

WELCOME

Impact of Artificial Flooding Related to the Operation of the Red River Floodway

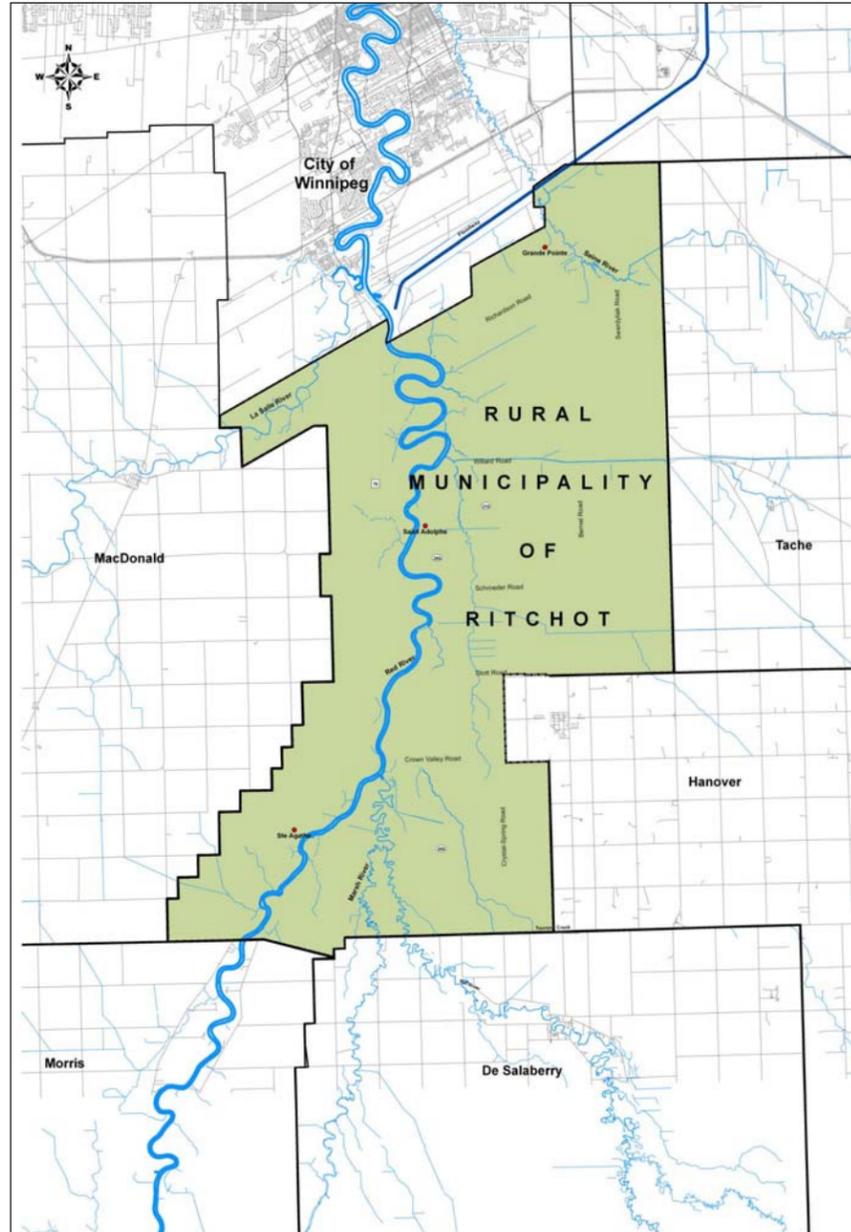
Public Information Session

- **Today's schedule:**
 - 4:00 – 8:00 pm – Open House
 - 4:30 – 6:00 pm – Presentations from the Public
 - 6:30 – 7:00 pm – MMM Group Limited Presentation
 - 7:00 – 8:00 pm – Question Period & Wrap-up
- **Objective of today's public information session:**
 - Present work completed by MMM to-date
 - Present forecast artificial flood levels based on the expanded floodway
 - Present forecast artificial flood levels based on possible mitigation measures and a 1-in-225 year flood
 - Present the estimated artificial flood damages
 - Obtain feedback from the public, including on possible mitigation measures
- **How can you contribute?**
 - Provide input to one of the study team or Steering Committee members here today
 - Complete and return a comment sheet today
 - Complete and return a comment sheet by October 24th to MMM

RM OF RITCHOT ARTIFICIAL FLOODING STUDY

STUDY OBJECTIVES AND SCOPE

STUDY AREA MAP



STUDY OBJECTIVE

MMM is working with Manitoba Floodway Authority (MFA), Government of Canada and the R.M. of Ritchot to better understand the consequences of Floodway operation in the R.M. of Ritchot, particularly as it relates to artificial flooding. The Terms of Reference for the study have outlined a general scope of work consisting of several work tasks designed to synthesize the existing information and develop a macro-scale tool to categorize the flooding in the R.M. of Ritchot. MMM will assess flood mitigation using sustainable tools such as economic total Life Cycle Cost Analysis (LCCA) and environmental Life Cycle Assessment (LCA).

One of the most important work elements for this project is the public participation component.

STUDY SCOPE

- Develop a system to categorize the nature (extent, depth and frequency) of natural and artificial flooding at a macro level.
- Identify the areas of the R.M. of Ritchot that are subject to these categories.
- Review mitigation measures available and associated costs (+/- 30%).
- Participate in public information sessions to explain the study and receive feedback on the proposed mitigation measures.
- Develop present value costs based on life-cycle analysis.
- Undertake a benefit/cost analysis and a risk analysis.
- Rate the options for mitigation measures for effectiveness, practicality and cost.
- Develop a matrix to evaluate mitigation options for the different categories/areas.

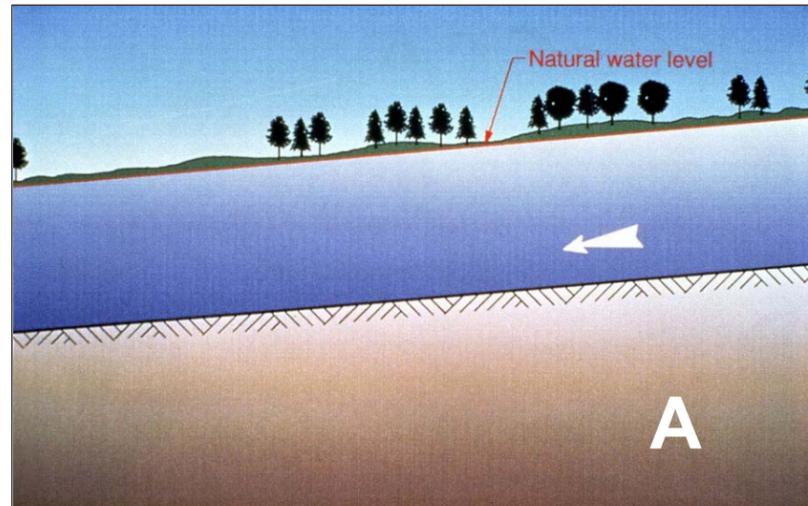
INTRODUCTION

- “Artificial flooding” defined as increase in flood level caused by flood protection works (primarily the Red River Floodway) when compared to “natural” conditions.
- Board #4 illustrates Floodway Operating Rules, which may lead to artificial flooding. Only under extreme emergency conditions is Floodway operation permitted and allowed to exceed “state of nature” water levels upstream of Floodway.
- Natural flood levels are defined as pre-flood protection condition just prior to the 1950 flood and were calculated in Acres (2004) study.
- All analysis is based upon Expanded Floodway in place. It will operate in accordance with current Floodway Operating Rules.
- Preliminary review of information indicates:
 - In the 1997 flood, approximately 0.6 m of artificial flooding occurred upstream of floodway inlet control structure;
 - With Expanded Floodway, no artificial flooding would have occurred in the 1997 flood. It will occur for a 1-in-120 year flood and larger;
 - With expanded floodway, up to 1.7 m of artificial flooding would occur for a 1-in-700 year flood (Board #10);
 - Board #9 shows the 1-in-700 year flood depths relative to the 1997 flood levels. Ritchot would experience up to 2.0 m more water compared to 1997 because the 1-in-700 year flood would be much larger; and
 - Extensive communal and individual flood protection works have been implemented since 1997 (Board #5).

RM OF RITCHOT ARTIFICIAL FLOODING STUDY FLOODWAY OPERATION RULES

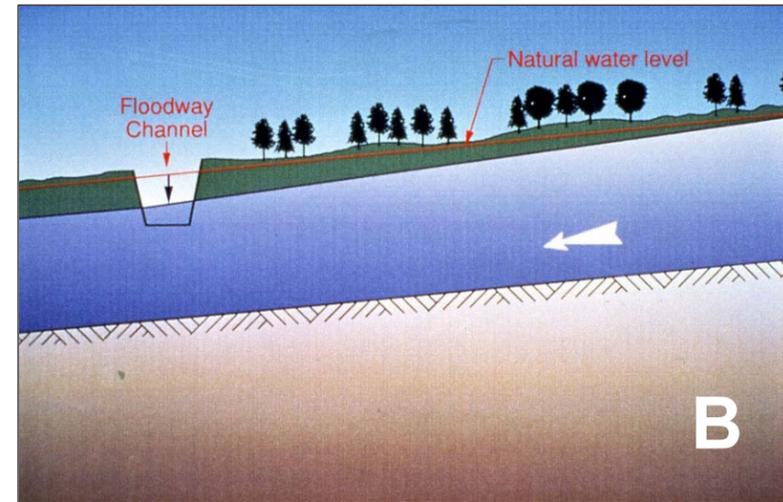
#4

SPRING OPERATION (PRE-FLOODWAY)



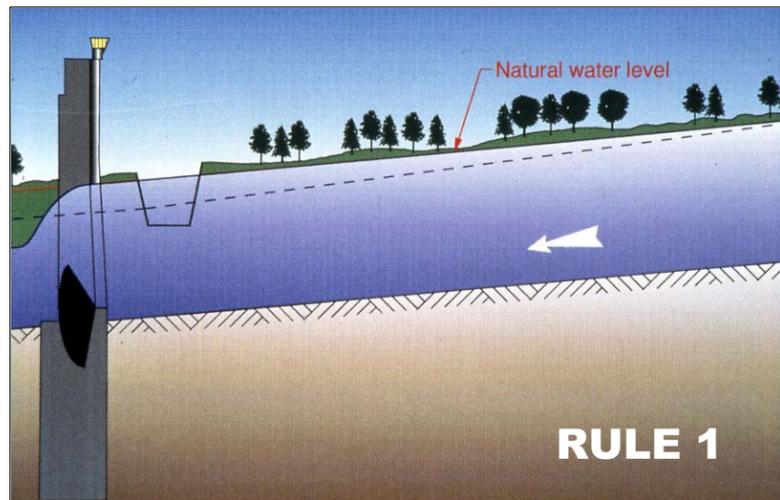
A. Before the Floodway, all the Red River water flowed through Winnipeg. The peak “natural” level of that situation with a flood flow of approximately 1,700 cubic metres per second (m³/s) (60,000 cubic feet per second) is shown in red.

SPRING OPERATION (POST-FLOODWAY)

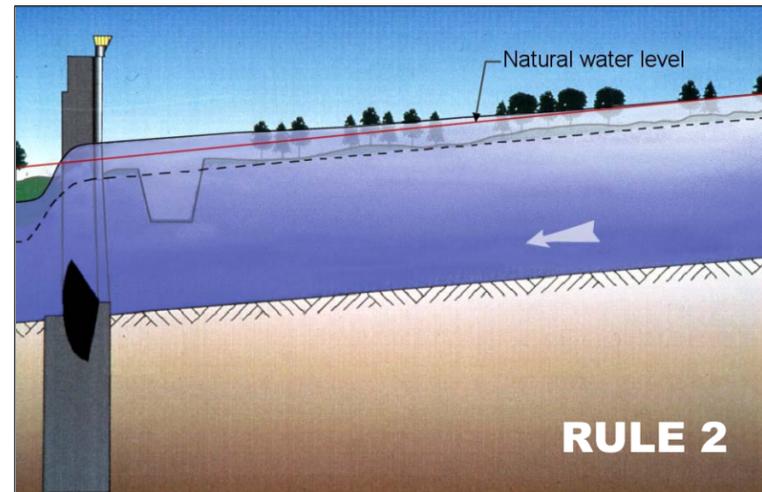


B. With the Floodway, a portion of the Red River water is routed around Winnipeg, resulting in a lowering of the water level from the “natural” water level.

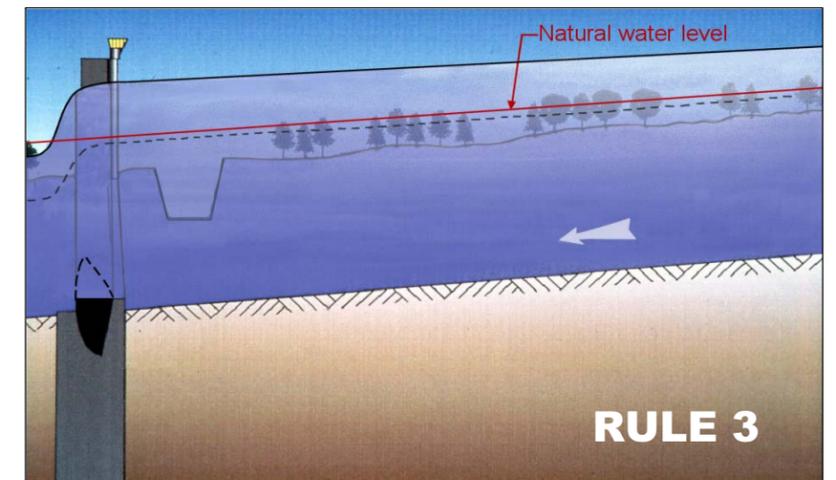
SPRING OPERATING RULES



The gates are raised from the bottom of the Red River channel thereby restoring the water level back to “natural” upstream of the Control Structure. This further reduces the water level downstream through Winnipeg to Lockport.



For major floods, “natural” upstream cannot be maintained without exceeding Winnipeg Primary Dykes. Water levels are therefore artificially raised above “natural” upstream, such as in the 1997 Flood when the peak water level was 235.15 metres (771.5 ft)



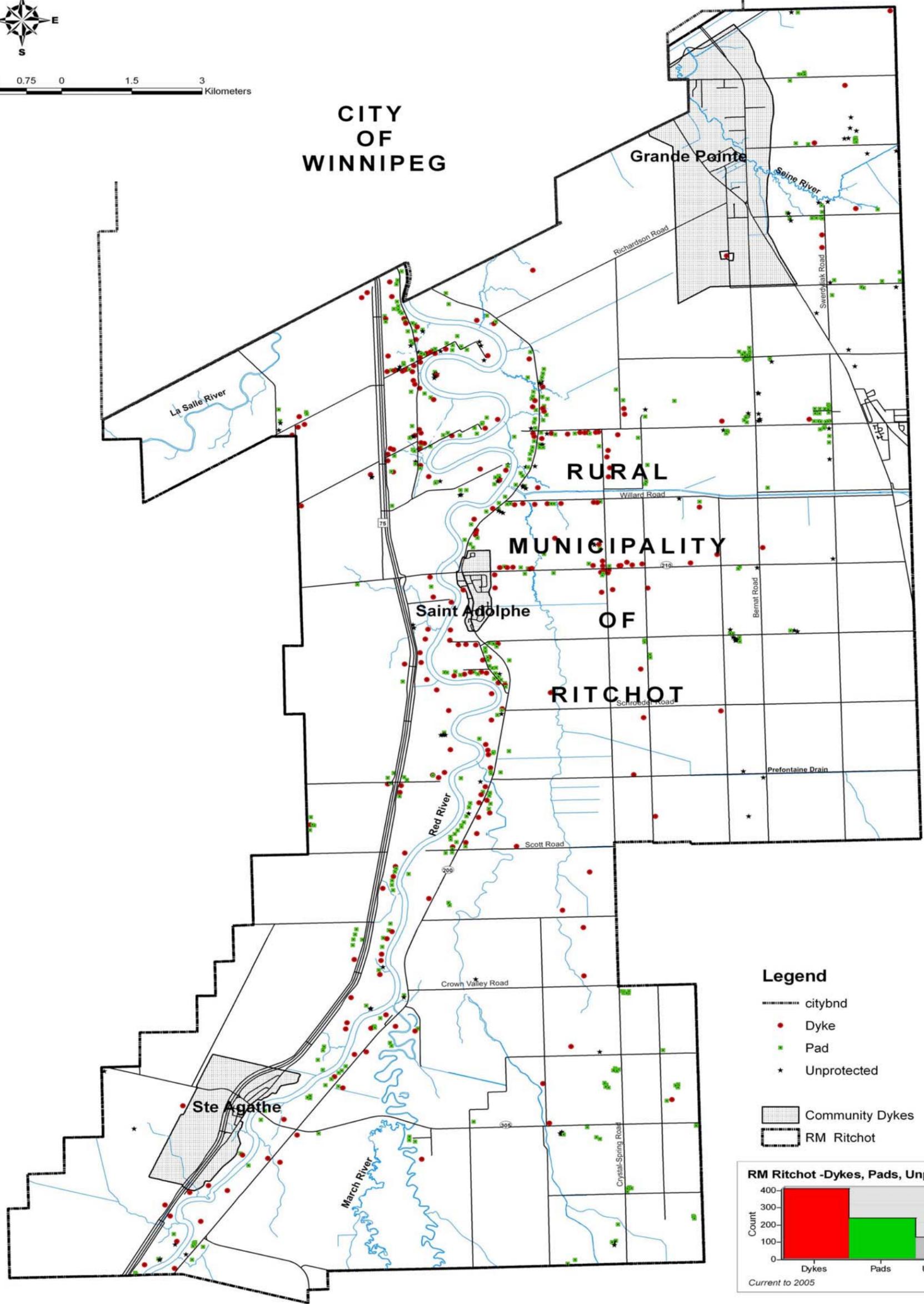
For extreme floods, river level at Floodway Inlet must not exceed 237.13 metres (778 ft) above sea level – additional water routed through Winnipeg. This would occur with a flood greater than 1-in-700 years with the Expanded Floodway.

NON-SPRING EMERGENCY OPERATION (RULE 4) (REFER TO BOARDS #20 & #21)



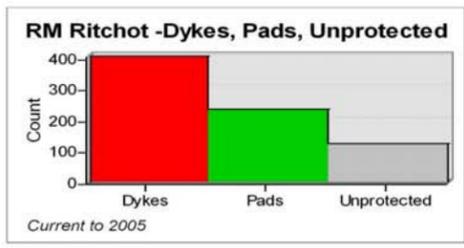
RM OF RITCHOT ARTIFICIAL FLOODING STUDY

FLOOD PROTECTION STATUS (FPS) - EXISTING DYKES AND PADS



Legend

- citybnd
- Dyke
- Pad
- ★ Unprotected
- ▨ Community Dykes
- ⊞ RM Ritchot



Data Source: Manitoba Conservation (Updated 2005)



RM OF RITCHOT ARTIFICIAL FLOODING STUDY PHOTOGRAPHS



Floodway Inlet Control Structure and Red River Floodway



The Floodway Inlet Control Structure



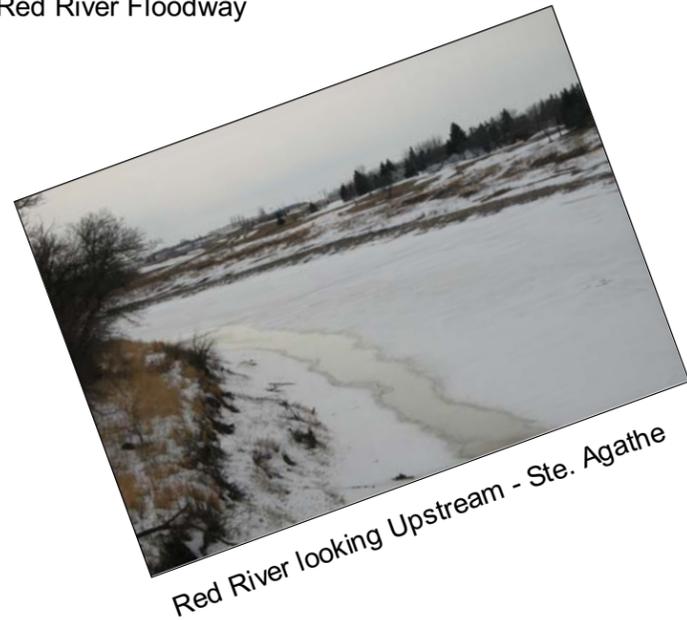
Upstream of Floodway Inlet Control Structure with Red River Floodway in background



Floodway Inlet Control Structure observed from entrance Floodway channel



Signage at first bridge crossing of Floodway channel



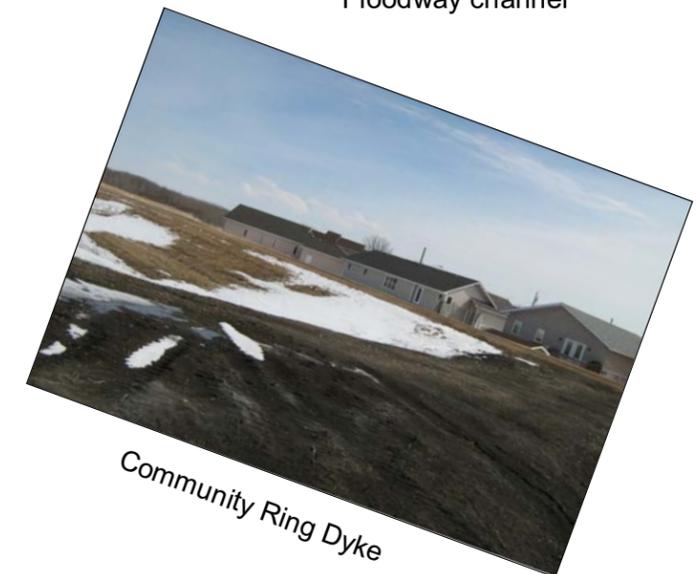
Red River looking Upstream - Ste. Agathe



The Red River looking downstream - Ste. Agathe



St. Adolphe, one of three Ring Dyke Communities in the RM of Ritchot



Community Ring Dyke



Single house enclosed by dyke



Multiple houses enclosed by dyke



Utility elevated by pad

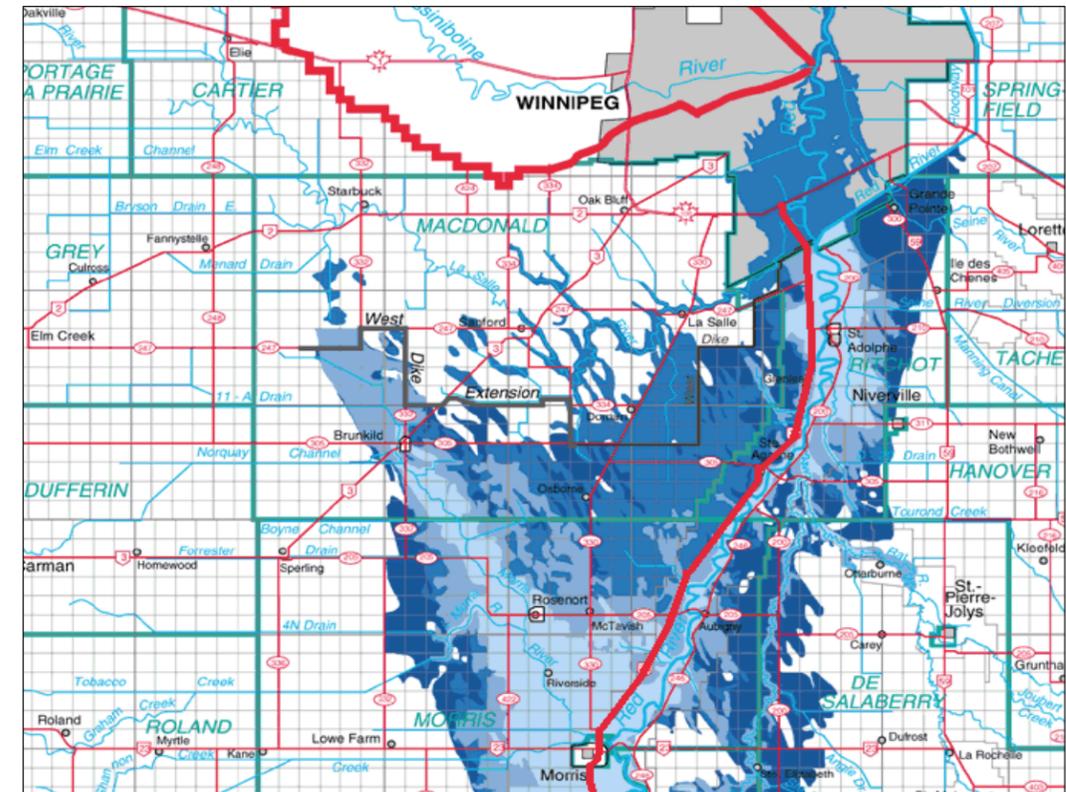
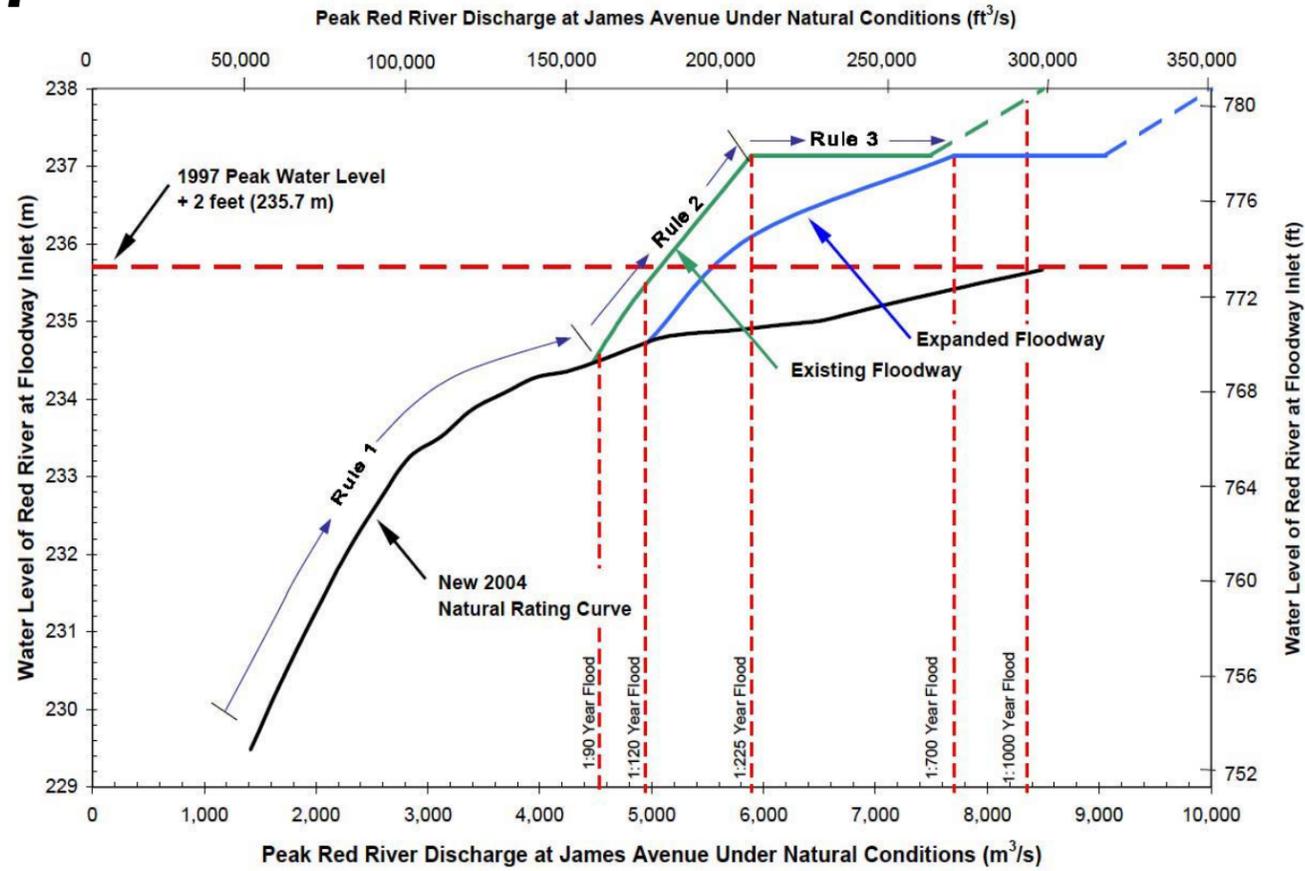


Single house on pad

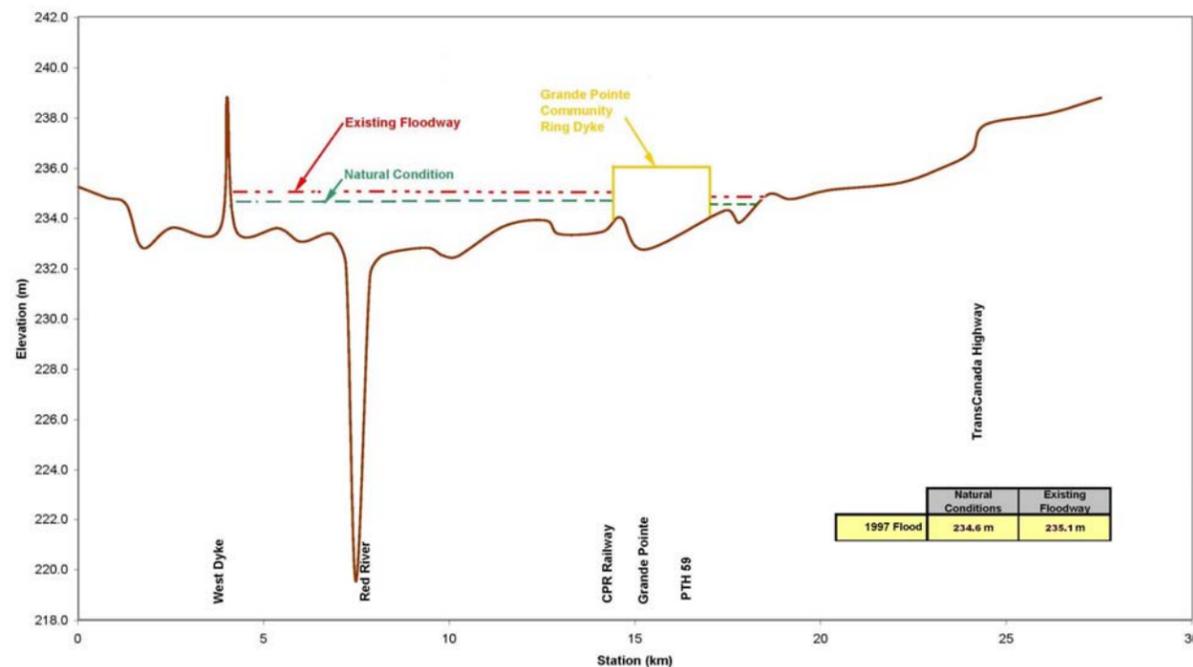


Structural dyke construction

RM OF RITCHOT ARTIFICIAL FLOODING STUDY 1997 FLOODING EXTENT AND FLOODWAY INLET RATING CURVE

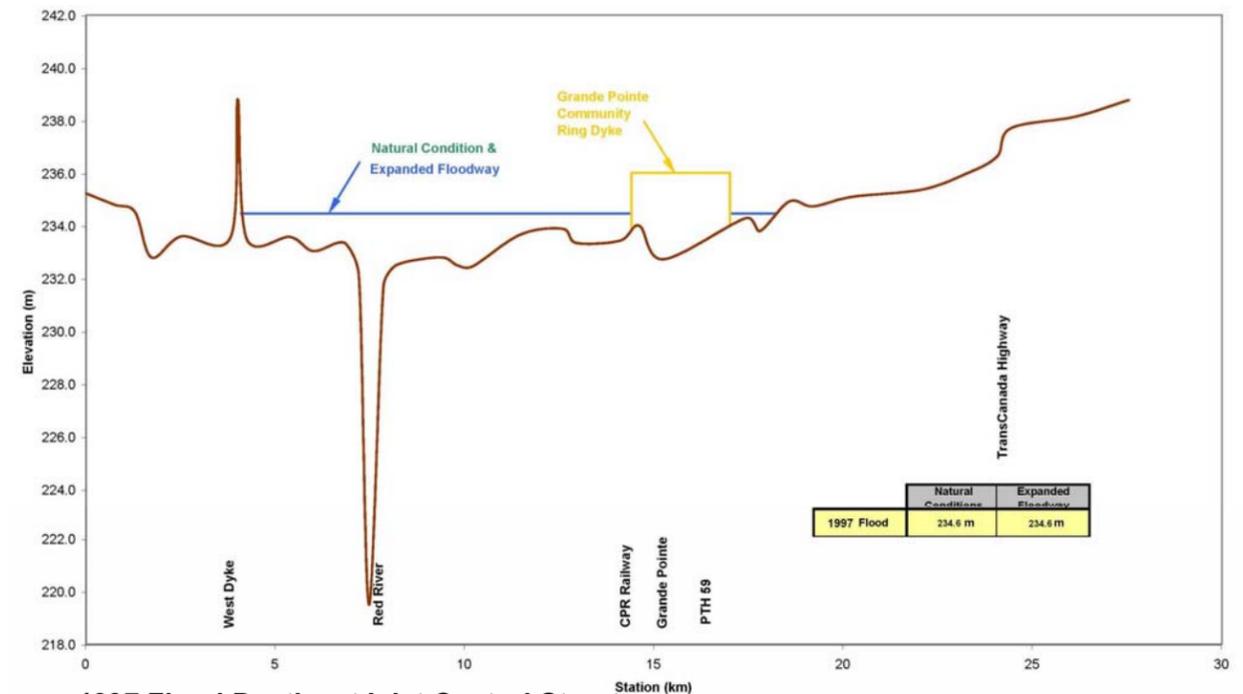


1997 Flooding Extent



1997 Flood Depths at Inlet Control Structure
- Existing Floodway

Cross Section #1
1997 Flood Event



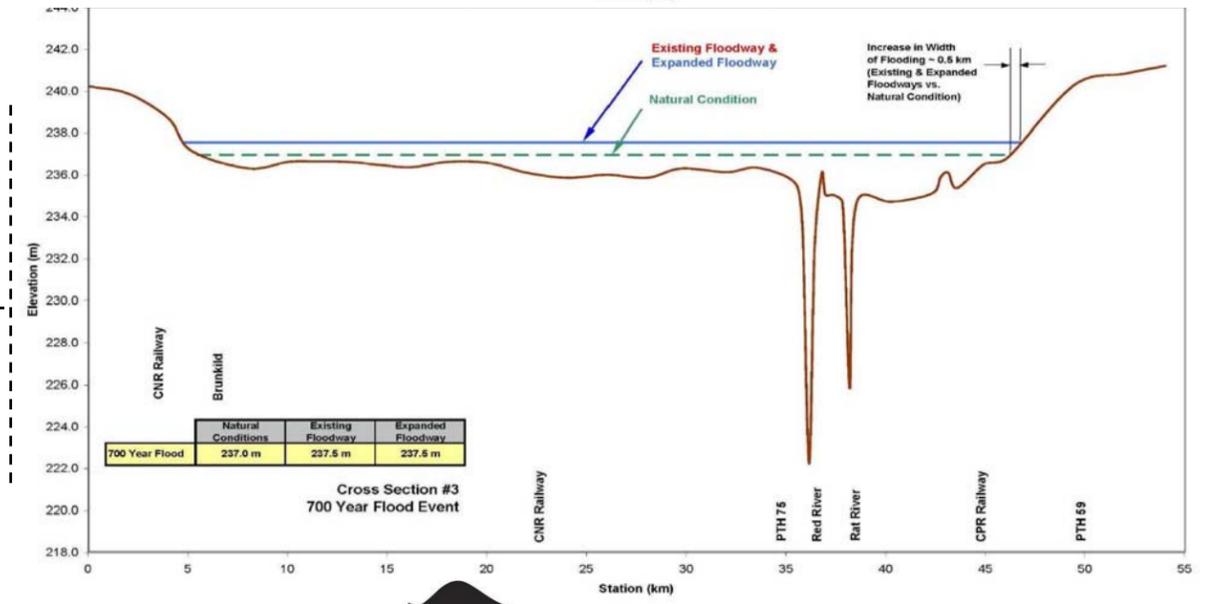
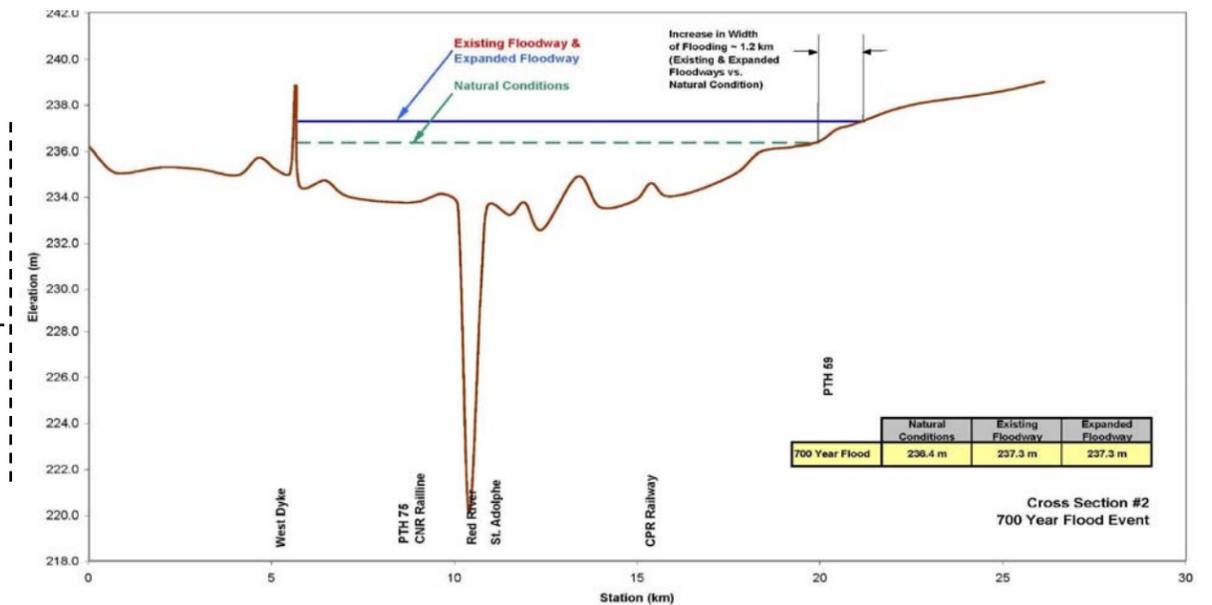
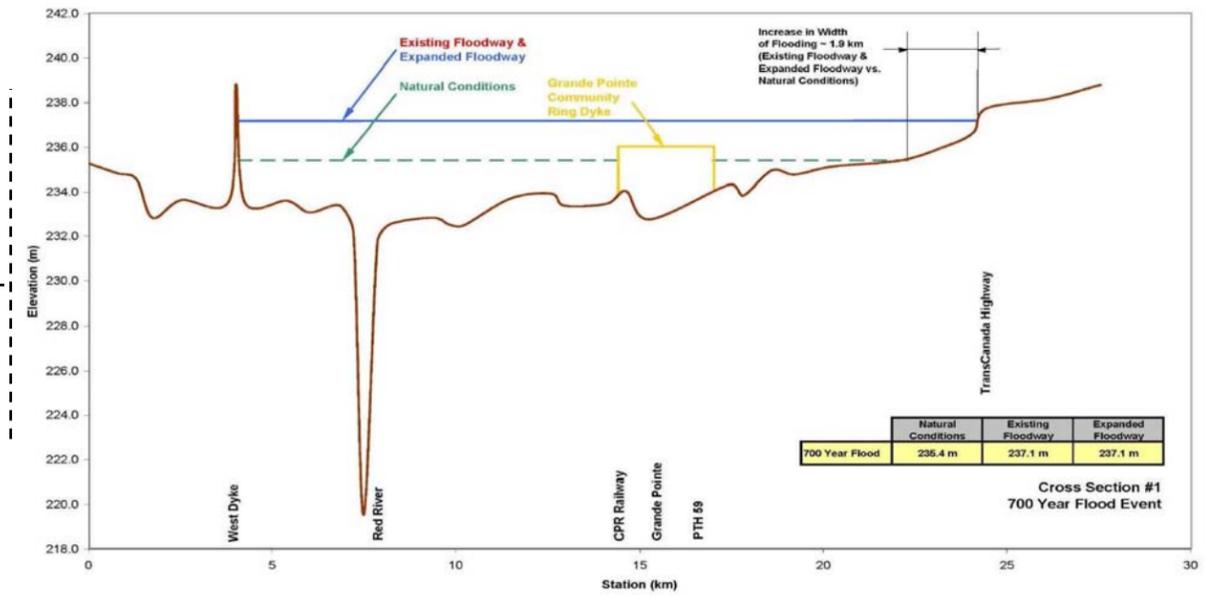
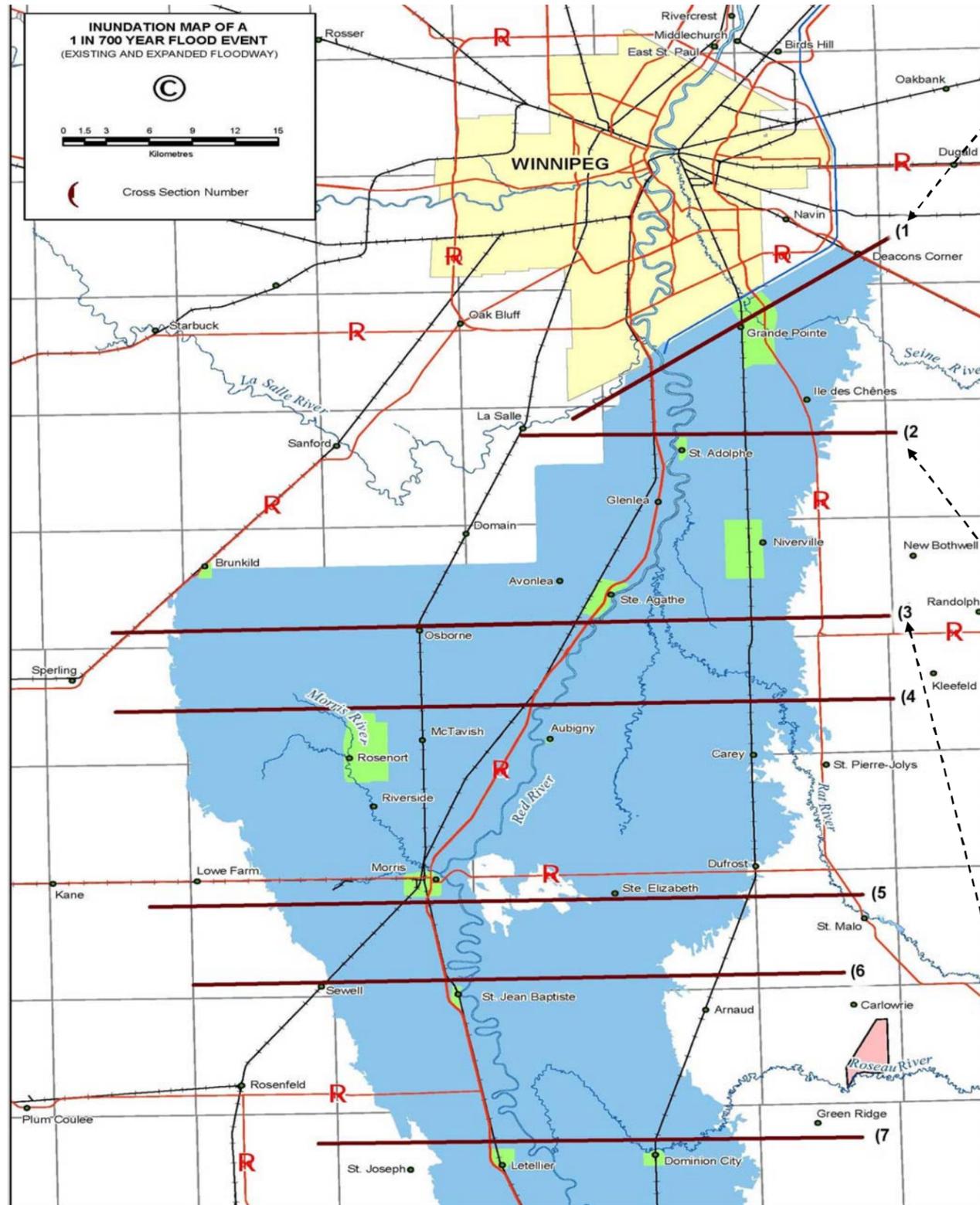
1997 Flood Depths at Inlet Control Structure
- Expanded Floodway

Cross Section #1
1997 Flood Event

RM OF RITCHOT ARTIFICIAL FLOODING STUDY

1-IN-700 YEAR FLOODING EXTENT

#8

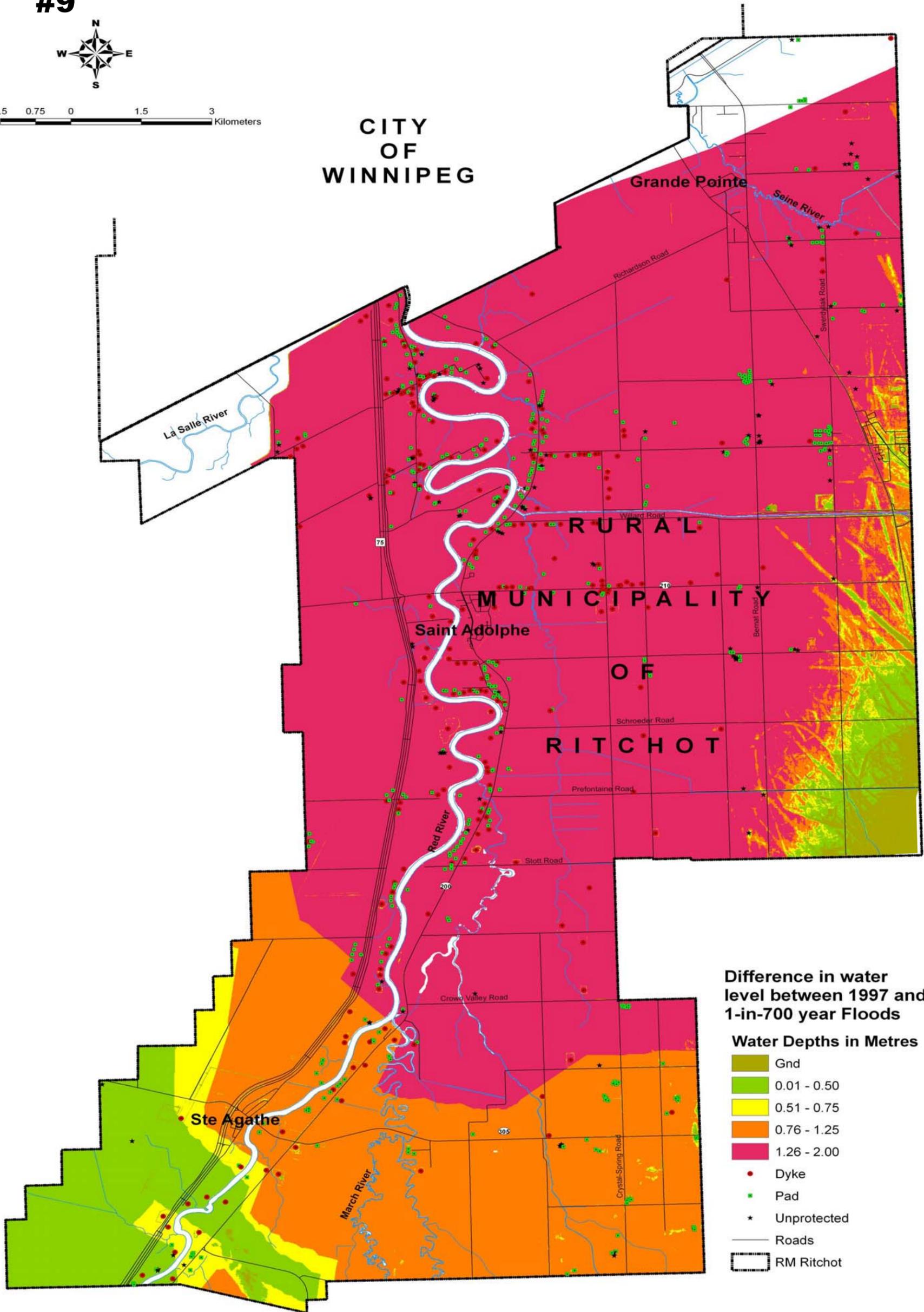


RM OF RITCHOT ARTIFICIAL FLOODING STUDY
1-IN-700 YEAR FLOOD DEPTHS RELATIVE TO 1997 WATER LEVELS



1.5 0.75 0 1.5 3 Kilometers

CITY OF WINNIPEG



Difference in water level between 1997 and 1-in-700 year Floods

Water Depths in Metres

- Gnd
- 0.01 - 0.50
- 0.51 - 0.75
- 0.76 - 1.25
- 1.26 - 2.00

- Dyke
- Pad
- Unprotected
- Roads
- RM Ritchot

Data Source: Manitoba Conservation (Updated 2005)

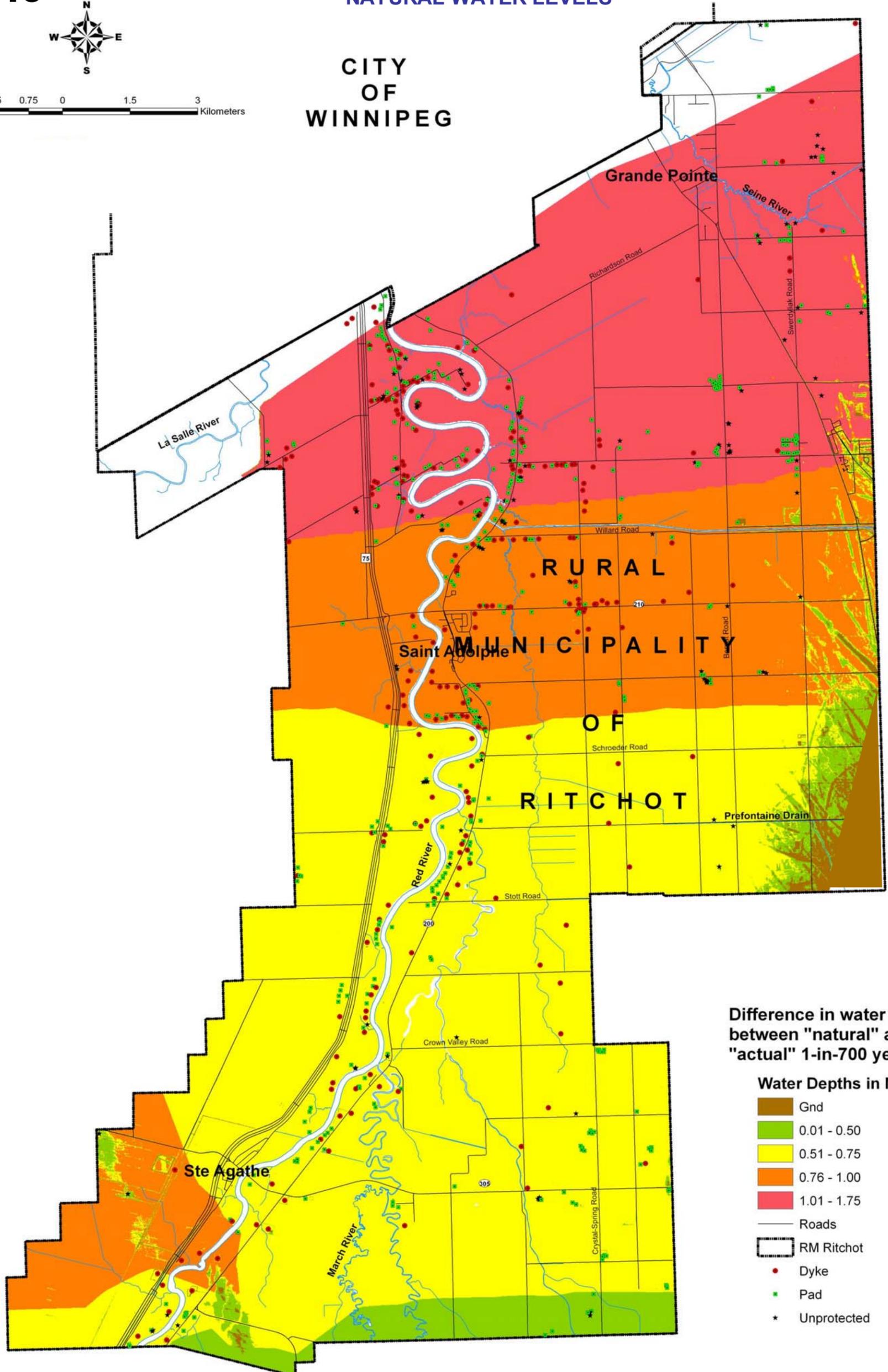


RM OF RITCHOT ARTIFICIAL FLOODING STUDY
1-IN-700 YEAR ARTIFICIAL FLOOD DEPTHS RELATIVE TO
NATURAL WATER LEVELS



1.5 0.75 0 1.5 3 Kilometers

CITY OF WINNIPEG



Difference in water level between "natural" and "actual" 1-in-700 year floods

Water Depths in Metres

- Gnd
- 0.01 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00
- 1.01 - 1.75
- Roads
- RM Ritchot
- Dyke
- Pad
- Unprotected

Data Source: Manitoba Conservation (Updated 2005)



ESTIMATION OF ARTIFICIAL FLOOD DAMAGES

- Artificial flood damages were calculated as an input to the calculation of benefit-cost ratios for the mitigation options (Board #17).
- Flood damage categories were based on the “Present Value” of the damages. The Present Value is the current worth of a series of damages occurring infrequently and irregularly in the future.
- The process of computing flood damages for structures in the study area is described on Boards #12 and #13.
- Board #14 presents the structural flood damages due to artificial flooding for all properties in Ritchot categorized into ranges.
- Board #15 shows the damage categories in more detail for ring-dyke communities.
- Board # 16 presents the total damage considering structural, agricultural and infrastructure damages (under existing flood protection for each land parcel).
- Residual flood damages are the potential flood damages, which would occur even if increased flood protection is provided.
- As an example, the Present Value of residual flood damages was computed for an increased flood protection level of 1-in-225 year.
- Boards #16 and #17 present the categorized, residual artificial flood damages if existing level of protection is increased to provide a 1-in-225 year level of protection.

Overview of Damage Calculations

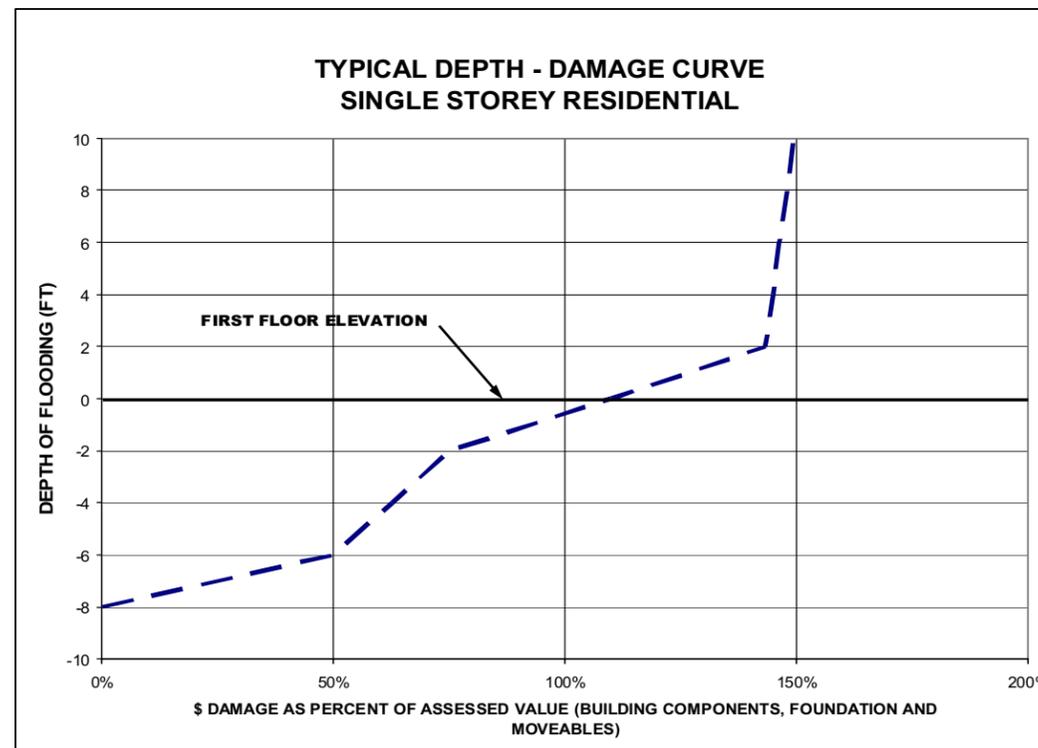
1. The original relationships between depth of flooding and flood damages were developed in the KGS (2000) Study prepared for the International Joint Commission (IJC) for the Red River Basin.
2. The Depth-Damage Curve (e.g. at right) provides an estimate of damages as a percentage of the market value of the structure for all depths of flooding above or below the first floor level.
3. The market value was assumed to be equal to the Assessed Value of the structure as determined by the Manitoba Rural Development Tax Assessment Branch.

According to the KGS (2000) study:

4. Damages were referenced to depth of flooding above the first floor level.
5. The depth of flooding above the first floor was calculated as follows:

$$DOF = WS - (GR + FFH)$$

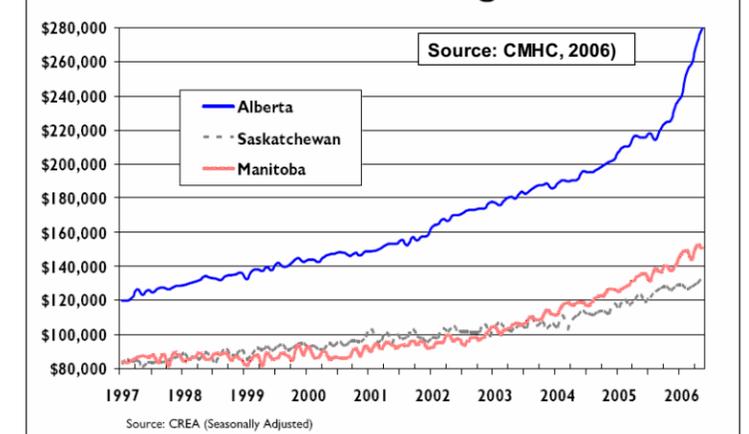
DOF = depth of flooding above first floor
WS = water surface elevation
GR = ground surface elevation
FFH = height of 1st floor above ground surface
6. If the water level was less than the height of flood protection, then the damages was set to zero. (See (G) for note on freeboard).
7. The structures were separated into specific categories with similar characteristics. Typical structure categories included single storey residential, multi-storey residential, mobile home and commercial/ industrial/ public buildings.
8. Residences were generally considered to have basements. commercial, industrial and institutional buildings were considered to not have basements.
9. The damage curves include three components: foundation, structure components and movables. Movables were considered to include building contents; individual pre-emptive flood fighting costs; crop inventory losses; yard restoration and other losses.
10. Manitoba Emergency Measures Organization flood claims were used to determine the value of the contents losses as a percent of the building value.



Update of Damage Calculations by MMM Group

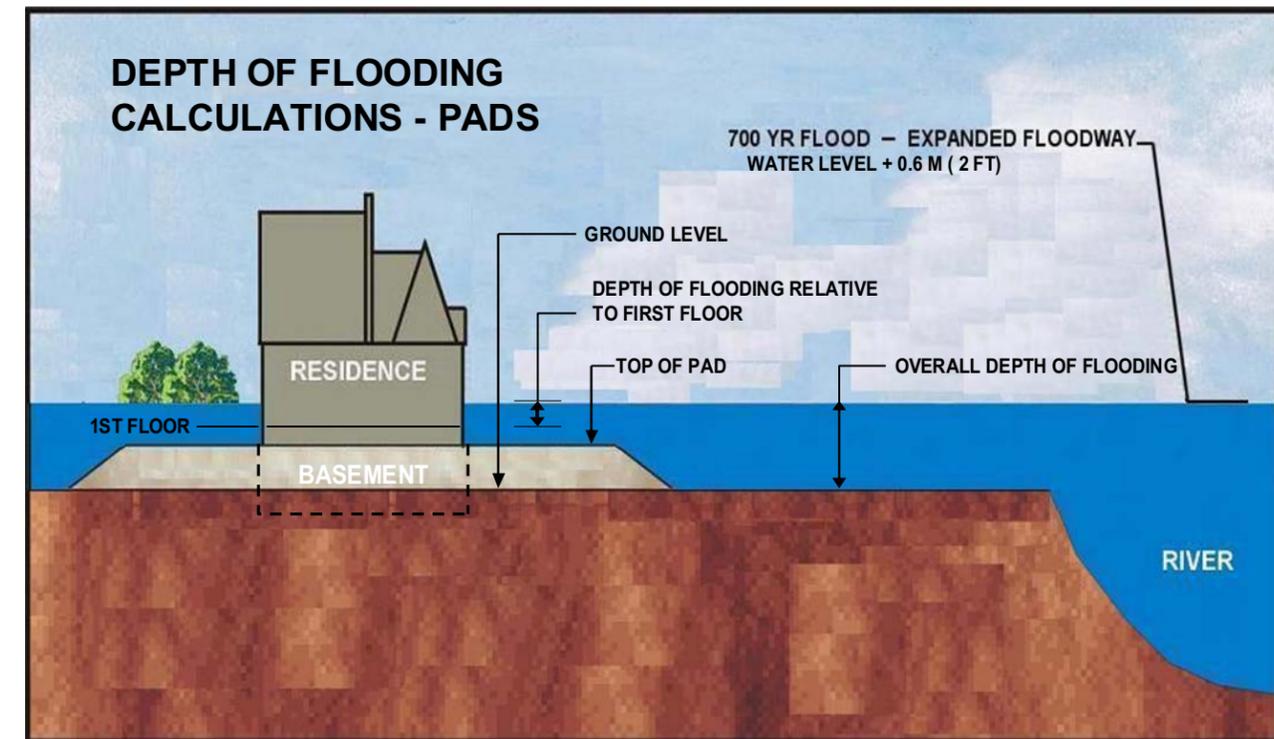
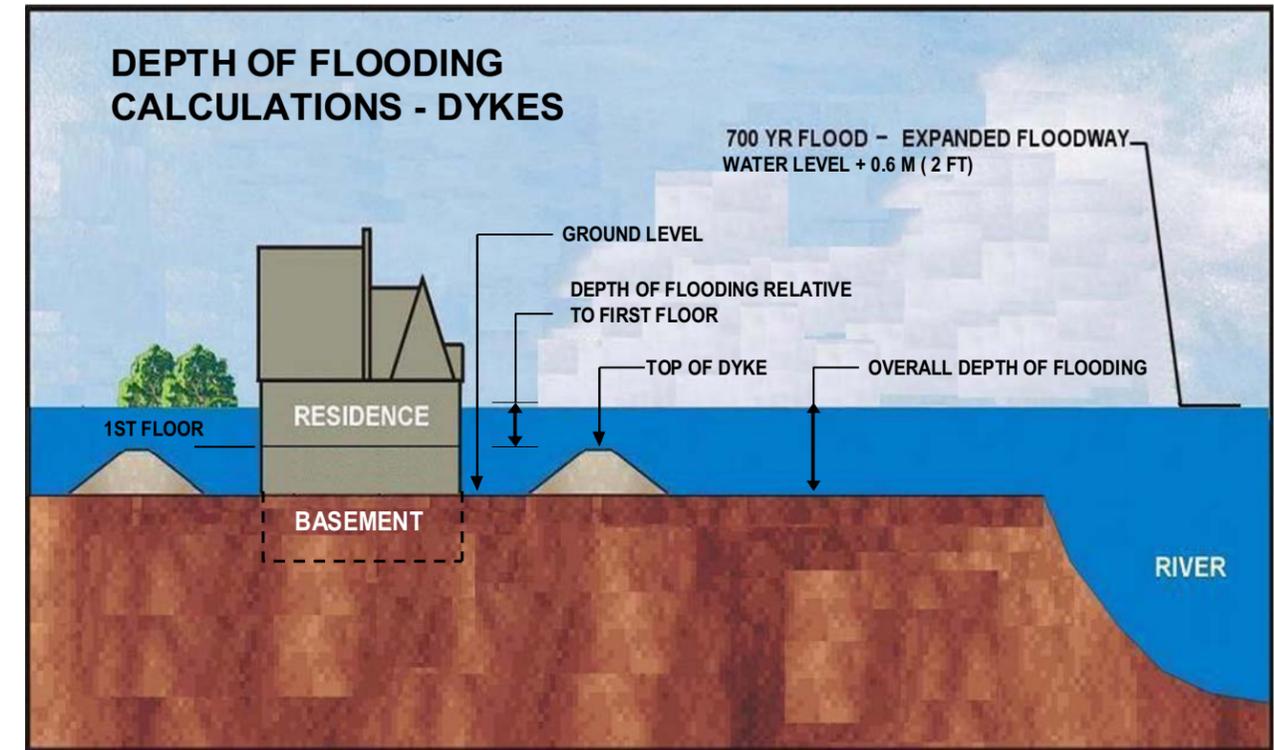
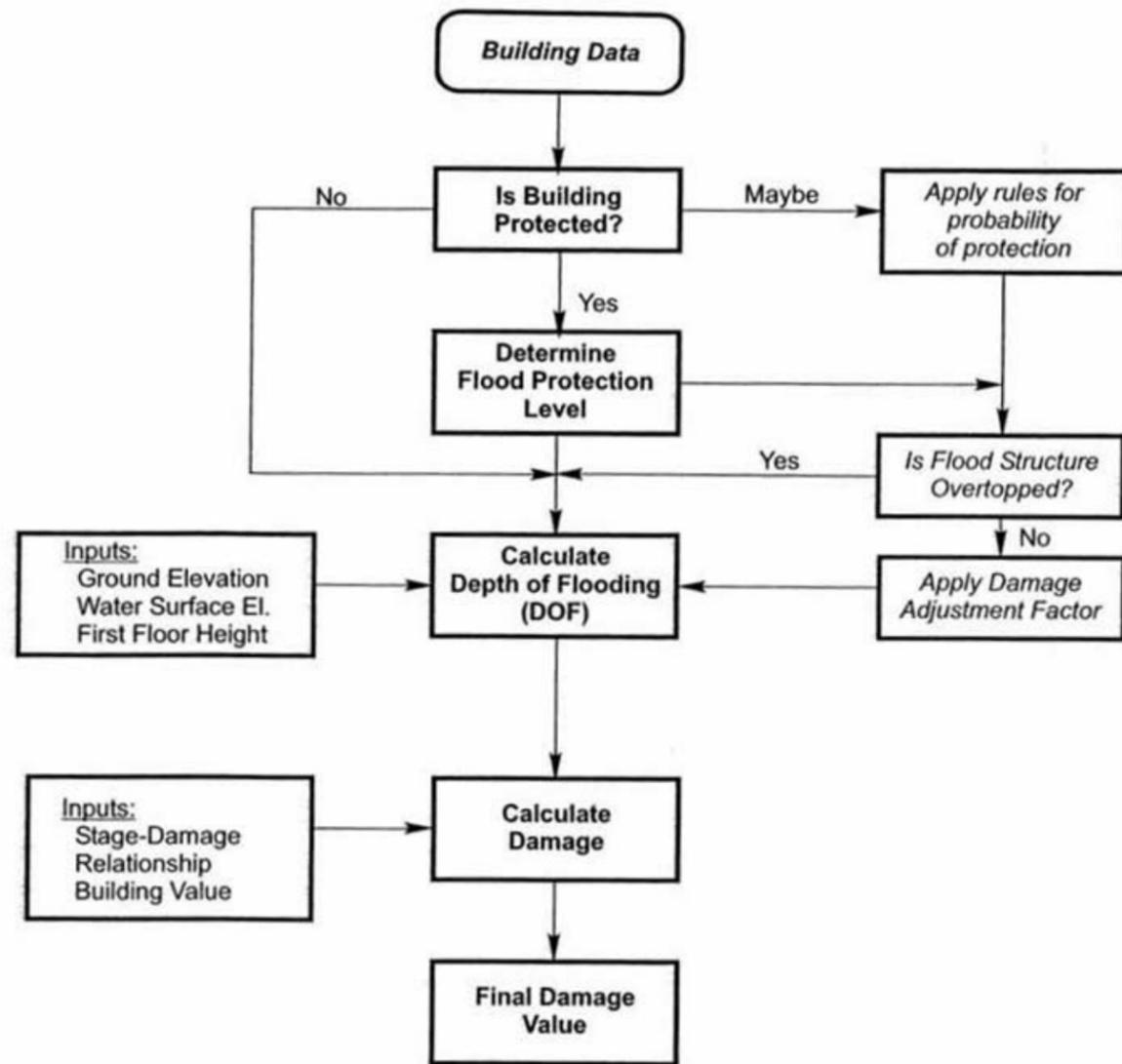
- A. The building database used during the KGS (2000) study was augmented and updated to reflect changes that occurred since 2000, in particular within ring dyke communities where the greatest changes occurred in Ritchot over the past eight years.
- B. Google Earth images (e.g. at left) were used to assist in the update of the building database and to geographically map the structures.
- C. The database of existing flood protection structures was updated to reflect the most recent mapping available from the Manitoba Conservation.
- D. The assessed value of buildings was updated in two steps using market trends reported by the Canada Mortgage and Housing Corporation (CMHC) (graph below):
 - Step 1) New buildings added to the existing building database had 2003 assessed values. Therefore, a multiplier of 1.25 was used to update all the buildings with 1995 assessed values to 2003 assessed values.
 - Step 2) Once all the buildings were brought to their 2003 market values, a factor of 1.5 was applied to bring all structures up to their 2008 market values.
- E. Tangible indirect damages, such as income disruption, reduced economic activity, business losses, etc., which were not included in the original Depth-Damage relationships, were included for this study.
- F. Indirect damages were taken on average as 25% of the direct flood damages to structures, in accordance with the approach used for other flood damages studies done for Ontario and Saskatchewan.
- G. Freeboard was accounted for in computing flood damages.

Prairie Provinces – Average MLS® Price



RM OF RITCHOT ARTIFICIAL FLOODING STUDY

FLOOD DAMAGES CALCULATIONS # 2



RM OF RITCHOT ARTIFICIAL FLOODING STUDY

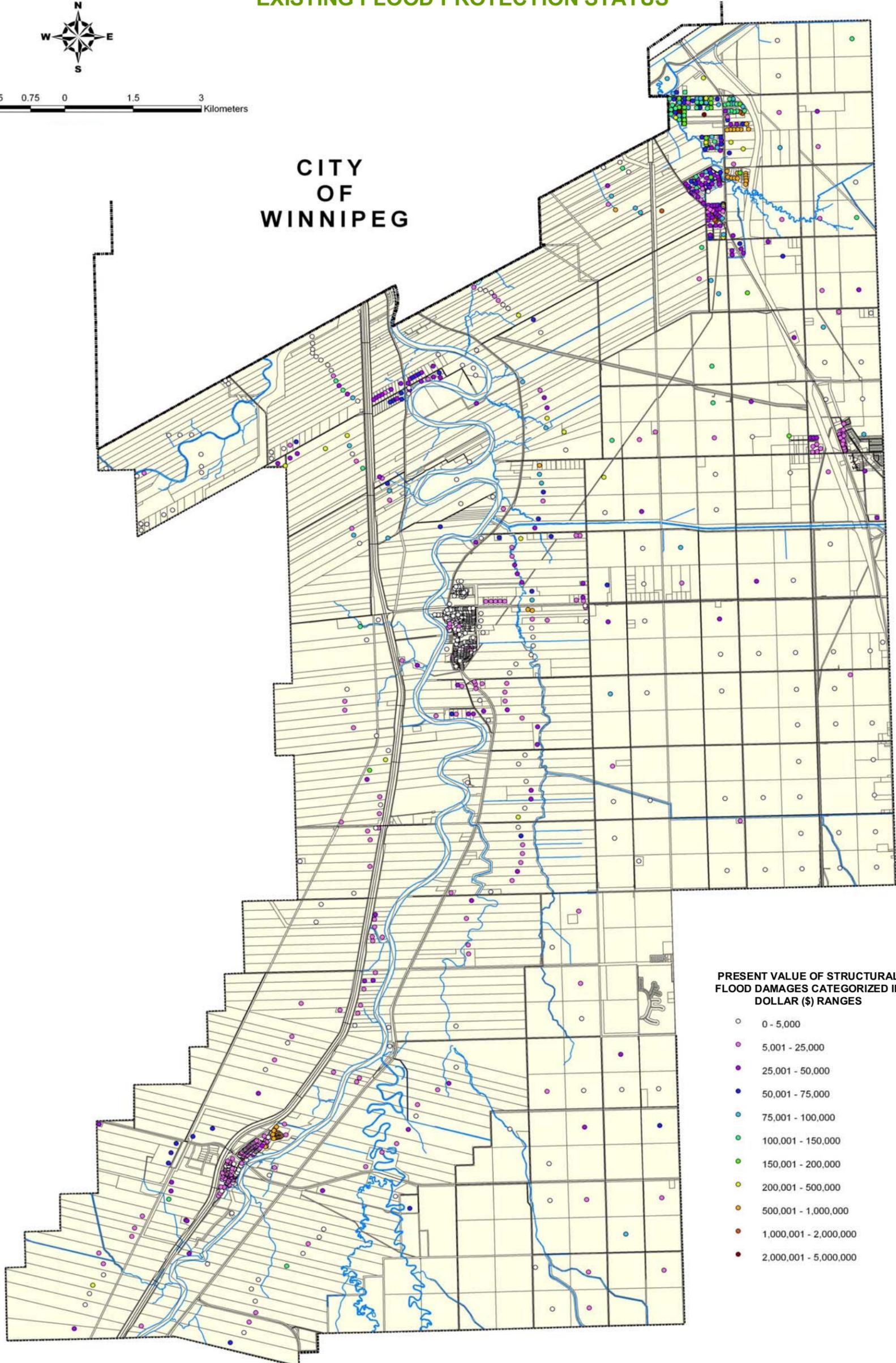
PRESENT VALUE OF STRUCTURAL FLOOD DAMAGES DUE TO ARTIFICIAL FLOODING EXISTING FLOOD PROTECTION STATUS

#14



1.5 0.75 0 1.5 3 Kilometers

CITY
OF
WINNIPEG



PRESENT VALUE OF STRUCTURAL
FLOOD DAMAGES CATEGORIZED IN
DOLLAR (\$) RANGES

- 0 - 5,000
- 5,001 - 25,000
- 25,001 - 50,000
- 50,001 - 75,000
- 75,001 - 100,000
- 100,001 - 150,000
- 150,001 - 200,000
- 200,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 2,000,000
- 2,000,001 - 5,000,000

Data Source: Manitoba Conservation (Updated 2006)

Manitoba
Floodway Authority



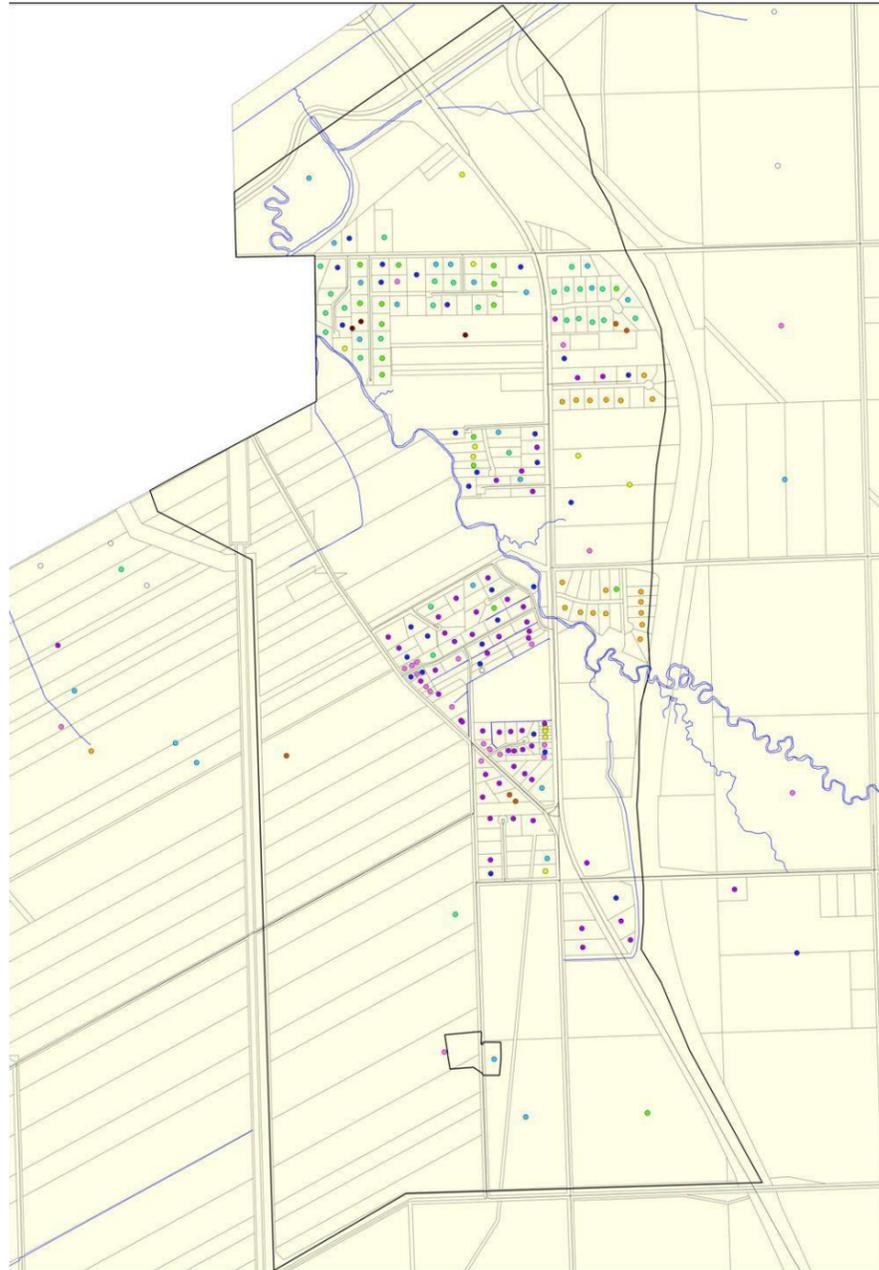
Manitoba 

Canada 

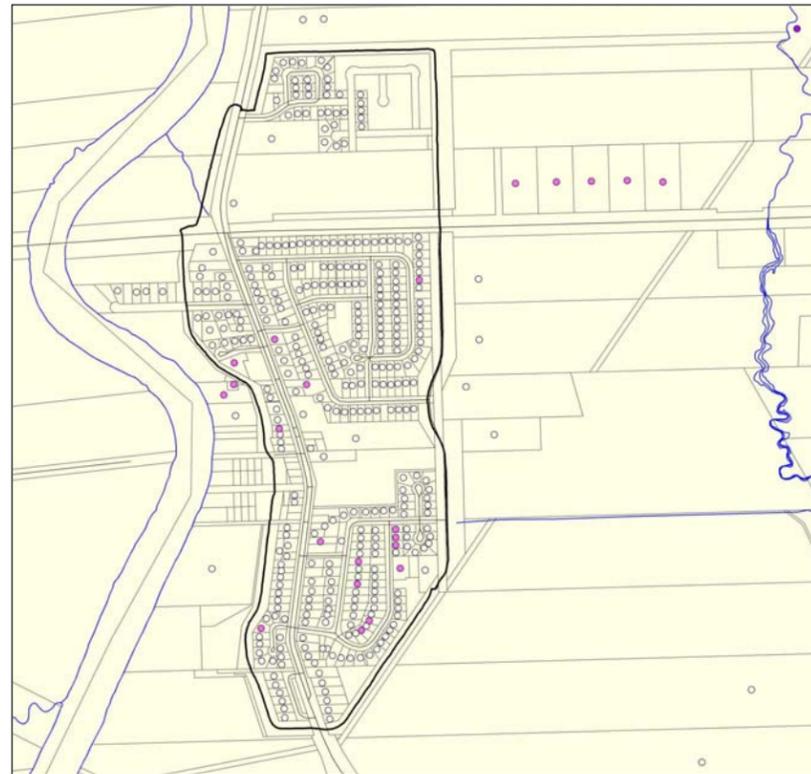
RM OF RITCHOT ARTIFICIAL FLOODING STUDY

PRESENT VALUE OF STRUCTURAL FLOOD DAMAGES DUE TO ARTIFICIAL FLOODING – RING DYKE COMMUNITIES

EXISTING LEVEL OF PROTECTION



GRANDE POINTE



ST. ADOLPHE



STE. AGATHE

PRESENT VALUE OF STRUCTURAL FLOOD DAMAGES CATEGORIZED IN DOLLAR (\$) RANGES

- 0 - 5,000
- 5,001 - 25,000
- 25,001 - 50,000
- 50,001 - 75,000
- 75,001 - 100,000
- 100,001 - 150,000
- 150,001 - 200,000
- 200,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 2,000,000
- 2,000,001 - 5,000,000

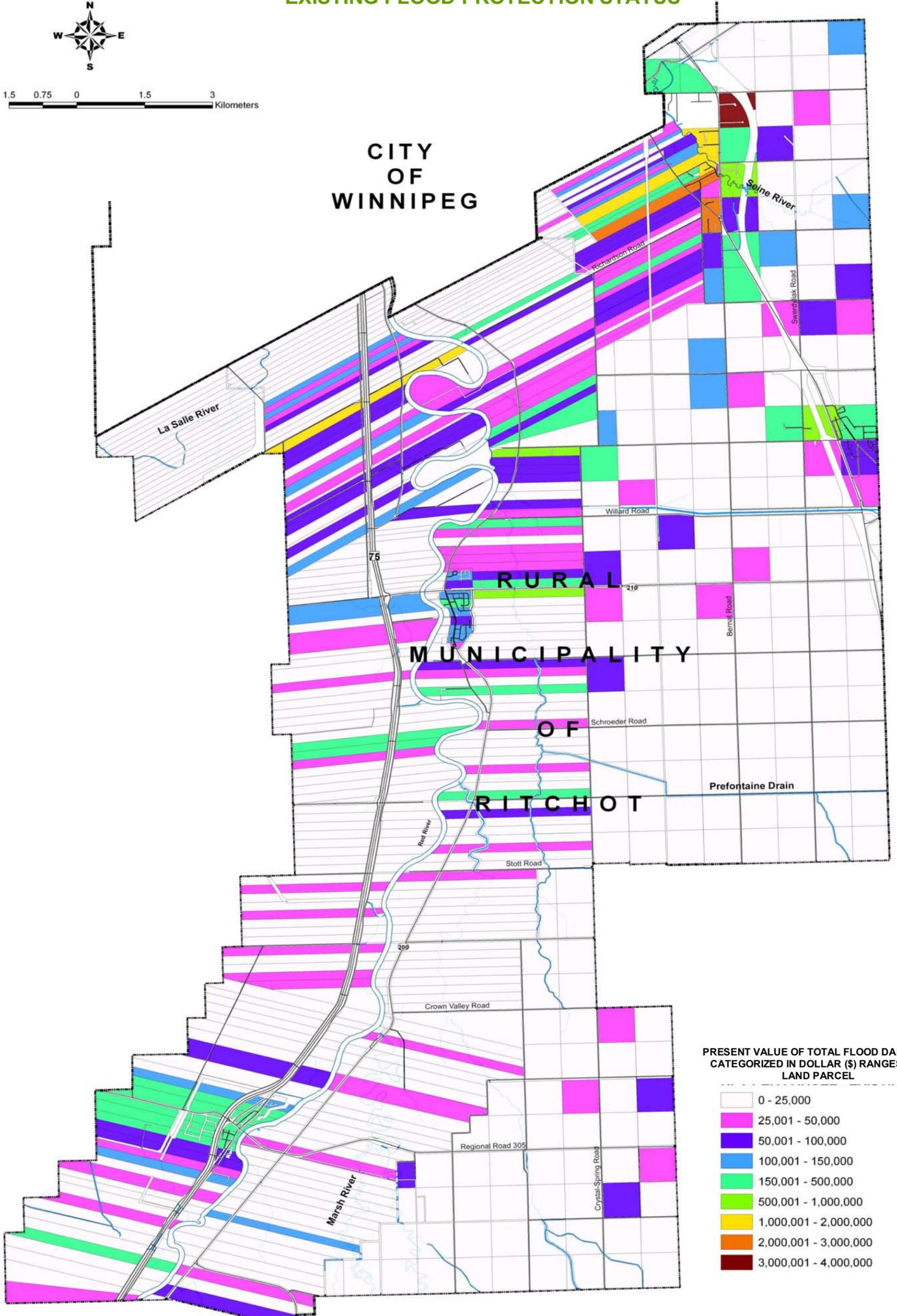
RM OF RITCHOT ARTIFICIAL FLOODING STUDY

**PRESENT VALUE OF ARTIFICIAL FLOOD DAMAGES PER LAND PARCEL
INCLUSIVE OF STRUCTURAL, AGRICULTURAL AND INFRASTRUCTURE DAMAGES
EXISTING FLOOD PROTECTION STATUS**

#16



1.5 0.75 0 1.5 3 Kilometers



**PRESENT VALUE OF TOTAL FLOOD DAMAGES
CATEGORIZED IN DOLLAR (\$) RANGES PER
LAND PARCEL**

White	0 - 25,000
Pink	25,001 - 50,000
Blue	50,001 - 100,000
Light Blue	100,001 - 150,000
Light Green	150,001 - 500,000
Green	500,001 - 1,000,000
Yellow	1,000,001 - 2,000,000
Orange	2,000,001 - 3,000,000
Dark Orange	3,000,001 - 4,000,000

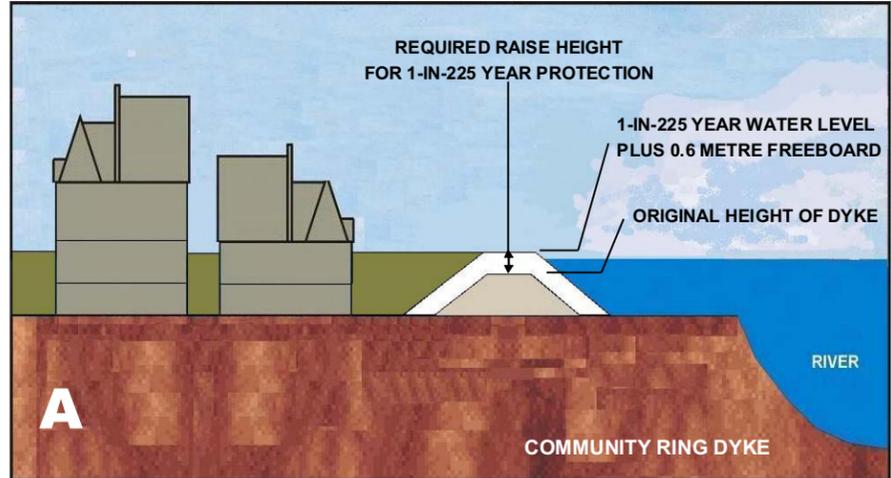
Data Source: Manitoba Conservation (Updated 2005)



RANGE OF MITIGATION MEASURES BEING CONSIDERED

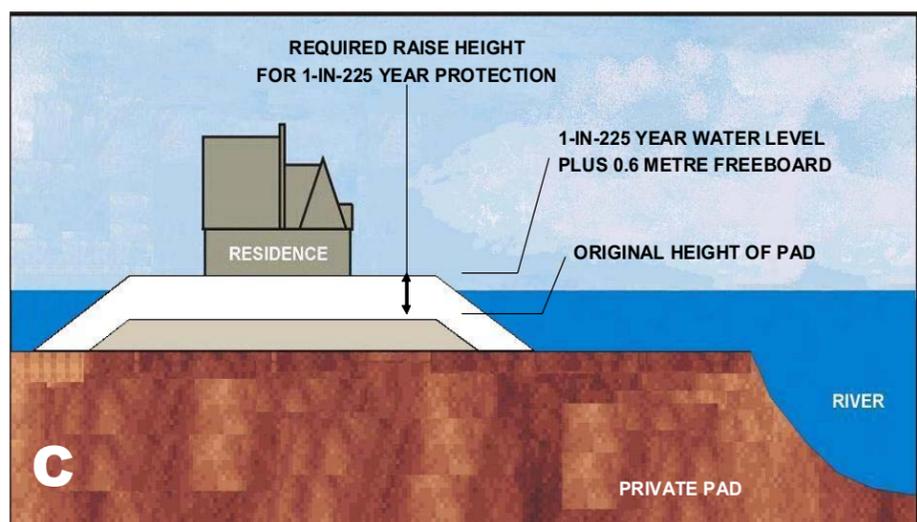
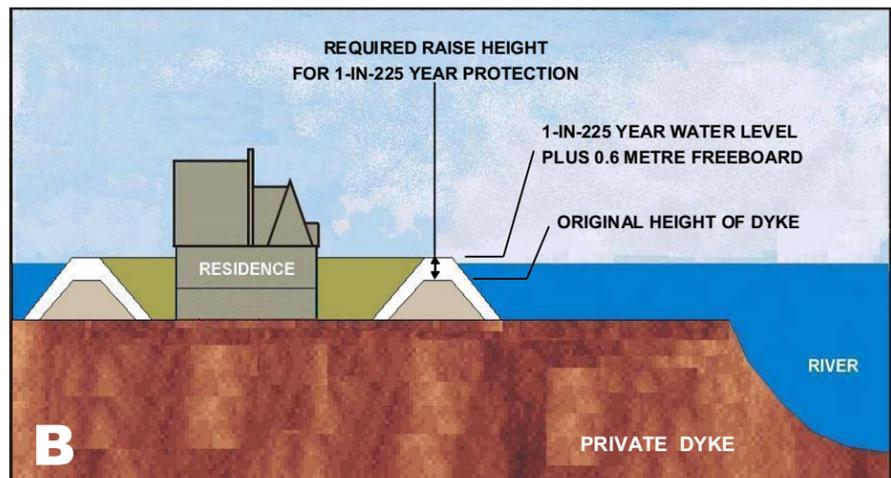
MITIGATION OPTIONS

- Do Nothing (i.e., use temporary measures such as sand bags).
- Raise Communal Ring Dykes (Exhibit A).
- Raise Individual Ring Dykes and Pads (Exhibits B and C).
- Purchase of Flood Prone Properties.
- Flood Easements.
- Monetary Compensation.



MITIGATION SELECTION PROCESS

- A range of design floods will be considered, e.g., 1-in-225, 1-in-500, 1-in-700.
- Cost estimates will be calculated for each option, e.g., costs to raise the height of dykes and pads for various design floods.
- Benefit-Cost Analysis will be completed for each option.
- Benefit is the Present Value of damages avoided due to the implementation of the particular mitigation option.
- The Benefit-Cost (B-C) Ratio is the Present Value of damages avoided divided by the cost estimate to implement that option.
- Other factors such as environmental and social impacts will be considered in combination with B-C ratio to identify recommended mitigation measures.



RM OF RITCHOT ARTIFICIAL FLOODING STUDY

PRESENT VALUE OF RESIDUAL FLOOD DAMAGES

DUE TO ARTIFICIAL FLOODING FOR

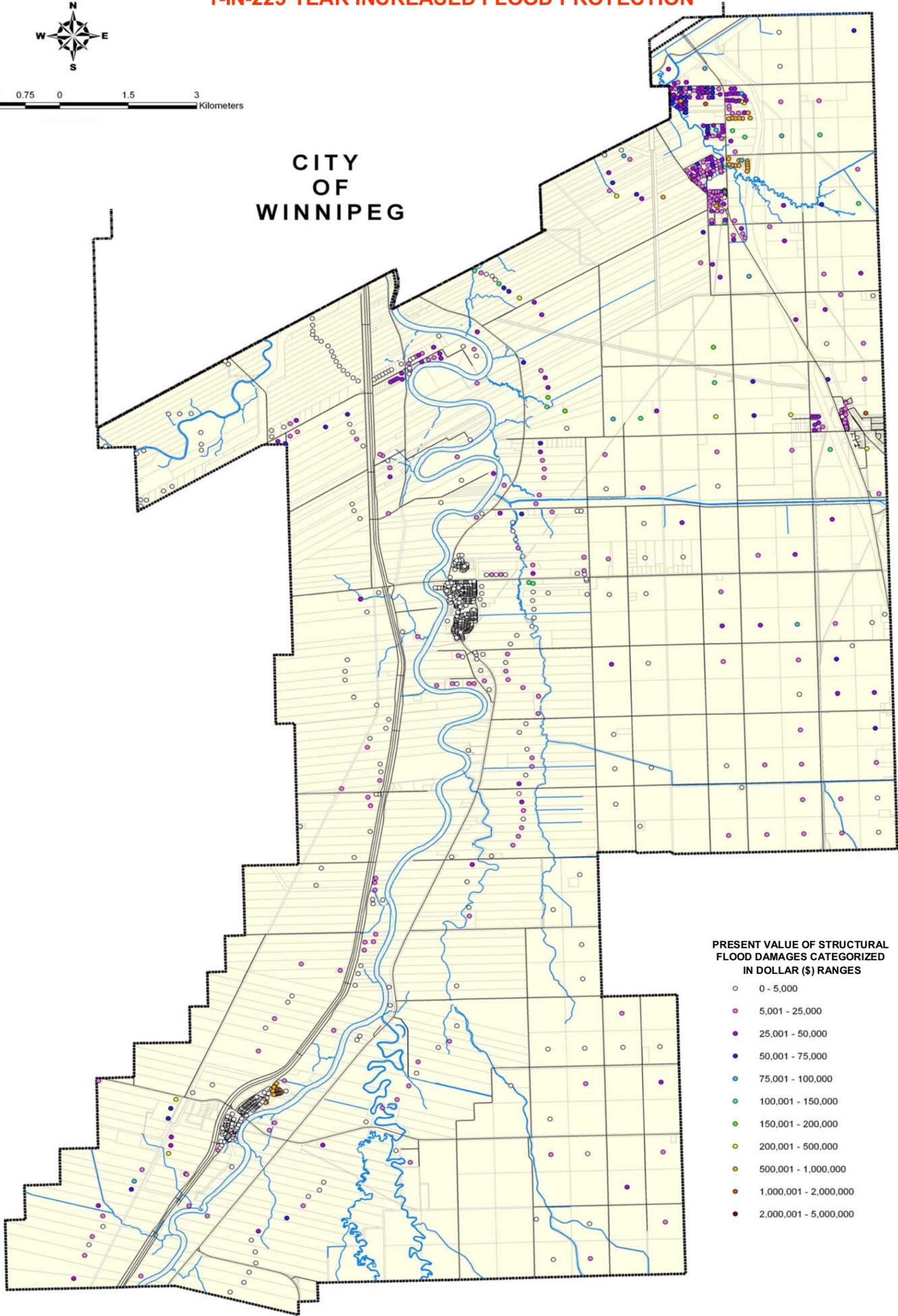
1-IN-225 YEAR INCREASED FLOOD PROTECTION

#18



1.5 0.75 0 1.5 3 Kilometers

CITY OF WINNIPEG



PRESENT VALUE OF STRUCTURAL FLOOD DAMAGES CATERGIZED IN DOLLAR (\$) RANGES

- 0 - 5,000
- 5,001 - 25,000
- 25,001 - 50,000
- 50,001 - 75,000
- 75,001 - 100,000
- 100,001 - 150,000
- 150,001 - 200,000
- 200,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 2,000,000
- 2,000,001 - 5,000,000

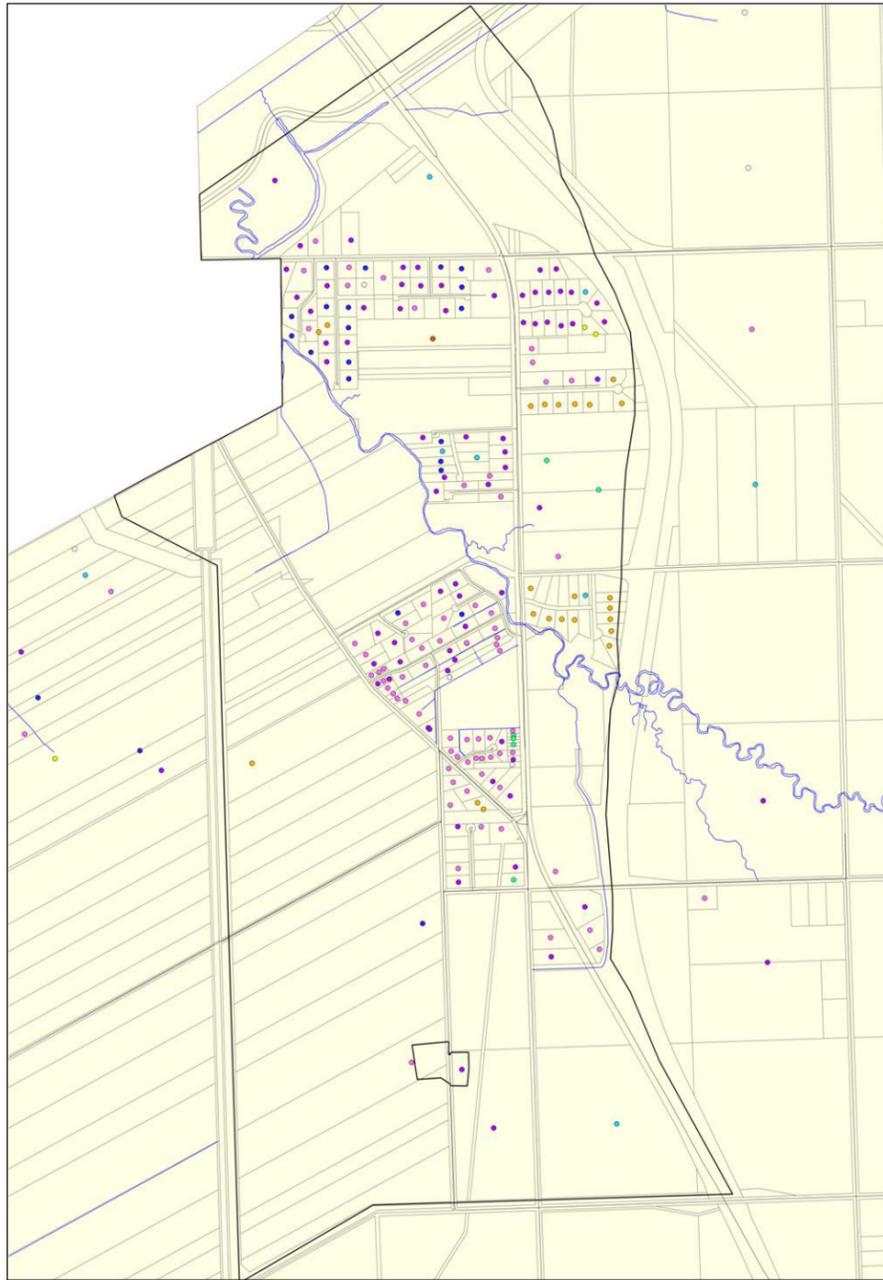
Data Source: Manitoba Conservation (Updated 2005)



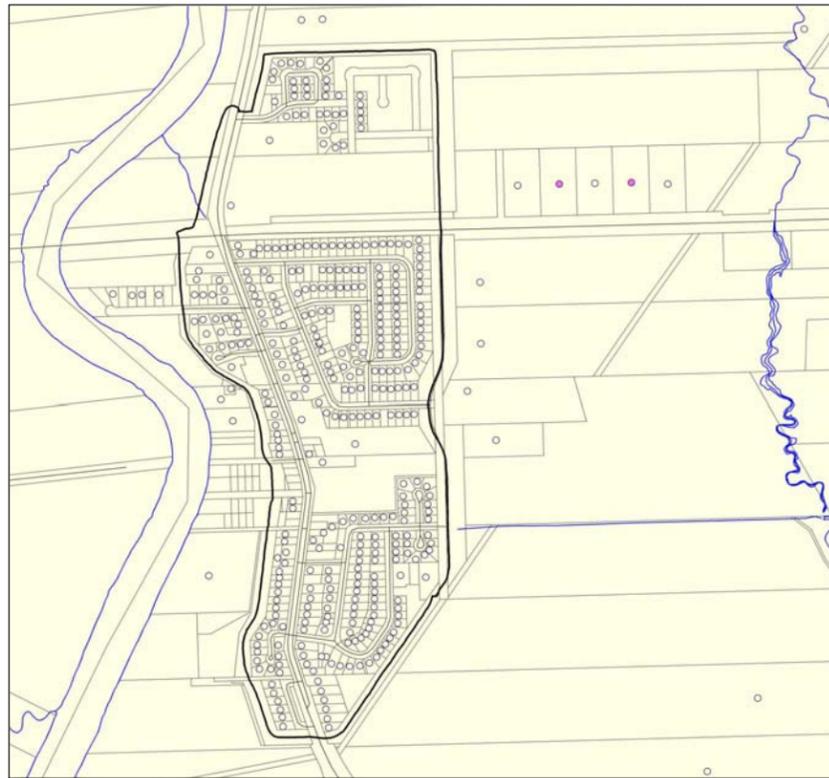
RM OF RITCHOT ARTIFICIAL FLOODING STUDY

ESTIMATED PRESENT VALUE OF RESIDUAL FLOOD DAMAGES DUE TO ARTIFICIAL FLOODING – RING DYKE COMMUNITIES

1-IN-225 YEAR INCREASED FLOOD PROTECTION



GRANDE POINTE



ST. ADOLPHE

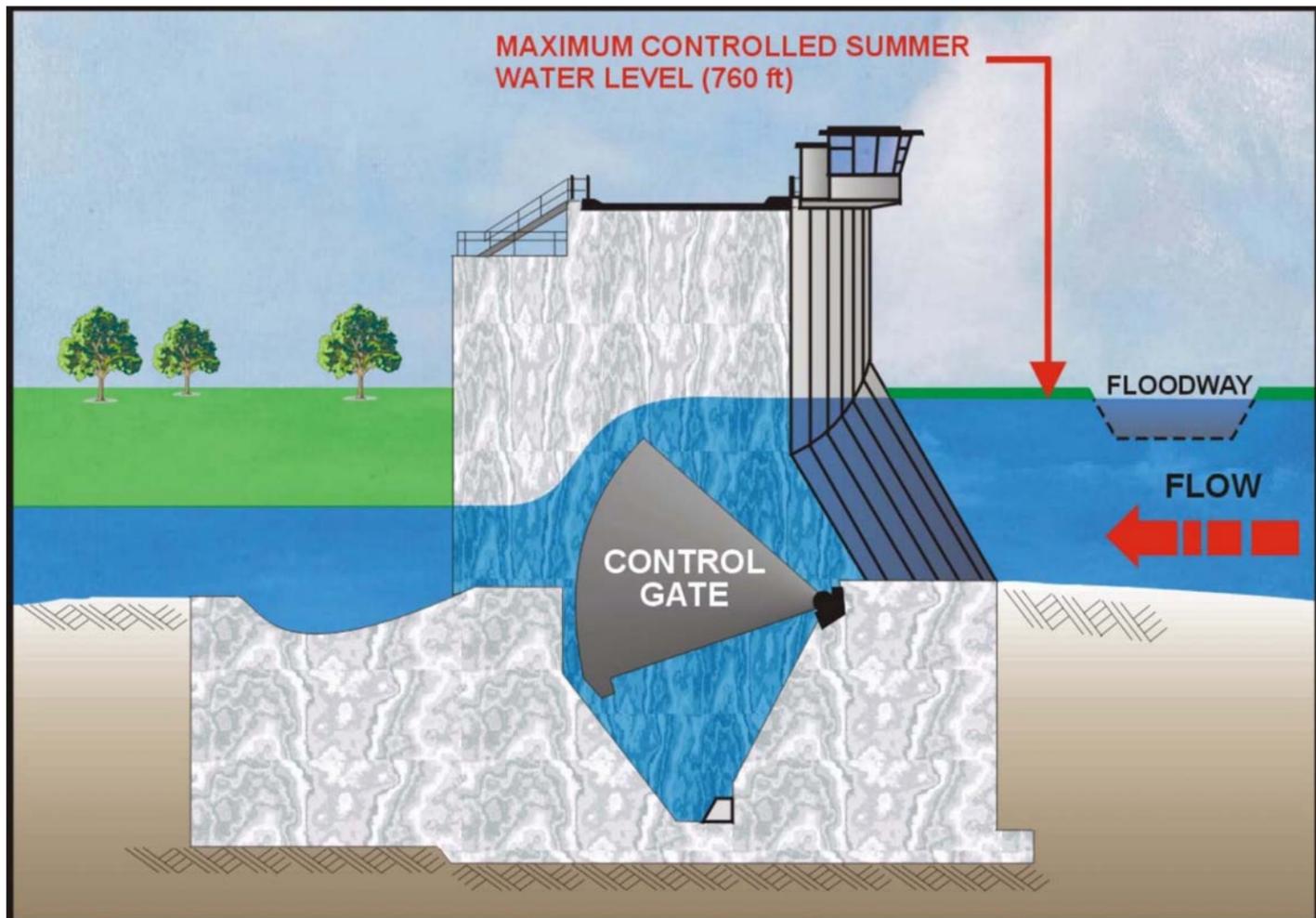


STE. AGATHE

PRESENT VALUE OF STRUCTURAL FLOOD DAMAGES CATEGORIZED IN DOLLAR (\$) RANGES

- 0 - 5,000
- 5,001 - 25,000
- 25,001 - 50,000
- 50,001 - 75,000
- 75,001 - 100,000
- 100,001 - 150,000
- 150,001 - 200,000
- 200,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 2,000,000
- 2,000,001 - 5,000,000

NON-SPRING OPERATION



- Operation of the floodway in non-spring emergency events (Rule 4 operation) or during proposed future non-spring non-emergency events will cause artificial flooding for each operation.
- Flows in these events are expected to be smaller than a spring event and Rule 4 requires that upstream water levels not exceed El. 760 feet above sea level or generally top of bank. The exception to this is during the rare event when high non-spring flows on the Red River reach the same flows that typically occur in spring and require implementation of Rule 1, which occurred only once in the history of the floodway (the summer of 2005).
- During the environmental assessment process for the floodway expansion project, non-spring (summer) operation of the floodway was considered out of scope of the assessment. Manitoba Conservation issued a licence under the Environment Act requiring that the development be operated under the existing four rules of operation or that an application be filed under the Act if the rules were to be altered.
- The Manitoba Floodway Authority (MFA) and Manitoba Water Stewardship (MWS) indicated during the public hearing process that no decision on non-emergency summer operation would be made until three studies of the effects of non-spring operation were undertaken:
 - effects of operating the gates on fish passage at the Inlet Control Structure;
 - effects on wildlife and wildlife habitat, and;
 - effects on river bank stability.
- MFA and MWS are following through with undertaking the studies and they are all at various stages of completion.

#21

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:
- The basis of the Department’s river level forecasts and its risk assessment;
 - The risk of basement flooding in Winnipeg, including the following factors:
 - The predicted peak river level in the next 10 days;
 - The length of time the Department forecasts the river level will be at 14 feet JAPSD or higher; and
 - The risk of an intense rainfall event in Winnipeg in the next 10 days.
 - The benefits and costs of Floodway operation, including:
 - The extent of basement flooding and damage to property expected from various combinations of intense rainfall events and high river levels;
 - The risk to the health of Winnipeg residents from sewer back-up;
 - Economic loss and damage caused by artificial flooding south of the Inlet Control Structure;
 - Impacts of operation on fish and wildlife and their habitat and on water quality;
 - 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;
 - 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;
 - 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 measures that may be taken to mitigate the costs and impacts of the operation under consideration, including:
 - minimizing the rate at which river levels are changed both upstream and downstream of the Floodway Inlet Control Structure;
 - 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:
- to raise river levels immediately upstream of the control structure to an elevation higher than 760 feet above sea level;
 - to achieve a river level of less than 9 feet JAPSD; or
 - 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.

SUMMARY OF NEXT STEPS

**Thank you for attending today's
Public Information Session.**

Next steps:

- Review comments from today's session. The final report will include discussion on today's session and a summary of comments.
- Complete this study.
- Present the final report to the parties represented on the Steering Committee.
- Representatives for the Federal Government, the Manitoba Floodway Authority and the RM of Ritchot will consider the results and recommendations of the Consultant and prepare a Joint Report that will propose mitigation measures. The Federal Government, the Province, and the RM will consider the report, and will determine whether they are prepared to implement the proposed mitigation measures.