will consist of a channel from Lake St. Martin to Big Buffalo Lake as shown on Figure 1 as Route L. Routes M and N were also investigated and evaluated but ruled out due to wetter ground conditions. The precise route of the recommended emergency channel is being refined with further field investigations. It is expected to be approximately 5 miles long, 300 feet wide and up to 25 feet deep. From Big Buffalo Lake, the water will follow natural channels to Buffalo Creek which discharges into Dauphin River and then into Lake Winnipeg.

The proposed emergency channel would allow flow from Lake St. Martin at a design capacity of 5,000 cfs at a lake level elevation of 801 feet above sea level. If the emergency channel can be completed before freeze-up it is expected to initially flow at approximately 9,000 cfs. Emergency channel flows would then vary depending on the level of the lake and the effects of the development of ice cover on the channels.

This project will amount to one of the largest and most challenging engineering projects ever undertaken in Manitoba on an emergency basis. Ideally, the emergency channel from Lake St. Martin would be completed prior to 2011 freeze-up to gain maximum benefit before ice cover reduces the channel capacity from Lake St. Martin on the Dauphin River. However, ongoing investigation of the potential channel site has identified serious challenges with construction in the area due to the remoteness of the location and encroaching flood waters. Immediate mobilization of contractors, construction equipment and support resources is required. Design will proceed as contractors mobilize in order to compress project timelines as much as possible.

The project will involve excavating 2.0 to 2.5 million cubic meters of earth from a bog-like area which is largely covered in water. The construction plans involve diking and draining the area to improve working conditions, but specialized construction techniques and equipment will still need to be used. Preliminary estimates indicate that at least 50 pieces of heavy equipment and over 150 construction and support staff will be required to complete the project in the limited timeframe available. The workers would be supported by camps built in the construction area and 3 to 4 barges to mobilize equipment and provide fuel and supplies. Several helicopter pads built to assist in early exploratory work of the emergency channel site will allow for access to points throughout the channel's path.

KGS and AECOM continue to work with Manitoba Infrastructure and Transportation and contractors to rapidly assess ways to overcome these challenges. It is recommended that every effort be made to achieve fall completion of the emergency channel. Manitoba Water Stewardship has estimated that completing the emergency channel and keeping Fairford flows at maximum all winter would bring the chance of Lake Manitoba staying below 814 feet in 2012 up to 90%, and Lake St. Martin's chance of staying below 802 feet to 98% in the summer of 2012. Even if fall completion proves logistically impossible, both Lake Manitoba and Lake St. Martin would still greatly benefit from completion of the emergency channel as soon as possible.

If aggressive efforts to construct the emergency channel before freeze-up prove successful, consideration of an emergency bypass channel is recommended around the north side of the FRWCS to achieve further reduction in Lake Manitoba's water levels as soon as possible in 2012. The proposed bypass channel would convey 2,500 cfs at a lake level elevation of 814 feet above sea level. Flows would vary depending on the level of the lake. The bypass channel would be approximately 1.5 miles long, 40 feet wide and up to 20 feet deep. It will include a temporary bridge for the PTH 6 crossing.

The Fairford bypass channel would result in a relatively modest additional decrease in Lake Manitoba's water levels (up to 6 inches, depending on the date it becomes operational) compared to the significant benefit provided by the primary recommendation of maximizing outflows from the FRWCS. However, the additional benefit would help to mitigate against a potential unfavourable weather scenario which would see Lake Manitoba above flood stage in 2012 even with the construction of the Lake St. Martin emergency channel. Manitoba Water Stewardship has estimated that even if a Fairford bypass channel were operational as late as April 1, 2012, it would increase the chance of Lake Manitoba staying below 814 feet in the spring of 2012 to 98.7%. Construction of this scenario could also be achieved at a relatively low cost compared to the other Lake Manitoba emergency channel options examined.

As noted, construction of the Fairford Control Structure Bypass would require expansion of the proposed Lake St. Martin emergency channel capacity to ensure Lake St. Martin's benefit remained the same. It is critical that the feasibility of rapidly constructing the Lake St. Martin emergency channel be confirmed before moving forward with the bypass project.



**TABLE 3**  
**PROJECTED LAKE MANITOBA AND LAKE ST. MARTIN LEVELS**

	LAKE MANITOBA	LAKE ST. MARTIN	COMMENTS
<b>Expected Summer Crest</b>	817.3 - 817.5	805.9 – 806.1	- crests will likely be slightly lower than the range presented due to significant evaporation - levels are early November estimates
<b>Pre freeze-up level</b>	815.2	804.5	
<b>Normal winter operation with restricted Fairford flows and no emergency channel</b>			
Peak winter levels	815.8 (late-March)	802.4 (not peak, constant all winter)	- Lake Manitoba levels would rise over the winter and remain well above flood stage in spring - not viable due to disbenefit to Lake Manitoba
Spring open water level prior to spring runoff	815.7 (mid-April)	803.7 (mid-April)	
<b>Unrestricted Fairford flows (Fairford fully open) all winter and no emergency channel</b>			
Peak winter levels	813.9 (late-January) – not peak as levels drop all winter	809.3 (late-January)	- Lake St. Martin levels would rise significantly over the winter due to ice effects and remain well above flood stage in spring - not viable due to disbenefit to Lake St. Martin
Spring open water level prior to spring runoff	813.1 (mid-April)	805.2 (mid-April)	
<b>Recommended Option: Lake St. Martin emergency channel (assuming operation by freeze-up) and maximum unrestricted Fairford flows</b>			
Peak winter levels	813.9 (late-January) – not peak as levels drop all winter	806.7 (mid-January)	- benefit of 2 to 3 feet seen for both Lake Manitoba and Lake St. Martin compared to other scenarios
Spring open water level prior to spring runoff	813.1 (mid-April)	802.8 (mid-April)	
<b>Conditionally Recommended Option: Fairford Control Structure bypass and expanded Lake St. Martin emergency channel (assuming both in operation by April)</b>			
Spring open water level prior to spring runoff	When completed it is expected there would no negative impact on LSM levels and up to a 6" reduction on LMB levels		- bypass construction completion date is dependent on initial emergency channel construction timelines

Note:

- all figures are in feet above sea level
- all lake levels are estimates based on Manitoba Water Stewardship's July 21, 2011 forecast and assume average weather conditions
- with unfavourable weather during this period levels could be higher
- dates are approximations
- lake levels are based on preliminary emergency channel design

As both the Assiniboine River and Lake Manitoba flow, indirectly, into Lake Winnipeg, construction of the Lake St. Martin emergency channel will result in negligible impact on the level of Lake Winnipeg. Manitoba Hydro estimates that, at most, the emergency channel running at full capacity will contribute less than one inch. Assessment of the potential environmental impacts of the project will continue to be investigated as the project proceeds. These will focus on biophysical and socioeconomic impacts including fish and fish habitat, water quality, species of concern, land use and heritage resources. Appropriate measures to mitigate potential effects will also be determined to effectively eliminate or reduce residual adverse effects.

## **ASSESSMENT OF OPTIONS CONSIDERED**

In arriving at the recommended option, several alternatives were reviewed to ensure the most timely, and cost-effective option with the highest likelihood of success was found.



**TABLE 4**  
**ASSESSMENT OF OPTIONS – OTHER OPTIONS**

PROJECT DESCRIPTION	CONCEPTUAL CONSTRUCTION ESTIMATES	COMMENTS
Lake Manitoba Channel A ** and Lake St. Martin emergency channel Twinning the Fairford River	\$240M	<ul style="list-style-type: none"> <li>- Not recommended due to impacts to Pinaymootang First Nation Reserve lands</li> <li>- High water levels would delay construction start date significantly and eliminate any chance of relief by spring</li> <li>- Limited benefit would be seen for Lake Manitoba by spring for a high cost</li> </ul>
Lake Manitoba Channel B or C** and Lake St. Martin emergency channel Channel south of Pinaymootang First Nation directly to Lake St. Martin or an alternate route slightly south	\$340M	<ul style="list-style-type: none"> <li>- Significant bedrock excavation needed which has the strong potential to increase costs dramatically</li> <li>- Limited benefit would be seen for Lake Manitoba by spring for a high cost</li> </ul>
Lake Manitoba Channel D** and Lake St. Martin emergency channel Birch Creek	\$330M	<ul style="list-style-type: none"> <li>- Route long and runs mostly through private land which could add significantly to the costs</li> <li>- Limited benefit would be seen for Lake Manitoba by spring for a high cost</li> </ul>
Holland Dam Dam on Assiniboine River thirty miles southwest of Portage La Prairie	\$230M	<ul style="list-style-type: none"> <li>- Ineffective at reducing Lake Manitoba or Lake St. Martin levels on an emergency basis</li> <li>- Could not be built within required timeframe</li> </ul>

**TABLE 4**  
**ASSESSMENT OF OPTIONS – OTHER OPTIONS**  
**(CONTINUED)**

PROJECT DESCRIPTION	CONCEPTUAL CONSTRUCTION ESTIMATES	COMMENTS
Long Lake Drain** Channel from Lake Manitoba to Assiniboine River via Long Lake	\$195M	<ul style="list-style-type: none"> <li>- Only fully operational when Assiniboine River is at 13,000 cfs or less</li> <li>- Significant private land acquisition required for 22 mile channel which could add significantly to costs</li> <li>- Limited benefit would be seen for Lake Manitoba by spring for a high cost</li> </ul>
La Salle River Diversion Channel from Assiniboine River to La Salle River	\$315M	<ul style="list-style-type: none"> <li>- Inadequate at reducing Lake Manitoba or Lake St. Martin levels in 2011/12</li> <li>- Large environmental impact</li> <li>- Would add volume to the Red River within the City of Winnipeg downstream of the Floodway inlet</li> </ul>
Assiniboine River Channel Capacity Increase Expand Capacity of Assiniboine River east of Portage La Prairie	\$480M	<ul style="list-style-type: none"> <li>- Ineffective at reducing Lake Manitoba levels in 2011/12</li> <li>- Large environmental impact</li> </ul>
Take No Action Allow lake levels to decline over time with existing channels	N/A	<ul style="list-style-type: none"> <li>- Potential damages and economic losses on Lake Manitoba and Lake St. Martin could total hundreds of millions of dollars</li> </ul>

\*\*Note –Lake Manitoba channel options are for a 5,000 cfs channel. Lake Manitoba channels larger than 10,000 cfs were considered but proved to be cost-prohibitive and could not feasibly be constructed within the required timelines.

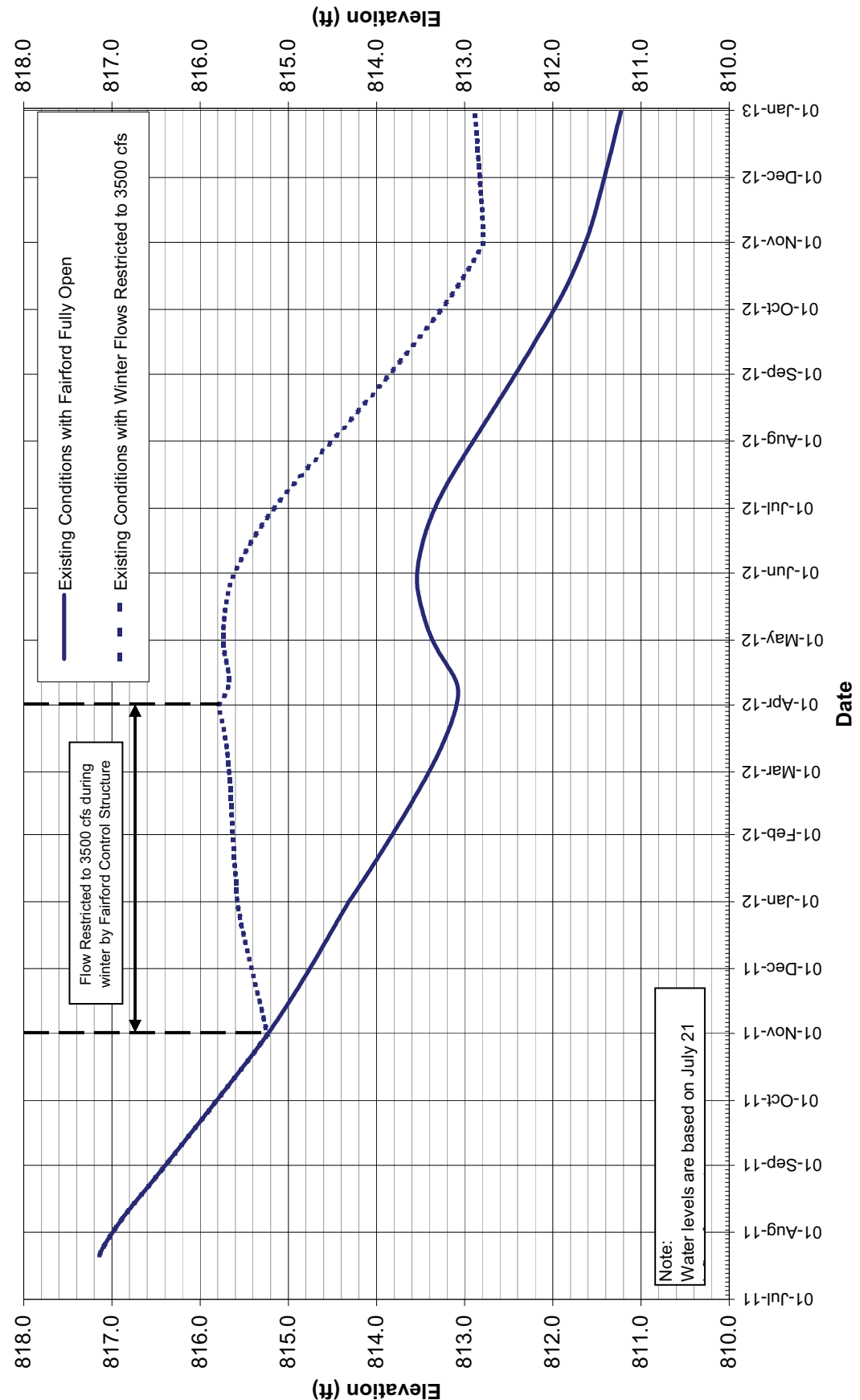
## SUMMARY

- Of all options reviewed, constructing the Lake St. Martin emergency channel and maximizing FRWCS flows provides for the most timely and cost-effective means of lowering Lake Manitoba water levels.
- It is the preferred option that will allow for the concurrent lowering of both lakes in the very limited time frame available and not solely benefit Lake Manitoba while contributing to flooding downstream on Lake St. Martin.
- If in operation from fall 2011 to spring 2012, both lakes could be 2 to 3 feet lower than they would be by spring in scenarios without the emergency channel.
- Manitoba Water Stewardship has estimated that building the emergency channel and keeping Fairford at maximum all winter would bring the chance of Lake Manitoba staying below 814 feet in 2012 up to 90%, and Lake St. Martin's chance of staying below 802 feet to 98% in the summer of 2012.
- Manitoba Hydro estimates that, at most, the emergency channel running at full capacity will contribute less than one inch to the level of Lake Winnipeg.

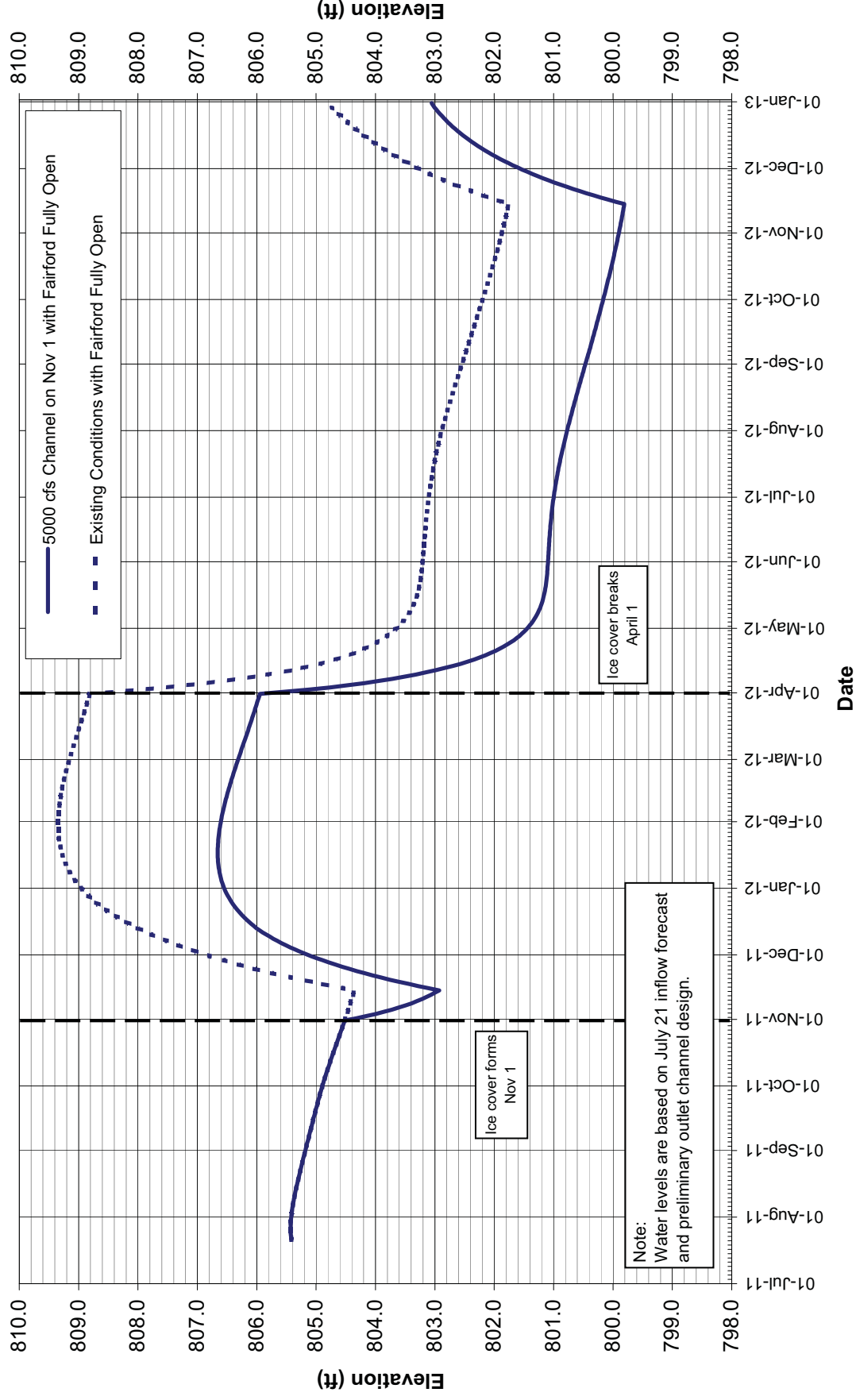
## APPENDICES

- Chart 1 - Computed Lake Manitoba Level - Favourable Construction Conditions – Fairford Fully Open
- Chart 2 - Computed Lake St. Martin Level - Favourable Construction Conditions
- Figure 1 - Alternate Proposed Channel Routes
- Photo 1 - Lake St. Martin Emergency Channel Route L

# Computed Lake Manitoba Level Favorable Construction Conditions - Fairford Fully Open



# Computed Lake St. Martin Level Favorable Construction Conditions





**PRELIMINARY**  
NOT TO BE USED FOR CONSTRUCTION

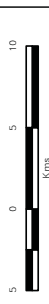
**LEGEND:**

- Fairford River Channel Option A
- Fairford River Channel Option B
- Fairford River Channel Option C
- Birch Creek Channel Option D
- Fairford Bypass Option E
- Lake St. Martin Channel Option L (Optional Route)
- Lake St. Martin Channel Option M (Optional Route)
- Lake St. Martin Channel Option N (Optional Route)
- Dauphin River Centraline
- Road Paved 2 or more lanes
- Paved Street or Road
- Gravel Road
- Unimproved Road
- Accessway or Backlane
- Trail
- Railway
- Ditch
- River/Stream, Indefinite
- River/Stream
- Dugout, Pond
- Lake
- Marsh
- First Nation
- Compelle

**NOTES:**

- Selection and actual alignment of routes to be determined.

**DRAFT**



SCALE: 1:300,000 METRIC 11"X17"

All units are metric and in metres unless otherwise specified.  
North arrow pointing towards True North (TN) and Magnetic North (MN).  
Transverse Mercator Projection, NAD 1983, UTM Zone 14

NO.	DATE	REVISIONS / ISSUE
1	11/07/25	RE-ISSUED FOR INFORMATION
2	11/07/25	RE-ISSUED FOR INFORMATION
3	11/07/25	RE-ISSUED FOR INFORMATION
4	11/07/25	RE-ISSUED FOR INFORMATION
5	11/07/25	RE-ISSUED FOR INFORMATION
6	11/07/25	RE-ISSUED FOR INFORMATION
7	11/07/25	RE-ISSUED FOR INFORMATION
8	11/07/25	RE-ISSUED FOR INFORMATION
9	11/07/25	RE-ISSUED FOR INFORMATION
10	11/07/25	RE-ISSUED FOR INFORMATION

LAKE MANITOBA AND  
LAKE ST. MARTIN EMERGENCY  
CHANNELS  
ALTERNATE PROPOSED CHANNEL  
ROUTES

NO.	DATE	REVISIONS / ISSUE
1	11-0300-18-F01	C





Photo 1 - Lake St. Martin Emergency Channel Route L



# Channel Improvement and Auxiliary Outlet from Lake Manitoba



# Optional Outlet Routes Lake St. Martin

