PRAC Municipal Adaptive Planning (MAP) Study

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Prepared for:

Manitoba Conservation and Water Stewardship and Manitoba Local Government

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Associated Engineering

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The consultant team would like to thank the PRAC MAP Scoping Study Steering Committee members for their enthusiastic embrace of the study, for their advice and assistance throughout the process, and for their appreciation of the importance of climate change adaptation for Manitoba municipalities.

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EXECUTIVE SUMMARY

The Prairies Regional Adaptation Collaboration (PRAC) is a joint undertaking of the provinces of Alberta, Saskatchewan and Manitoba, Natural Resources Canada (NRCan) and the University of Regina. One of the major aims of the PRAC is to build the capacity of decision-makers to incorporate climate change adaptation into decision-making related to water resources management, terrestrial ecosystem management and drought and excessive moisture (DEM).

As part of Manitoba's contribution to the PRAC, a series of climate adaptation planning workshops were planned to test two (2) municipal adaptation planning approaches for possible application at the municipal and planning district and/or conservation district levels in the province. The first of these approaches was developed by the Saskatoon based Agri-Environment Services Branch of Agri-Food and Agriculture Canada. Called the "Land and Infrastructure Resiliency Assessment" or LIRA, this process is the subject of a companion report prepared for Manitoba Conservation and Water Stewardship and Manitoba Local Government as a separate but related component of the present study.

The present report deals with the second Municipal Adaptation Planning (MAP) process selected for a Manitoba trial run: "Adapting to Climate Change – A Risk-based Guide," hereafter referred to interchangeably as the "RBG" or the "Guide." The RBG was developed with the support of NRCan as a "national guide" for assisting municipalities to adapt to the risks associated with climate change. The Guide outlines a six-step process to help users assemble a MAP team to oversee application of the process, identify and analyze climate change risks, formulate adaptation or mitigation plans, and communicate the findings of their analysis to stakeholder groups and the general public prior to embarking upon the preparation and implementation of mitigation plans.

To initiate testing of the RBG process, Manitoba Conservation and Water Stewardship (CONWS) and Manitoba Local Government (MLG) organized an initial MAP workshop in November 2011 in Brandon MB involving selected municipalities in the western part of the province. The workshop introduced NRCan's Risk-Based Guide to participants and worked through the first two (2) steps of the RBG process.

As a follow-up to the November 2011 workshop, the project consultants were engaged by CONWS and MLG to:

- Review to the RBG manual and available case studies;

- Organize a follow-up workshop with municipal representatives to work through the steps 3 through 5 of the RBG process, and;

- Provide an opinion, based on the consultant's assessment and workshop feedback, on the value and practicability of implementing the RBG process in Manitoba with particular attention to:

    - The workability of the RBG process as a municipal adaptation planning tool;

    - The effectiveness of the RBG in encouraging the integration of climate change adaptation into the existing municipal decision-making processes, and;

    - The potential of the RBG in contributing to more comprehensive and coordinated response to the risks of climate change at the local level.

The follow-up workshop was held in Brandon on March 7, 2012. The workshop focused on "Water Quantity" which was confirmed at the November 2011 workshop as being a climate factor posing severe hazards for local governments in terms of too little water, i.e. drought, and too much water, i.e. flooding from extreme rain events (EREs). Participants at the March 2012 workshop were asked to identify, assess and evaluate "risk events" associated with Water Quantity for use in working through steps 3 to 5 of the RBG process.

Based on its review of the RBG process and the experience of applying the process in a workshop setting, the project consultants arrived at the following major conclusions:

1. The RBG presents an easy-to-understand and user-friendly municipal adaptation planning process that is scalable depending upon a particular municipality's financial and administrative resources.

2. The RBG does not demand of its users a detailed level of prior knowledge or understanding in the area of climate change or risk assessment.

3. The RBG process need not be an onerous, time-consuming effort, but can be applied very quickly at a high level to identify high frequency/high consequence risk events requiring prompt action.

4. The RBG provides not only a blue-print for risk assessment, but a framework for the administrative infrastructure and procedures necessary for sustaining a MAP effort over the long term.

5. An RBG process would be useful in getting a municipality's or region's climate change stakeholders together in a structured manner in order to share information and resources and help forge partnerships for tackling climate change risks at the local level.

6. Overall, the RBG has the potential for being a highly effective tool for helping Manitoba municipalities and conservation districts to integrate climate change considerations into their day-to-day planning, operations and general decision-making.

Based on the above, the project consultants would recommend the following:

1. That the Province of Manitoba considers adapting the RBG for use by Manitoba municipalities, conservation districts and planning districts, with due consideration to the following:

    a. Designating a provincial department to coordinate local risk assessment and mitigation planning and plan implementation using the RBG or similar tool.

    b. Encouraging the formation of partnerships at the local level to share resources and avoid duplication of effort;

    c. Assessing the potential for, and implications of, making climate risk assessment and adaptation/mitigation planning a mandatory undertaking by municipalities and planning districts as, for instance, a component of municipal or district development plans and planning processes.

2. That local governments and planning authorities be advised of the availability of the RBG and provided with links to various web-sites where copies of the manual and its derivatives can be down-loaded.

3. That CONWS and MLG consider partnering with a willing municipality or planning district to run a pilot project involving a comprehensive application of the RBG process.

4. That support networks for applying the RBG process be established to foster collaboration and efficiency of assessment efforts, with government playing a role in facilitating this partnership/collaboration process.

1.0 INTRODUCTION

Recent climate change assessments reveal that Manitoba and the rest of the Prairie Provinces will experience an increased risk of water scarcity and variability of water supply in the future. This includes the potential for more frequent and extreme weather events that cause flooding and excess moisture conditions within river floodplains and across landscapes.

Manitoba is currently implementing the Prairies Regional Adaptation Collaboration (PRAC), a joint initiative of the provinces of Alberta, Saskatchewan and Manitoba, along with Natural Resources Canada (NRCan) and the University of Regina. The PRAC is seeking to enhance the adaptive capacity of provincial and local decision makers by integrating climate change adaptation strategies into decision-making involving water resource management, drought and excessive moisture (DEM) planning, and terrestrial ecosystem management.

One of the PRAC's focus areas is to address policy and planning issues related to the impacts of climate change on municipal governments and the rural landscape. Specifically, how will the risks of climate change, particularly increased moisture and flooding and/or more severe and frequent drought events affect planning and decision-making at the local level?

One process for taking adaptive action in response to the impacts of climate stage was developed by NRCan, Climate Change Impacts and Adaptation Directorate, in conjunction with the insurance industry's Institute for Catastrophic Loss Reduction. The methodology was first published in 2006 under the title "Adapting to Climate Change – A Risk-based Guide for Local Governments," Hereafter referred to as the "RBG" or, simply, the "Guide," this document outlines a six-step process or framework for undertaking Municipal Adaptation Planning (MAP) and climate risk assessment. The document was produced for NRCan by Summit Enterprises International Inc. and authored by Dr. James P. Bruce and I.D. Mark Egener with assistance from Robert A. Black.

This risk-based guide follows a standard risk management approach and uses Canadian risk management terminology. NRCan is promoting the document as a "national guide" and it is hoped that it will be adopted provincially and adapted for use by municipalities in all climatic regions of the country. British Columbia and Ontario are leading the way in this regard, with both provinces having published their versions of the Guide. Municipal Adaptation Planning is a statutory requirement in BC and the BC Guide is especially useful as a reference tool as it includes a Volume 2 workbook and selected case studies.

In exploring tools to aid Manitoba municipalities and conservation or planning districts in adapting to climate change, the NRCan's Risk-Based Guide has emerged as a leading candidate methodology and was selected by Manitoba Conservation and Water Stewardship and Manitoba Local Government for a trial application. To this end, CONWS and MLG organized an initial MAP workshop on November 2, 2011 in Brandon MB to introduce the Guide process to selected municipalities in the western part of the province including the Trans Canada West Planning District (RMs of Archie and Wallace, the Town of Virden, and the Village of Elkhorn) and the City of Brandon. The November workshop used the results of a pre-workshop, province-wide municipal survey to identify climate change hazards as the basis for introducing workshop participants to the Guide and working through the first two (2) steps of the RBG process. The November 2011 workshop report is included as **Appendix A.**

2.0 STUDY PURPOSE

As a component of their PRAC commitments, CONWS and MLG engaged the project consultants to complete the assessment of the RBG municipal adaptation planning process initiated by the November 2011 workshop. In this context, the objectives of the present study as assigned to the project consultants were to:

- Review the RBG manual and its derivatives like the BC Guide Volume 1 manual and Volume 2 workbook and case studies.

- Review the findings of the November 2011 Brandon workshop related to Steps 1 and 2 of the RBG process.

- Organize a follow-up workshop with municipal representatives in order to work through the intermediate, risk assessment steps in the Guide process (Steps 3 through 5).

- Provide an opinion, based on the consultant's assessment and workshop feedback, on the value and practicability of implementing the RBG process in Manitoba with particular attention to:

    - The workability of the RBG process as a municipal adaptation planning tool;

    - The effectiveness of the RBG in encouraging the integration of climate change adaptation into the existing municipal planning and decision-making processes, and;

- The potential of the RBG in contributing to more comprehensive and coordinated response to the risks of climate change at the local level.

The follow-up workshop was held in Brandon in March of 2012. The workshop focused on "Water Quantity" which was confirmed at the November 2011 workshop as being a climate hazard posing severe consequences for local governments in terms of too little water, i.e. drought, and too much water, i.e. flooding from extreme rain events (EREs). Participants at the March 2012 workshop were tasked with identifying, assessing and evaluating "risk events" associated with Water Quantity over the course of working through steps 3 to 5 of the RBG process.

The March workshop provided the ideal forum for gauging the effectiveness of the RBG process as measured, in a subjective sense, by:

- The ease with which participants were able to understand the mechanics and grasp the intent of the process;
- The ability of the process to facilitate --in a short time frame and without "expert" prompting— the identification of a meaningful range of risk events;
- The "quality" of the information generated by the process given its application by a largely lay audience with respect to climate change;
- The degree of "comfort" with the RBG process exhibited by participants based on the subjective witnessing of the proceedings by the workshop facilitators.

3.0 RISK-BASED GUIDE - PROCESS OVERVIEW

Risk management is the process of identifying, assessing and prioritizing risks and risk responses in the face of uncertainty. The NRCan RBG guide follows the risk management framework provided by the Standards Council of Canada (SCC) and described in the Canadian National Standard System publication CAN/CSA-Q850-01. The RBG describes a risk-based approach that regional and local communities can employ in adapting to climate change through a combination of long-term planning and short-term actions. The Guide also explains how the RBG's risk management process can be used as a straight-forward, quick and logical way to identify workable options for adapting to the risks of climate change at the local level.

The Guide follows the six (6) basic steps of classical risk management as illustrated in **Figure 1** and outlined in the following paragraphs:

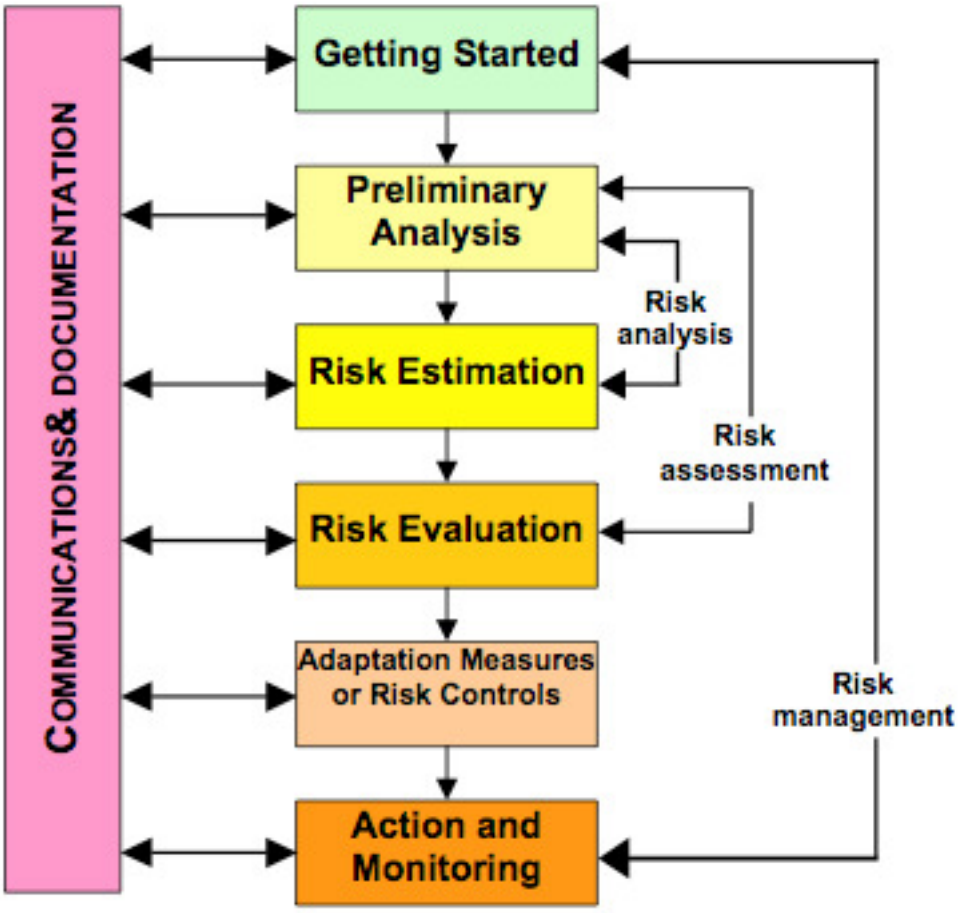


Figure 1: Risk Management Process (*Source: RBG*)

3.1 STEP 1: Getting Started

This step initiates the risk management process by:

- Identifying specific climate hazards and their associated risks to people, property or the environment.
- Establishing the project team or risk management team and identifying principal stakeholders that may be affected or involved;
- Identifying the resources required to undertake the MAP process and determining the responsibilities of the members of the project team;
- Developing a work plan and communications plan, and;

- Establishing a permanent "library" for information collected throughout the project and for future reference including climate information, data used to analyze the risks, a record of decisions taken, views of the people or groups that may be affected, records of meetings, and any other information pertaining to the risk management process.

The Decision Diamond: Illustrated in **Figure 2**, the RBG process calls for a decision to be made at the completion of each step to: a) end the process if the risk management team finds that the identified hazards and related risks are of a low frequency, a low consequence, or both (i.e. acceptable); b) repeat the step on the basis of new information, or; c) continue to the next step in the process if the identified risk events remain a concern. The manual calls for this "decision diamond" to be thought through at the completion of each stage in the process.

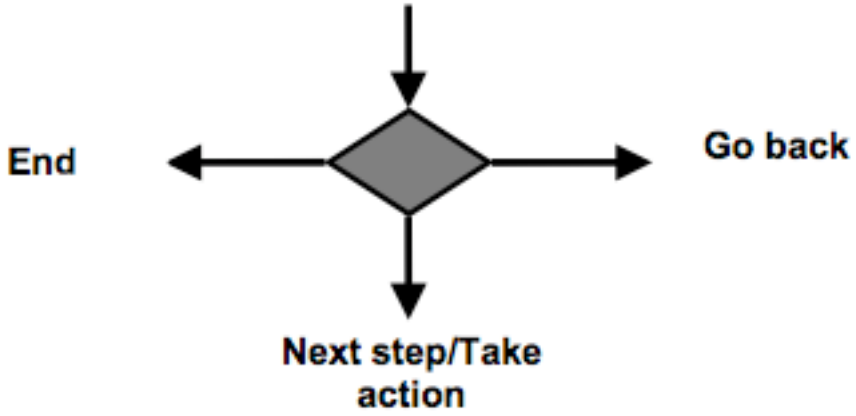


Figure 2: The Decision Diamond (*Source: RBG*)

3.2 STEP 2: Preliminary Analysis

This step begins the risk assessment part of the process by initiating a detailed examination of the risk events through:

- The development of risk scenarios or a sequence of "risk events" that could result from the climate hazards and vulnerabilities;

- Analyzing the risk events or scenarios by identifying the types of losses or impacts that could result, such as:

    - Injuries or deaths and health losses due to illness;

    - Property and economic losses;

- Cultural impacts, and;
- Environmental or ecosystem losses or impairment.

The above risk scenarios form the basis for the risk estimations and risk evaluations to be undertaken in Steps 3 and 4. The manual provides the following table (**Figure 3**) for compiling the risk scenarios and events, their estimated frequency and consequences, and possible adaptation or mitigation measures.

HAZARD: .

RISK	EVENT OR RESULT	FREQUENCY			CONSEQUENCE			COMMENT or POSSIBLE CONTROL
		1	2	3	1	2	3	
	Add as many rows as needed for each risk							
Add as many rows as needed								

Notes: Make rough estimates of (these will be expanded in Step 3)

Frequency:

1. Unlikely to occur
2. Moderately frequent occurrence
3. Almost certain to occur

Consequences:

1. Low
2. Moderate
3. High

Figure 3: Preliminary Hazard and Risk Scenario Assessment Table (*Source: RBG*)

3.3 STEP 3: Risk Estimation

In Step 3 thorough consideration is given to the probability, frequency and consequences of the risk events or risk scenarios based on the initial estimates that were developed in Step 2. This stage of the process includes:

- Assessing the quality of data and seeking additional information or input if some aspect of the data is in doubt;

- Estimating the frequency or probability of the possible outcomes on a scale of "unlikely to occur" to "virtually certain to occur." (**Figure 4**) This analysis is accomplished with the help of historical data, current research, expert judgment, experience, intuition, or other practicable and credible methods;

- Determining the magnitude of the various risk scenarios on a scale of "very low" to "very severe," (**Figure 5**) and;

- Assessing the "perception" (i.e. degree of acceptability or concern) of risks on the part of people or groups who might be affected (**Figure 6**).

The "decision-diamond" options that have to be considered at the end of this step call for the project team to:

- End the process if the estimated risks are much lower than initially perceived in the preliminary analysis and stakeholders are in agreement that they don't pose any significant concerns;

- Go back to previous steps if new information needs to be considered or if key stakeholders are not comfortable with the level of uncertainty associated with the analysis, or;

- Proceed to Step 4 if the risk management team is comfortable with the data, assumptions and outcomes of the risk estimation process.

The RBG manual provides the following tables for use in recording the risk estimation information.

Probability or Frequency / Event	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain to Occur
Events from scenario (list each)	Not likely to occur during the planning period	May occur sometime but not often during the planning period	Likely to occur at least once during the planning period	Likely to occur several times during the planning period	Happens often and will happen again during the planning period

Note: If the event is ongoing the frequency should be related to it reaching a more severe level than what is occurring now.

Figure 4: RBG Manual Table 3.1 - Frequency/Probability Rating (*Source: RBG*)

Impact / Degree	Social factors				Economic factors			Environmental factors			
	Health & Safety	Displace-ment	Loss of Livelihood	Cultural Aspects	Property Damage	Financial Impact	Impact on community	Air	Water	Land	Eco-systems
Very low											
Low											
Moderate											
Major											
Very Severe											

Figure 5: RBG Manual Table 3.2 - Impact Rating Matrix (*Source: RBG*)

Climate Factors: (Hazards)	Risk Scenarios - Aspects of Hazards and Risks to Community	Stakeholders and perception of Risk
	Use a many rows as needed	

Figure 6: RBG Manual Table 3.3 - Risk Perception Table (*Source: RBG*)

3.4 STEP 4: Risk Evaluation

In this step, the project team ranks each risk scenario according to its impact severity, from "very low" to "extreme," and frequency/probability from "very unlikely" to "virtually certain." The RBG manual provides users with a Risk Evaluation Matrix for use in ranking the risk events or scenarios, reproduced below as **Figure 7.** The frequency/probability ranking comes directly from the **Figure 4** table in Step 3. The impact severity ranking is based on a review and averaging of the full range of risk scenario impacts compiled in the **Figure 5** Impact Rating Matrix.

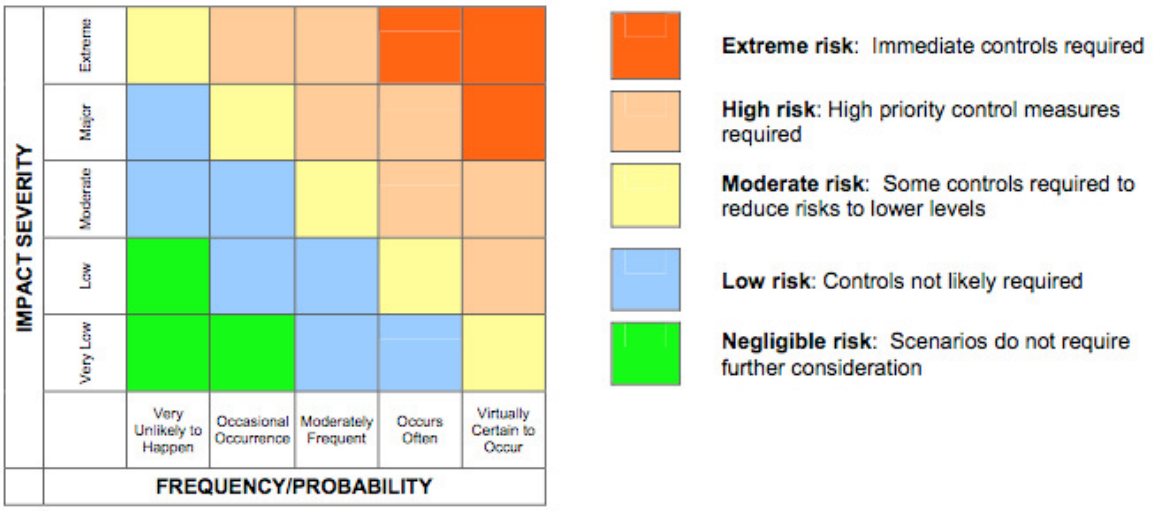


Figure 7: RBG Risk Evaluation Matrix (*Source: RBG*)

Risk	Control or Adaptation Measure (Use as many rows as needed	Time Frame	Cost	Effectiveness	Acceptability	Comment / Evaluation

Figure 8: RBG Risk Controls and Adaptation Measures (*Source: RBG*)

The Step 4 risk evaluation includes the following major components:

- Assessing each risk according to its potential costs and public perceptions;
- Considering the needs, issues and concerns of the principal stakeholders that may be affected or involved;
- Ranking the risk events or scenarios for purposes of ruling out low frequency/low consequence risks while identifying unacceptable risks that require risk reduction or control measures.

3.5 STEP 5: Risk Controls and Adaptation Decisions

Step 5 includes:

- Identifying feasible adaptation measures or risk control strategies for eliminating or reducing unacceptable risks to acceptable levels;
- Estimating the costs (order-of-magnitude) and benefits of the risk control measures;
- Assessing any outstanding stakeholder concerns, and;
- Developing a communication strategy for conveying information to the general public for the proposed risk control measures.

The RBG manual provides the following table (**Figure 9**) for recording information related to risk controls and adaptation measures.

Risk (Use as many rows as needed)	Control or Adaptation Measure (Use as many rows as needed)	Time Frame	Cost	Effectiveness	Acceptability	Comment / Evaluation

Figure 9: Risk Controls and Adaptation Measures. (*Source: RBG*)

The decision options at the end of this step call upon the risk management team to:

- End the process if there are no feasible adaptation options;
- Go back to previous steps if new information is required to make a decision and assumptions and uncertainties associated with estimates are not acceptable to key stakeholders, or new unacceptable risks will be introduced if the proposed control options are implemented, or;
- Proceed to Step 6 if feasible adaptation or risk control measures are defined and can be implemented and proposed control options and residual risks are acceptable to stakeholders.

3.6 STEP 6: Implementation and Monitoring

The final step in the RBG is the implementation and monitoring component. The Guide recommends that this step only be embarked upon once a Draft Risk Management Plan has been reviewed and approved by the responsible senior administrator and/or municipal council.

This final step involves:

- Developing an outline implementation plan;
- Identifying links with ongoing activities in the community and beyond (e.g. local, regional or national activities);
- Identifying resources to implement the plan;
- Establishing an effective monitoring and review program;
- Submitting an Draft Risk Management Plan or implementation plan for approval, and;
- Developing a communication strategy to support the plan and its implementation.

4.0 RISK-BASED GUIDE – PROCESS WORKSHOP

4.1 WORKSHOP CONTEXT

This section of the report describes the March 2012 MAP workshop held as part of the current study featuring NRCan's Risk-Based Guide for Local Governments (RBG). The

workshop was attended by representatives of municipal and provincial governments, planning and conservation districts, academia, non-government organizations and other stakeholders with interests in southwest Manitoba as it relates to climate change adaptation. Municipal representatives attended from urban municipalities of Brandon, Virden and Elkhorn and the Rural Municipalities of Wallace and Archie. The workshop agenda is attached as **Appendix B**, while the list of workshop participants is attached as **Appendix C**.

The initial November workshop aligned with a PRAC Drought and Excessive Moisture (DEM) planning task of providing decision-makers with ideas for incorporating strategies aimed at improving resilience, increasing preparedness and enhancing policies, programs, plans, and regulations. The DEM-related activities undertaken in Manitoba in partial fulfillment of its PRAC commitments focus on:

- Improving the adaptive capacity of provincial and municipal governments, planning districts and other stakeholder groups, and;
- Encouraging the integration of "adaptive planning" with local decision-making, land use planning and development endeavors in order to increase local resiliency to the impacts of climate change.

The November workshop was organized around the theme, "Preparing for Current and Future Vulnerabilities: Climate Impacts and Adaptation." The objectives of this initial workshop were broad, and included:

- Increasing the awareness and understanding of climate change impacts on Manitoba with specific reference to key vulnerabilities in the southwest region of Manitoba;
- Identifying existing and potential policy, planning and operational vulnerabilities to current and future climate change, variability and extremes;
- Gaining knowledge of existing climate adaptation planning processes and best practices employed in similar jurisdictions in Canada;

- Summarizing pre-selected adaptive planning processes, and;
- Seeking consensus on a shared approach for sustaining an adaptive planning endeavor in the targeted region.

4.2 WORKSHOP PURPOSE

The March 2012 workshop was a continuation of CONWS and MLG's "Municipal Adaptation Planning Workshop" held in November 2011 to introduce NRCan's Risk-Based Guide, a municipal adaptation-planning framework. To reiterate, the RBG approach involves a logical, 6-step risk management process: 1) Getting Started; 2) Preliminary Risk Analysis; 3) Risk Estimation; 4) Risk Evaluation; 5) Risk Adaptation Measures and Controls, and; 6) Action and Monitoring. The November workshop introduced participants to the first two (2) steps in the process. The follow-up workshop in March applied the intermediate risk assessment steps in the RBG process (Steps 3-5) to critical risk scenarios identified in November 2011.

The goals of the workshop were to increase awareness and understanding of climate change impacts to Manitoba, specifically in the southwest region of Manitoba, and to gain knowledge of climate adaptation planning processes and best practices through the application of NRCan's RBG.

4.3 WORKSHOP SYNOPSIS

Workshop Introduction: Jeff O'Driscoll of Associated Engineering opened the workshop by welcoming participants and outlining the day's activities.

Katy Walsh of Manitoba Local Government provided background on the Prairies Regional Adaptation Collaborative (PRAC) and its partner agencies and their activities aimed at helping municipalities and the resource sector formulate adaptation strategies that respond to the anticipated regional impacts of global climate change.

Brandon Mayor Shari Decter-Hirst welcomed the participants. Her Worship emphasized the need to increase the understanding of climate change risk- based adaptation to avoid or minimize any associated socio-economic and environmental impacts on the communities.

Workshop Groups:

The workshop participants were divided into two groups, a "Flood" group and a "Drought" group. Each group undertook risk estimation, evaluation and adaptation exercises for flood or drought risk events or scenarios. Ross Mitchell (GENIVAR) facilitated the drought group and Jeff O'Driscoll (Associated Engineering) facilitated the flood group.

Session 1: Roger Rempel (Stantec) recapped the November 2011 workshop and presented a PowerPoint overview of the RBG Municipal Adaptation Planning (MAP), risk management process. Mr. Rempel explained the need to understand and manage risks due to climate change and defined the key terms that would be used over the course of the workshop.

Mr. Rempel explained the RBG Step 3: Risk Estimation process, including identification and assessment of vulnerabilities. He provided instructions on how each group would be expected to use the RBG tool to estimate risk events related to flood or drought. Mr. Rempel's PowerPoint presentation is attached as **Appendix D.**

Group Working Sessions (RBG Steps 2 and 3): Mr. Rempel provided group instructions prior to each breakout session prior to the start of each exercise. To begin, each group was asked to identify a list of risk events that could result from the impact of flooding or drought. This start-up exercise essentially reprised Step 2 of the RGG process undertaken in the November workshop. At the end of the session, four flood risk events four drought risk events were selected for closer examination in Step 3 of the RBG: Risk Estimation.

With the risk events identified, the groups proceeded to Step 3 of the process whereby each event was assigned a frequency and severity rating following group discussion. This involved a series of tasks:

Task 1: Participants assigned a frequency (likelihood) rating factor for the given event or possible outcome.

Task 2: For each of the consequence categories (e.g., social, economic, and environmental), relative estimates were made as to how severe the consequences are expected to be in each of the key impact categories. Consequence rankings were then assigned.

Task 3: Participants provided an opinion on stakeholder perceptions, or key concerns relative to the impact of the event, in consideration of social, economic and environmental factors.

Task 4: Each group reviewed their consequence ratings and chose the highest rating across the various factors as the overall consequence rating.

Plenary review: Brad McIntosh (City of Brandon) from the flood group and Ted Snure (City of Brandon) from the drought group provided a brief discussion on the process of risk estimation and the risk events their respective groups selected as a direct impact of flooding or drought. Participants from both groups then commented on the process of assigning frequency and severity ratings.

Greg Neelin (Assiniboine Community College) acknowledged that it was necessary to spend time understanding the key terms used in the RBG as it made the risk estimation process easier to understand.

Ted Snure suggested that the public is mostly engaged in the severity of the risk events and there is a need to educate people on causal hazards and associated impacts.

Stella Fedeniuk (Agriculture and Agri-Food Canada) and Dan Mazier (Keystone Agricultural Producers) echoed a concern as to whether frequency ratings should be assigned based on climate event or impact.

Roger Rempel clarified that there is flexibility in the case of this workshop where we are using historical events and personal experience to reflect on frequency and severity ratings.

He also commented that during the risk evaluation step, if it seems a risk associated with an event was over- or-underestimated, the risk estimation for that event should be reviewed and re-assessed.

Jeff O'Driscoll (Associated Engineering) noted that the RBG tool encourages the involvement of stakeholders from different backgrounds when assessing the risk and reviewing the adaptation options. This is important as a particular event could pose a high risk for a specific stakeholder as compare to the general public. Therefore, input from all stakeholders is important while reviewing the adaptation options.

Session 2: Roger Rempel (Stantec) presented background on RBG Step 4: Risk Evaluation. This included instruction on ranking risk scenarios by considering each risk in terms of costs, benefits and acceptability, while considering the needs, issues and concerns of the people or groups affected or exposed to that risk.

Mr. Rempel also provided the instructions for using the risk evaluation matrix in the group working sessions.

Group Working Session: Based on the frequency and severity ratings of the event each group assessed the risk intensity by populating the risk evaluation matrix. The participants in each group then discussed and prioritized the risk events based on their evaluation.

Plenary review: A participant from each group provided a brief discussion on the process of risk evaluation of the events based on the risk estimation from the earlier session.

Session 3: Roger Rempel (Stantec) explained the process of risk controls and adaptation options for a particular risk event. He stressed the importance of a balanced approach to managing climate and non-climate risks, and the need to focus on high priority risks. Mr. Rempel then provided instructions on the process of adaptation planning to the working groups.

Group Working Session: Workshop participants in each group brainstormed different risk controls and adaptation measures for a particular risk event. This also included discussions on the cost, effectiveness, and acceptability of each adaptation option or control measure considered for a particular risk event.

Plenary review: Stella Fedeniuk (Agriculture and Agri-Food Canada) from the flood group and Dan Mazier (Keystone Agriculture Producers) from the drought group presented the adaptation measures for the particular events discussed in their respective groups. This plenary session concluded the workshop.

Closing Remarks: Jeff O'Driscoll thanked all the participants and the planning team. He emphasized that the workshop aimed to provide a better understanding of one particular MAP tool, NRCan's RBG, that municipalities, planning districts and conservation districts can use for climate change risk identification, estimation and evaluation. Moving forward, Mr. O'Driscoll stressed that the next steps would be to continue the municipal adaptation planning process by using this and other tools available to better understand the risks associated with climate change while identifying risk controls and adaptation options.

A number of participants commented that workshop was well organized and provided a better understanding of the climate change adaptation planning process.

Dan Mazier (Keystone Agriculture Producers) commented that a province-wide water management strategy was necessary that would include risk controls and adaptation planning measures related to climate change. He stressed the importance of the Province undertaking such a study in order to help avert major impacts and costs related to climate change events.

Brad McIntosh (City of Brandon) commented that the workshop was very informative and similar workshops should be recognized for professional learning credits under the Association of Professional Engineers and Geoscientists (APEGM) continuous learning program.

Workshop Findings: The following workshop materials are provided in the appendix:

- **Appendix E.1: Group Session Worksheets – Drought Group.**
- **Appendix E.2: Group Session Worksheets – Flood Group**
- **Appendix F: Worksheet Summaries.**

Workshop Exit Survey: An on-line workshop exit survey was completed by nine (9) workshop attendees. Selected responses are provided below.

- Seven (7) of the nine (9) respondents believed that the workshop increased their knowledge and understanding of the potential impacts of climate change on their communities.
- Six (6) respondents felt that the workshop provided them with a working knowledge of the RBG process.
- Six (6) respondents believed that the RBG process was user friendly, but requires considerable time and dedicated effort to employ in a meaningful way.
- Four (4) respondents felt that application of the RBG process in their communities would be difficult given either their current level of financial and staff resources or their time constraints.
- Six (6) respondents felt that climate change adaptation was receiving a "moderate" priority by their respective municipalities.
- Seven (7) respondents felt that the RBG process should be run at a regional level.
- Most respondents felt that the RBG process would have its greatest value in:
    - Incorporating climate change adaptation planning into other planning processes;
    - Conveying information on climate change impacts;
    - As a vehicle for engaging with other government departments and agencies;
    - As a high level starting point for climate risk adaptation, and;
    - Identifying stakeholders and determining who should be "at the table."
- Six (6) respondents thought they would like to know what other risk assessment tools are available before signing on to the RBG process.
- Respondents felt that the following factors were necessary in order to begin engaging in climate risk assessment and adaptive planning:

  - Provincial direction/facilitation/coordination;
  - Financial assistance;
  - Local leadership, and;
  - A greater sense of urgency.

- Six (6) respondents believe that the RBG process is most useful for Identifying what can be accomplished at a grass-roots level and getting people thinking and talking about climate change.
- Three (3) respondents felt that the RBG process was "not very useful" in the absence of provincial involvement and oversight.

In responding to Question 9, the only open-ended question on the survey, respondents listed the following areas where they believed local governments were best able to respond to climate change risks given jurisdictional limitations:

- Local bylaws for improved water conservation and water management.
- Education and public awareness.
- Integration with mid- to long-term planning.
- Development or updating of emergency measures plans and procedures.
- Control of local flooding and improved land drainage.
- Improved water supply infrastructure.
- Zoning changes.
- Considering risk mitigation in infrastructure design and construction.
- Prepare or update flood risk mapping.
- Prioritize resources for implementing localized improvements and risk mitigation measures.
- Promote program for recognizing Ecological Goods and Services that would attach a monetary value of restoring wetlands or containing storm runoff on farm land.
- Promote partnerships for developing BMP's related to DEM.
- Develop regional-scale sewer, water and land drainage infrastructure to build in resiliency, help spread climate risks and dampen localized impacts.

The unedited survey results are provided in Appendix G.

5.0 RBG PROCESS - OBSERVATIONS AND RECOMMENDATIONS

The following comments and observations flow from the consultant team's review of the RBG MAP process, its experience in working with the Guide in conducting the March 2012 workshop, and remarks made by workshop participants with reference to the process itself.

The RBG process offers teams tasked with assessing climate vulnerability several important benefits:

1. **User Friendly**: The Guide provides municipalities and planning authorities with a user-friendly process for identifying, assessing, evaluating, and prioritizing risks associated with climate change.

2. **Straightforward**: In the consultant's estimation, the RBG process can be conducted by most organizations without benefit of "expert" input in areas such as climate data and risk analysis.

3. **Scalable Process**: The RBG process is "scalable" depending upon the size, sophistication and resources of a particular user group. It also offers capacity to address issues related to trans-boundary/inter-jurisdictional and ecosystem-wide impacts and linkages.

4. **Introduction to Climate Change**: The Guide identifies the critical climate change variables like temperature, precipitation, EREs. In this way the guide provides an introduction to the basic precepts of climate change, but only to the level of detail necessary for running the process. Users, typically laypeople, should not feel overwhelmed by the science behind the forecasts.

5. **Logical Framework**: In addition to the risk evaluation process, the Guide provides users with a framework for setting up the administrative infrastructure and procedures necessary for sustaining a MAP effort over the long term. To this end, the guide provides direction and advice in a number of key areas including:

    a. Stakeholder identification;

    b. Leadership structure (committee and/or risk-specific sub-committee structure);

    c. Document/data base assembly and management;

    d. Community engagement and communication;

e. Formulation and implementation of adaptation plan(s), and;

f. Ongoing monitoring of MAP activities and progress.

6. **Rapid Deployment**: The Guide MAP process can be deployed rapidly, as a high level, quick scan for eliminating low frequency-low consequence risks. This initial process could be conducted by a committee comprised of representatives from major stakeholder groups. The RBG process can then be re-applied with a greater degree of precision on high frequency/high consequence risks, at a sub-committee level if necessary. This enables users to quickly focus efforts and resources on critical-risk areas.

7. **Implementable Actions**: The Guide enables municipal users to tailor their adaption strategies and related implementation plans to their particular jurisdictional and operational limitations in consideration of legal or decision-making authority and financial and administrative resources.

8. **Partnerships**: The Guide MAP process makes it apparent where partnerships and inter-jurisdictional cooperation will be essential for efficient and cost-effective adaptation and mitigation planning and plan implementation.

9. **Terminology:** While the RBG process requires a consistent understanding and application of terminology to be effective to avoid confusion by process participants, once this terminology is accepted and understood, the process provides ample opportunity for participants who may be unfamiliar with the topic of climate change adaptation, to engage in and contribute effectively to the process.

Concluding Remarks: The relative simplicity of the RBG MAP process compared to other risk assessment tools is not without its drawbacks. The benefit of information obtained from a one- or two-day RBG process might be limited, by its generality, to identifying areas needing a more focused risk assessment and evaluation effort. Moreover, while the tables provided by the guide are extremely helpful to those facilitating and participating in the process, the tendency might be to regard the RBG process as complete when the tables are filled in. On the contrary, while useful for focusing the discussions and recording key information, the tables cannot capture the nuances of discussions concerning a complex issue like climate risks and the multitude of related impacts and community/stakeholder perceptions. This is especially true in the case of the Step 3 Impact Rating Matrix, wherein the generality of the socio-economic and environmental factors included in the table makes it difficult to rate a particular risk event's severity.

It should also be noted that the RBG process, while encouraging a somewhat linear process of assessment, does not insist upon it. With effective facilitation, a circular or iterative flow to the assessment is possible and supported by the RBG process.

The RBG process should be undertaken as a starting point for municipal adaptation planning, one that will identify where more detailed analysis is necessary leading up to Step 5: Risk Controls and Adaptation Measures and the all-important Step 6: Risk Management Plan Implementation and Monitoring.

A thorough application of the RBG process offers communities a practical, accessible, documentable and reproducible framework for enabling the assessment of impacts affecting municipalities with respect to climate change vulnerability. Additional value can be gained by using the RBG process to support the integration of adaptation with ongoing planning and development processes. Many of the steps conducted in the RBG process support municipal planning efforts. This enables municipalities, planning districts and conservation districts to adapt the RBG process to their particular circumstances depending upon their sophistication and the level of resources available for undertaking climate risk management.

The accessibility of the RBG process, combined with sufficient interest by municipalities in applying RBG in their own planning processes, could result in a scenario where support networks could be established to foster collaboration in data gathering, policy development and mitigation option assessment. Support networks could include other organizations such as the Association of Manitoba Municipalities (AMM) and the Manitoba Conservation Districts Association (MCDA), with the government playing a role in facilitating this partnership/collaboration process.

APPENDIX A

November 2011 Workshop Report

SUMMARY REPORT

MUNICIPAL ADAPTATION PLANNING WORKSHOP

Preparing for Current and Future Vulnerabilities: Climate Impacts and Adaptation

November 2, 2011
Victoria Inn Hotel and Convention Centre
3550 Victoria Avenue
Brandon, Manitoba

Project Sponsors and Partners:

EXECUTIVE SUMMARY

In partnership with the City of Brandon, Rural Municipalities of Archie, Wallace, Virden Town, Elkhorn Village and Manitoba Local Government, Manitoba Conservation's Climate Change Branch held a one-day Municipal Adaptation Planning Workshop at the Victoria Inn Hotel and Conference Centre in Brandon, Manitoba on November 2, 2011. As a key activity under the drought and excessive moisture theme area of the Prairies Regional Adaptation Collaborative (PRAC), the workshop had a theme "*Preparing for Current and Future Vulnerabilities: Climate Impacts and Adaptation*".

The PRAC, a joint project with Alberta, Saskatchewan, Natural Resources Canada and the University of Regina, seeks to increase capacity of decision-makers in integrating climate change adaptation into water resources management, terrestrial ecosystem management and drought and excessive moisture planning.

The workshop aimed to promote increased awareness and understanding of climate change impacts to Manitoba, specific to the southwest region of Manitoba and vulnerable sectors; identify existing and potential policy, planning and operational vulnerabilities to current and future climate change, variability and extremes; gain knowledge of existing climate adaptation planning tools, processes and best practices among similar jurisdictions in Canada and beyond; and develop a consensus of shared approach for further adaptive planning in the targeted region. The activity was attended by 31 participants representing municipal governments, Conservation and Planning Districts, provincial/federal government departments/agencies, academia and non-government organizations within the region.

The one-day workshop was structured into presentations that provided the context and breakout group discussions that allowed the participants to review and validate the online municipal needs assessment and pre-workshop survey results on current and future climate change risks. Hazard/risk assessment focused on key climate impacts on water quality and quality, ecosystem and infrastructure. The participants also provided frequency and consequence ratings to identified climate impacts/risks using a scale of low, medium and high and identified current and potential adaptation options to address those risks.

Common themes that were surfaced in the breakout and plenary sessions centered on:

- Climate data
- Adaptive strategies
- Communication and knowledge
- Collaboration, partnerships and financing

Breakout group outputs were then presented to plenary, and followed by observations from the participants. The final plenary revolved around the themes of priority climate risks and vulnerabilities, policy planning and strategy development and municipal decision-maker engagement and recommendations on ways to advance municipal adaptation planning for the southwestern Manitoba region. This was followed by the concluding remarks from the overall facilitator and the workshop planning team lead.

INTRODUCTION

As part of Manitoba's component of the larger Prairie Regional Adaptation Collaborative (PRAC), a series of climate adaptation planning workshops and related information sharing and planning activities were planned with three regions or local governments: City of Winnipeg, City of Brandon and the four municipal governments of Virden, Elkhorn, and RMs of Archie and Wallace.

The PRAC, a joint undertaking with Alberta, Saskatchewan and Manitoba, Natural Resources Canada and the University of Regina, aims to build capacity of decision-makers to incorporate climate change adaptation into decision-making related to water resources management, terrestrial ecosystem management and drought and excessive moisture (DEM).

The objective of the PRAC DEM planning task is to provide decision-makers with recommendations to incorporate into existing, or the development of new, policies, programs, plans, regulations and strategies aimed at improving resilience, increasing preparedness and enhancing response effectiveness. DEM activities in Manitoba focus on increasing awareness and capacity of provincial and municipal governments, planning districts and other stakeholder groups to initiate adaptive planning actions on land-use and municipal planning that increase local resilience.

To achieve this, Manitoba PRAC organized a Municipal Adaptation Planning Workshop with the theme, "Preparing for Current and Future Vulnerabilities: Climate Impacts and Adaptation". The workshop was attended by 31 representatives of municipal and provincial governments, planning and conservation districts, academia, non-government organizations and other stakeholders with interests in southwest Manitoba as it relates to climate change adaptation.

WORKSHOP OBJECTIVES

The one-day workshop sought to:

1. Increase awareness and understanding of climate change impacts to Manitoba and specific to the southwest region of Manitoba and key vulnerable sectors
2. Identify existing and potential policy, planning and operational vulnerabilities to current and future climate change, variability and extremes
3. Gain knowledge of existing climate adaptation planning processes and best practices among similar jurisdictions in Canada and beyond
4. Summarize pre-selected adaptive planning process and tool/guide to use; and
5. Develop a consensus of shared approach for further adaptive planning in the targeted region.

Shown in Annex 1 is the workshop agenda.

HIGHLIGHTS OF THE WORKSHOP

Opening Remarks

Mayor Shari Decter- Hirst
Brandon City, Manitoba

Mayor Shari Decter-Hirst welcomed the participants. She stressed that the recent historic spring flooding experienced in Brandon highlighted the need to increase understanding on climate change and its impacts on the local economy and communities and to incorporate climate change into city plans. The Mayor also underscored the importance of developing a communication strategy as an integral element of any intervention, noting that getting the right information is key to people's awareness and action. She further added that there is a need to work closely with the research community.

In conclusion, the Mayor also outlined the city government's legislative agenda and flood mitigation initiatives such as riverbank restoration and dike construction. She also emphasized the need to address downstream and upstream and inter-jurisdictional issues related to Souris River, to foster collaboration with producers and other stakeholders on developing the city's comprehensive flood mitigation plan and downtown revitalization.

Workshop Overview

Mr. Sheldon McLeod, the workshop facilitator, presented the workshop overview – objectives, agenda and timeline, and facilitated the presentations, breakout group sessions and plenary discussions throughout the workshop with the assistance of other facilitators from International Institute for Sustainable Development and Brandon City government.

Presentations

Mr. Randall Shymko
Climate Change and Environmental Protection
Manitoba Conservation
Presentation: **Project Overview**

To set the overall context of the workshop, Mr. Randall Shymko, Manitoba Conservation, provided a brief overview of the Prairies Regional Adaptation Collaborative (PRAC), its goal, key theme areas, expected outcomes and the proposed DEM municipal adaptation planning framework and processes for southwestern Manitoba municipal partners. He then shared the key results and findings of the on-line municipal adaptation needs and pre-workshop risk assessment surveys. He ended his presentation with an overview of preferred actions on advancing adaptation actions based on the pre-workshop survey results and the proposed risk-based municipal adaptation planning framework for Manitoba PRAC municipal partners.

Dr. Danny Blair
Principal, Richardson College for the Environment (Acting)
Associate Dean of Science (Acting)
University of Winnipeg
Presentation: **Climate Change in Manitoba: A Review of Science, Trends and Projections**

Dr. Danny Blair provided the scientific context of climate change, exploring the causes, historical and current and projected trends and impacts globally and for Manitoba. He also presented a more detailed description of key climate trends, impacts and projections in Canada, the Prairie region and Southern Manitoba, particularly in relation to precipitation, temperature, snow and rain trends, over a range of time scales. Finally, he presented a summary of projected changes along key variables in Southern Manitoba for 2050s and 2080s.

The link to Dr. Blair's presentation is shown below:

http://dannyblair.uwinnipeg.ca/presentations/blair-climate-change-adaptation-workshop-science-trends-projections-november-2011.ppt

Mr. Jeff O'Driscoll (Associated Engineering) and
Mr. Roger Rempel (Stantec)
Presentation: **How the City of Portage La Prairie Integrated Climate Change into their Water Supply Planning Using the PIEVC Protocol Process**

In their presentation, Engineers O'Driscoll and Rempel provided a brief overview of the water works infrastructure and climate variables that characterized the project area and the risk assessment process undertaken by the city looking into the different components of the study, including engineering analysis. Based on the study outcomes, the presenters outlined the recommended actions- both management and remedial, designed to increase resilience and adaptive capacity of the city's infrastructure.

Shown in Annex 2 are the other presentations made during the workshop.

Breakout Group Discussions: Summary Assessment of Current and Future Climate Risks/Impacts

Breakout Session # 1

The participants were divided into four breakout groups and asked to review, validate and revise the summary charts for current climate risks/impacts based on the pre-workshop survey results and also to populate the blank charts for potential future climate risks. The groupings were made according to four identified key themes/topics: water quantity, water quality, ecosystems and infrastructure. Workshop planning team members and staff from International Institute for Sustainable Development (IISD) facilitated the breakout group discussions. Shown below are the key assessment results of the current and future climate hazards and risks/impacts (Please see Annexes 3a and 3b for more details).

- Climate variability and extreme events result in changes in water quantity and quality (too much or too little water); ecosystem degradation/fragmentation and damage to infrastructure (houses, buildings, roads, drainage, energy and communications, etc.) that have far-reaching implications to Southwestern Manitoba municipalities.

- Identified current climate risks resulting to drought, flooding and ecosystem degradation/fragmentation create a variety of interrelated social, economic and environmental consequences. Social impacts include human displacement (home

evacuations), human /animal loss and diseases and reduced access to basic social services (housing, transportation, drinking water, communications and energy, home care for the elderly, etc.), and rural to urban migration, among others. Economic impacts include decreased production and income, and infrastructure damage, increased operating and maintenance costs, and lack of insurance, etc. Environmental impacts include soil erosion/siltation, nutrient loss, land and water pollution, reduced food safety, and loss/changes in biodiversity, among others.

- In terms of frequency ratings, current risks/impacts associated with changes in water quantity and quality including residential/overland flooding, drought/lack of water, decreased crop production and income losses, human/animal sickness and lack of water supply were rated as medium to high. Livestock morbidity and loss and contamination of wells, and decreased crop yield were given a low frequency rating.

- Most of the identified risks/impacts to water quantity and quality mentioned above were given high consequence ratings, except for livestock/animal morbidity and loss, access to remote pastures, leaching/salinization, home flooding and long-term displacements, and decreased crop yield, which were all rated as low to medium.

- A medium frequency rating was allocated to most of the identified risks/impacts to existing water/wastewater and housing infrastructure and their associated economic costs, whereas transport infrastructure (roads, bridges and culverts), except for road potholes was rated as low.

- More than half of the identified risks/impacts to infrastructure were given high consequence ratings, while residential flooding, other infrastructure-related risks contributing to human injury, reduced access to transport route, and increased home care services for the elderly were rated as medium and risks resulting to natural habitat degradation and increased travel time were categorized as low.

- Identified future risks/impacts to agricultural production were given high frequency ratings, while other future risks/impacts to water quality and quantity were not given ratings.

- Identified risks to ecosystems including soil erosion, increased fire risk and invasive species were given high frequency ratings, though with some disagreement on nutrient loss, being rated as medium frequency by some group members. Changing risks to crop cultivation associated with vegetation shift were rated as medium, while expansion of semi-arid zone and biodiversity shift were categorized as low.

- Potential risk of sewage problems was rated as high, while increased risk of drought was categorized as medium and the risk of water main breaks was rated as low. No frequency ratings were indicated for transport and buildings.

- In general, future risks to infrastructure were considered to have greater consequences than current risks.

- Most of the identified future risks such as soil erosion, water quality changes, vegetation shift and fires were given medium to high consequence ratings, with the expansion of

semi-arid zone being considered as long-term in nature. High consequence ratings were assigned to water and wastewater systems and drought. In general, future risks will have greater consequences than current risks.

Current/Potential Reponses/Opportunities to Address Identified Climate Risks/Impacts

Based on the above risk assessment results, the following were identified as current and potential responses/strategies and opportunities to enhance resiliency:

Knowledge and Communication

- Promote awareness and education of stakeholders (farmers, urban and rural residents, etc.)
- Recognize the holistic and multi-dimensional (social, economic and environmental) nature of climate change adaptation, its causes and effects. Hence, risk and vulnerability assessments need to explore the linkages between urban and rural environments, man-made and natural environment, downstream and upstream localities, and their impacts on ecosystems, sectors and communities (e.g. Winnipeg City flooding discharges sewage into Lake Winnipeg).
- Broaden the definition of ecosystem to encompass man-made environment, including the proper valuation of ecosystem goods and services.

- Improve climate modeling methods (resolution) to provide sound risk and vulnerability assessments

Policy planning and strategy development

- Assess existing infrastructure facilities and systems (roads, bridges, dikes, transport, energy and communications, etc.) and develop long-term (10 years) comprehensive and integrated infrastructure development plans
- Promote strategies that increase infrastructure resilience (e.g. LEED/energy efficiency, small dams, agricultural storage/drainage/irrigation facilities, upgrading/relocation of infrastructure facilities (roads, pipelines; replacement of aging structures; combined/ multiple water/wastewater systems) that link upstream and downstream, rural and urban communities
- Enhance building codes, land-use plans and zoning by-laws
- Promote protection and restoration of natural areas (e.g. wetlands, watersheds) through establishment of shelterbelts and riparian buffers, etc.
- Promote resource conservation strategies such as zero tillage and diversified cropping
- Assess the viability of planting only native species and establish policy and regulation on genetically-modified organisms (GMOs)
- Ensure coordinated land-use and watershed management plans to protect and monitor water sources and riparian areas
- Consolidate and increase housing density to manage urban growth
- Develop long-term and comprehensive flood mitigation and flood management as well as drought management plans
- Promote regionalization of water management services and technology development
- Provide economic incentives to compensate affected landowners to restore/conserve ecosystems (e.g. wetlands)

- Enhance regulations on wetland protection, hunting and fishing to build adaptive capacity
- Develop monitoring programs for land and water resources and infrastructure (transport, energy and communications) use and development
- Promote micro/hydropower development

Decision-maker and stakeholder engagement and partnership

- Promote stronger collaboration and partnership between and among stakeholder groups (e.g., with NGOs like Ducks Unlimited)

Financing and resource generation

- Create new targeted investments in infrastructure (land and water/wastewater) development across the province, including Churchill
- Develop an integrated financial planning and budgeting system
- Taxation and funding available to cities and municipalities

Key Issues and Suggested Next Steps on Advancing Municipal Adaptation Planning

The following were the key issues raised and suggested recommendations during the plenary on ways to move forward with climate change adaptation in southwestern Manitoba:

Knowledge and Communication

- Increased risks of climate change and variability have interrelated social, economic and environmental consequences to water quantity and quality (flooding and excess moisture), ecosystem (pollution, habitat/biodiversity loss, diseases, invasive species) and infrastructure. However, there are also opportunities that can be maximized that will benefit certain economic sectors (e.g., agriculture- excess moisture provides the potential for expanded irrigation).

- In general, many of the sectors, particularly communications, energy sector/power utilities are not climate-focused, highlighting the need to develop long-term plans for infrastructure development, business, agriculture and resource conservation.

- Higher frequency of projected future impacts with greater consequences for infrastructure will require enhanced land-use planning, building codes and zoning by-laws.

- There is a need for more relevant data and information on potential future climate trends (temperature and precipitation changes, soil moisture, etc.) that will provide a good handle for municipal/community risk assessment and adaptation options development.

- There is a need to ensure consistency in the use of adaptation terminology, specifically in relation to the rating scale for “consequence” vs. “occurrence”.

Policy Planning and Strategy Development

- Recognize the complexity of the climate change adaptation issues that encompass different geographic scales and planning (time) horizons and the need to address these issues from a long-term perspective
- Explore the shift from government- to market-based solutions

Decision-maker Engagement

- Engage key decision-makers from Planning Districts and Association of Manitoba Municipalities (AMM) through conversations and dialogues to build awareness and capacity to address interrelated urban and rural and inter-municipal adaptation issues
- Ensure full representation of the different municipalities in adaptive planning and decision-making processes
- Engage the youth sector to promote awareness and action on climate change adaptation

Closing Remarks

Mr. Randall Shymko thanked all the participants, presenters and the planning team. He emphasized that the workshop provided a venue for the convergence of people, process and information from the presenters that were built into the preliminary risk and vulnerability assessment. Moving forward, he stressed that the next steps would be to continue the municipal adaptation planning process that would involve risk estimation, risk evaluation, development of adaptation options and their integration into existing municipal/local planning and alignment with current excess moisture/flood mitigation efforts.

ANNEX 1

MUNICIPAL ADAPTATION PLANNING WORKSHOP

Preparing for Current and Future Vulnerabilities: Climate Impacts and Adaptation

Draft Agenda

8:00 – 8:30 a.m.	**Registration, Coffee/Tea, Muffins/continental breakfast**
8:30 –8:50 a.m.	**Welcoming Remarks** • Hon. Shari Decter Hirst- Mayor, Brandon, TBC
8:50 – 9:00 a.m.	**Workshop Overview: Purpose, Agenda and Timeline; and Introductions** • Sheldon McLeod - Facilitator
9:00-9:20 a.m.	**Overview of Project and Municipal Adaptive Planning Process** • Randall Shymko Manitoba Conservation-Climate Change Branch
9:20-9:30	**Explanation of Break-out Session # 1** • Sheldon McLeod
9:30-10:15	**Break-out Session # 1: Assessing Current Local Vulnerabilities**
10:15:10:30	**Break-out Group Report-Back**
10:30-11:00	**Health Break**
11:00-12:00	**Presentation**: **Climate Science, Recent and Future Climate Trends and Impacts to Manitoba** • **Dr. Danny Blair**, Professor of Geography Acting Associate Dean of Science Acting Principal, Richardson College for the Environment
12:00 – 1:00 p.m.	**Buffet Lunch –**provided
1:00-1:45	**How The City of Portage la Prairie Integrated Climate Change Into Their Water Supply Planning Using The PIEVC Protocol Process** • Jeff O'Driscoll, Associated Engineering • Roger Rempel, STANTEC
1:45-2:30	**Break-out Session # 2: Local Area Vulnerabilities in the future with Climate change considerations**
2:30-3:00	**Health Break (taken at opportune time)**
3:00-3:40	Continued **Break out Session # 2 and Report Back**
3:40-4:15	**Group Session Summary, Next Steps and Closing Remarks** • Sheldon McLeod • Randall Shymko Manitoba Conservation- Climate Change Branch

ANNEX 2

OTHER PRESENTATIONS

Note: For copies of the following documents, please contact Randall Shymko, Climate Change and Environmental Protection Division, Manitoba Conservation and Water Stewardship at: randall.shymko@gov.bm.ca

- PowerPoint Presentation – Preparing for Current and Future Vulnerabilities: Climate Impacts and Adaptation
- Breakout Group Outputs – Current Risks/Impacts
- Breakout Group Outputs – Future Risks/Impacts
- Summary of Breakout Group Assessment – Current Climate Risks and Impacts
- Summary of Breakout Group Assessment – Future Climate Risks and Impacts
- Municipal Adaptation Planning Workshop – Plenary Session Summary

APPENDIX B

March 2012 Workshop Agenda

Prairie Regional Adaptation Collaboration (PRAC)
Municipal Adaptive Planning (MAP) Workshop
Adaptation Planning for Climate Change
Wednesday, March 7, 2012
Victoria Inn Hotel & Convention Centre,
3550 Victoria Avenue, Brandon

Workshop Agenda

8:15 – 8:45 Registration, Coffee & Seating

8:45 – 9:00 Opening Remarks & Introductions

9:00 – 10:15 Overview of the Municipal Adaptation Guide
- Purpose of the day
- Risk management process
- Update on previous workshop

10:15 – 10:30 Refreshment Break

11:30 – 12:00 **Session 1**: Risk Estimation Session
- Risk estimation presentation
- Group work session
- Plenary review

12:00 – 1:00 Lunch

1:00 – 2:30 **Session 2**: Risk Evaluation Session
- Risk evaluation presentation
- Group work session
- Plenary review

2:30 – 2:45 Refreshment Break

2:45 – 3:45 **Session 3**: Risk Adaptation Session
- Risk adaptation presentation
- Group work session
- Plenary review

3:45 – 4:00 Closing Remarks & Next Steps

APPENDIX C

March 2012 Workshop Participants

PRAC MAP Workshop
Adaptation Planning for Climate Change
Brandon, Manitoba
March 7, 2012.

List of Attendees

Tim Gompf	West Souris River CD
Lindsay Hargreaves	City of Brandon
Garth Mitchell	Elkhorn Village
Gregg Neelin	Assiniboine Community College
Kevan Sumner	MAFRI- Brandon
Peter Andersen	Manitoba Local Government
Stella Fedeniuk	Agriculture & Agri-Food Canada
Ramon Sales	Manitoba Conservation, Winnipeg
Katy Walsh	Manitoba Local Government
Ross Mitchell	GENIVAR
Roger Rempel	Stantec
Jeff O'Driscoll	Associated Engineering
Khizar Mahmood	Stantec
Dan Mazier	Keystone Agricultural Producers (KAP)
Ted Snure	City of Brandon
Brad McIntosh	City of Brandon
Ryan Nickel	City of Brandon
Marvin Elder	RM of Woodworth
Arnold Hildebrand	Brandon Environmental Committee

APPENDIX D

RBG Overview PowerPoint Presentation

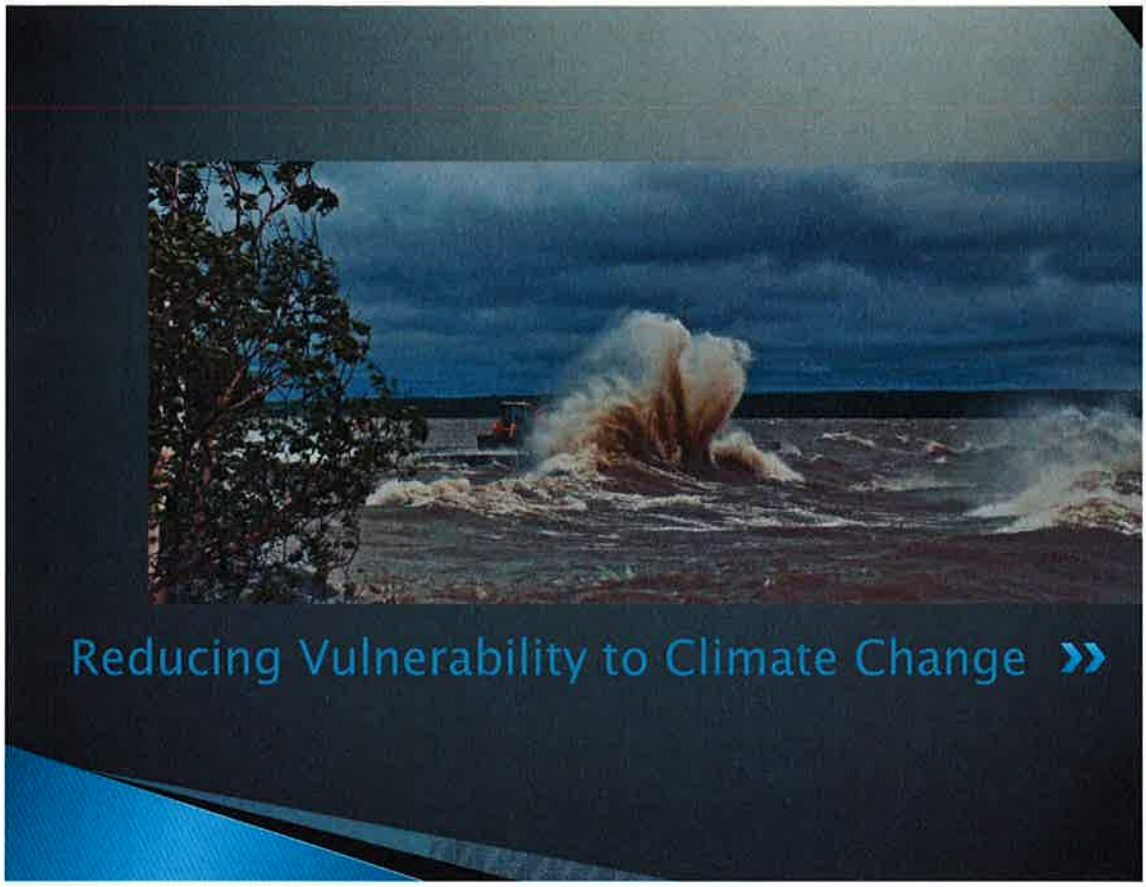
Municipal Adaptive Planning (MAP) Risk Assessment and Adaptation Workshop

A Prairie Regional Adaptation Collaboration (PRAC) Initiative

Brandon, Manitoba, Canada
Victoria Inn, March 7, 2012

Today's Agenda

- Opening Remarks
- Introductions
- Overview of the Municipal Adaptation Guide
  - Goals for today's sessions
  - Overview of Risk Management Process
  - Review of previous Workshop
  - Facilitated Group Working Session: Defining Events for further analysis
  - Next steps
- Risk Estimation
  - Risk Estimation Concepts and Overview
  - Facilitated Group Working Session
  - Plenary Review
- Lunch
- Risk Evaluation
  - Risk Evaluation Concepts and Overview
  - Facilitated Group Working Session
  - Plenary Review
- Identifying Adaptation Options
  - Adaptation Options Concepts and Overview
  - Facilitated Group Working Session
  - Plenary Review
- Closing Remarks and Next Steps



The Goal of Today's Workshop

- Today, we intend to expand on the work initiated in the November Workshop
  - If you weren't a participant, no problem, today's session will build progressively from a common starting point today
- Our analyses today will work to
  - We will examine IMPACTS resulting from the HAZARD of high concern identified from stakeholder survey and workshop in 2011. The Hazard is Water Quantity, the Impacts are Floods and Drought.
  - We will work through remaining Risk Management Steps for the November Workshop
  - Our efforts today will illustrate a structured method of *effective reduction of vulnerability* to the adverse effects of climate change and coordinate options to *enhance adaptive capacity*

The Need to Understand and Manage Risks Due to Climate

- The impacts of a changing and more a variable climate affect almost every aspect of society
- These Climate Impacts create a change in our operating environment, these changes create risk to communities and their:
  - Social networks
  - Economies
  - Cultural activities
  - Environment

GENIVAR

Adaptation and Mitigation

- Adaptation- Measures to reduce impacts from climate change already underway and expected, while maximizing beneficial opportunities (e.g., Prepare for extreme weather conditions such as heat and drought and prepare for extreme events).
- Mitigation - Measures to reduce greenhouse gas sources and emissions and future climate change (e.g., Reduce use of fossil fuels and Reduce emissions from landfill, land-use changes)

This Workshop focuses on ADAPTATION PLANNING, and will not deal with mitigation efforts to manage greenhouse gas emissions (GHG).

GENIVAR

Some Key Terms

- Adaptation to Climate Change: means making adjustments in natural or human systems to reduce harm or exploit benefits arising out of actual or expected climatic changes
- Adaptive Capacity: means the ability, or capacity of a system, region or community to adapt
- Vulnerability: means how susceptible social, economic and environmental systems are to climate change severe events or climate variability

GENIVAR

Some Key Terms

- Hazard: a major change in climatic conditions *e.g. weather variability*
- Impacts: physical outcomes of hazards, *e.g. more intense rain*
- Events: the problem to deal with that arrives at your desk, *e.g. culvert failure*

GENIVAR

Some Key Terms

- Success in Climate Change Adaptation: means *effective reduction of vulnerability* to the adverse effects of climate change and to *enhance adaptive capacity*

By reducing vulnerability through adapting, you make your community more RESILIENT to climate change impacts.

GENIVAR

How to Identify and Understand Impacts and Vulnerabilities?

- Best approach is to apply Risk Management techniques
- Risk Management is a framework used to:
  1. Identify and understand impacts/vulnerabilities of climate change
  2. Estimate and rank risks

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How to Identify and Understand Impacts and Vulnerabilities?

- Risk Management Approach has key benefits:
  1. Process helps us to select the best actions to reduce risks to acceptable levels, even when there are uncertainties about future climate
  2. Offers a simple, practical and credible approach for identifying and ranking risk issues and selecting the best risk-reduction strategies

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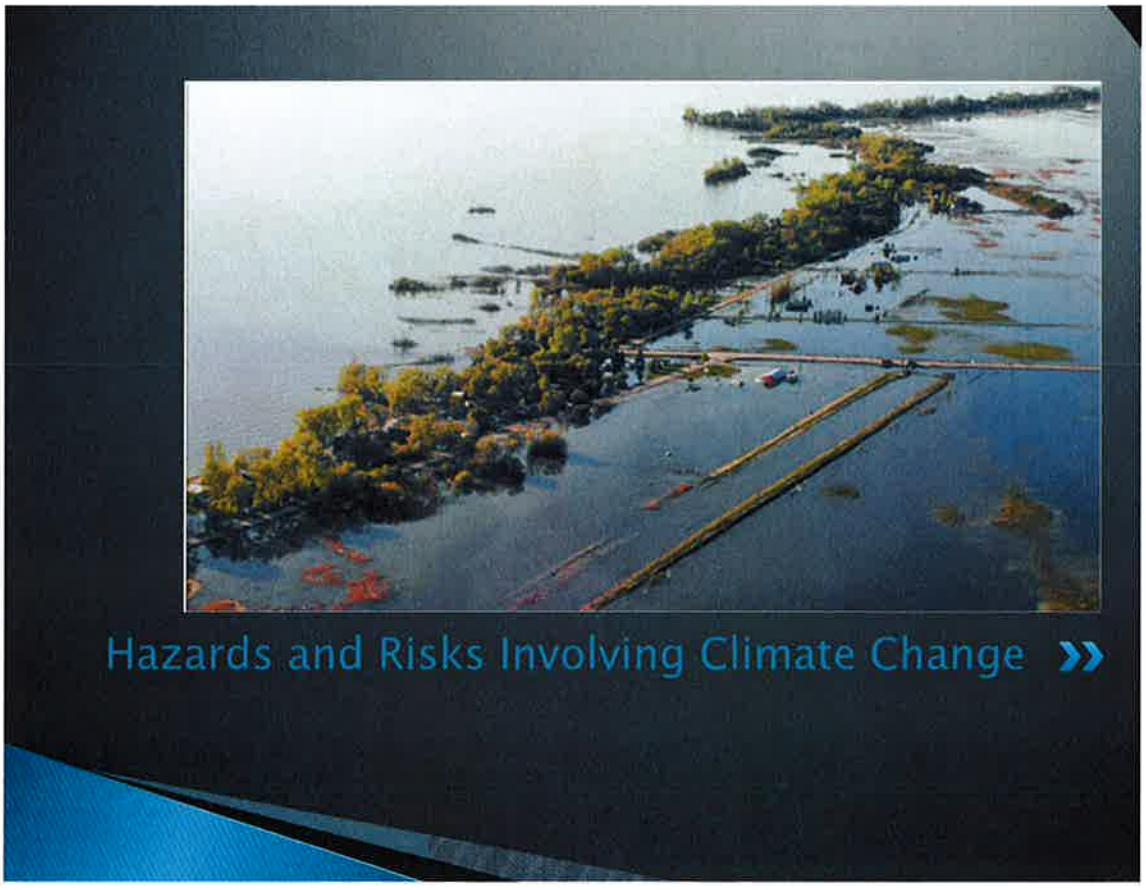

The Importance of Climate Change Impacts for Regions Across Canada

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How Would Climate Change Impact Us?

- The frequency of major natural disasters is now 3 times what it was in the 1960s.
- The largest insurer in the U.K. forecasts that at the current rate of increase in property damages, by 2065 the cost of these disasters will be higher than the entire world economic production!

UN Framework Convention on Climate Change, 2000.

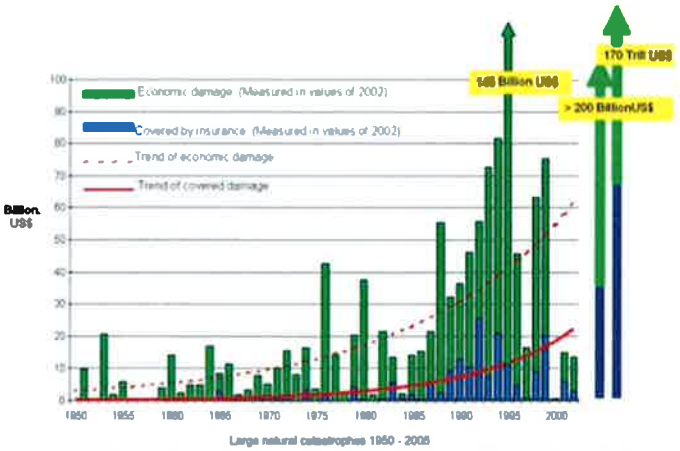

Figure: Evolution of Economic Costs and Insured Costs of Natural Disasters Worldwide[8]

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Southern Manitoba: Identified Hazards and Risks

- MB Conservation conducted a survey of S. MB stakeholders prior to Brandon Workshop in Nov 2011.
- *Survey asked:*
  - *Current level of awareness on Climate Change*
  - *Current climate mitigation and adaptation measures in place or planned*
  - *Climate impacts and adaptation information gaps/needs*

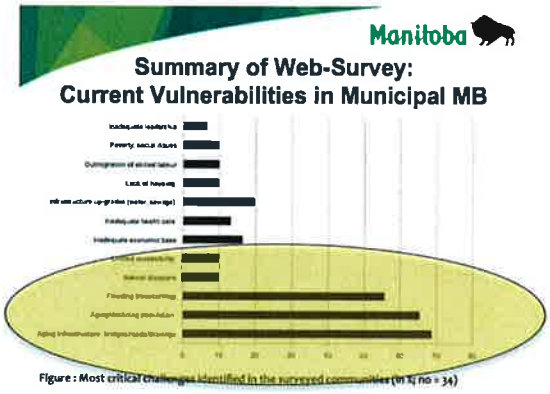

Figure : Most critical challenges identified in the surveyed communities (in %; no = 34)

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Southern Manitoba: Identified Hazards and Risks…

- A number of future climate change impacts were also identified in the pre-workshop survey

Manitoba

Potential future climate change impacts	Chosen by respondents (%)
More frequent and severe heat waves	24
Less certainty of seasonal weather patterns (more variability and less predictability of seasonal weather)	76
Increased frequency and severity of flooding and excess moisture episodes	91
Increasing challenges in storm water management	68
Changes in lake and river water levels	62
Increased frequency and severity of drought	15
Biodiversity and ecosystems shifts	12
Greater risk for invasive species	15
Altered transportation systems	18
Impacts on energy generation and distribution	15
Impacts on housing and buildings	35

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Southern Manitoba: Identified Hazards and Risks…

- In November's Brandon Workshop, the identified Climate Risks were considered, and an initial list of potential consequences were developed for each climate risk
  - *Key concerns reported as flooding, drought, extreme events*

Manitoba

Summary of Current Municipal Climate Risks

IDENTIFIED CLIMATE RISKS (%)	CURRENT CONSEQUENCES
Flooding (recurring floods, flash floods) By 60% of respondents	- Higher water levels in rivers including the Assiniboine river - Loss of agricultural land, trees and vegetation - Flooded agricultural land leading to loss of crops, reduced agricultural productivity - Damage to infrastructure (drainage problems caused by flashfloods) - Destruction of roads - Damage to cottages and recreational infrastructure (especially that which is constructed on the flood plain); reduction of tourism - Overland flooding due to extreme rainfall amounts and uncertain policy agreement on appropriate outlets/lake levels. As a result, a great deal of pasture/grazing/hay land has experienced extensive flooding for many years.

Manitoba

Summary of Municipal Climate Risks-cont.

IDENTIFIED CLIMATE RISKS (%)	LISTED CONSEQUENCES
Drought (17%)	- Impacts on agricultural production - Pressure on potable water
Extreme weather events (intense precipitation, storms, hail, wind) (10%)	- Damage to infrastructure (sewer back-up, sewer system discharge to waterways) - Impacts on agricultural production - Windstorms cause property and infrastructure damage
Heat waves (7%)	- Elderly and children in increased risk of heat stroke and other negative impacts on health of people with chronic illnesses - Pressure on the healthcare system

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Southern Manitoba: Identified Hazards and Risks…

- Using a very coarse evaluation ranking system as a "first pass", the survey also included results of preliminary analyses on these identified climate risks. This way, climate risks are "graded" on:
- *Frequency of their occurrence*
- *Severity of the consequences, should the risk occur*

Manitoba

Summary Results Surveys: Identified Current Hazards and Risks

Current Hazards	Key 1-3 Risks with each Hazard	Current Results/ Impacts	Current Average Frequency			Average Current Consequence rating			Current Management or Response Measure in Place
			1	2	3	1	2	3	
Water Quantity-flooding, excess moisture, drainage	Crop failure	Lack otmo feed for livestock/animals; Lack of food for human consumption; Soil erosion			X			X	Small water retention dams
	Livestock	Sickness/loss		X	X			X	Noisy farmers
	Natural habitat	Plant life loss			X			X	Salinity barrier programs
Infrastruc-ture-roads, bldgs, pipes, treatment plants	Water/sewerage system breaks/ unable to hold larger volumes	Water shortages, residential flooding; Sewer backups; Increased release levels downstream		X				X	Currently use crisis manage-ment; very costly to fix
	Potholes	Damage to vehicles		X				X	
	Financial stress	Increased infra costs/ housing prices		X				X	
	No homes for current/potential residents	People will move/have to commute/choose to live/ work elsewhere		X				X	

LEGEND: Frequency ratings: 1-Unlikely to occur; 2-Moderately frequently occurrence; 3- Almost certain to occur
Consequence ratings: 1- Low ; 2- Moderate; 3 - High

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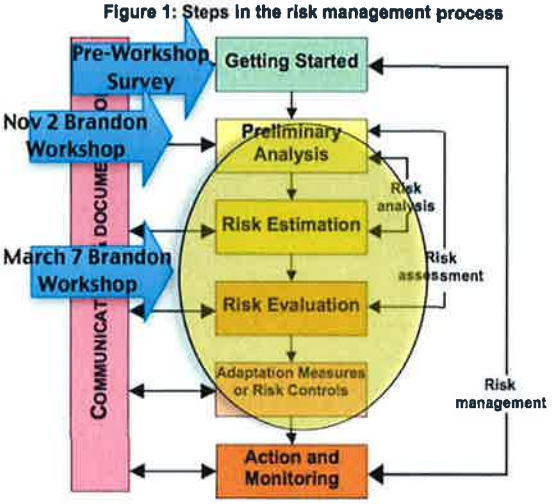
Southern Manitoba: Identified Hazards and Risks…

- With this initial work completed, let's look at the overall RISK MANAGEMENT PROCESS and review our steps completed, and our steps to cover today..

Figure 1: Steps in the risk management process



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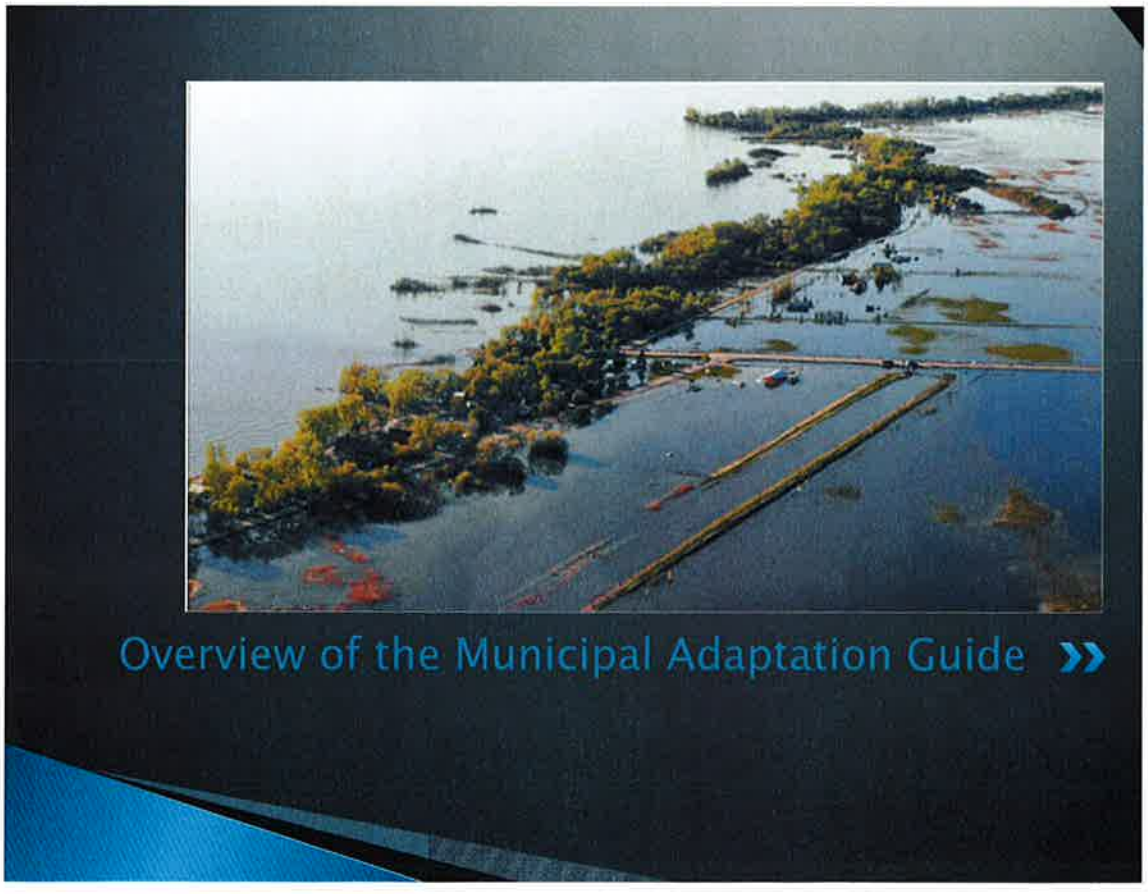
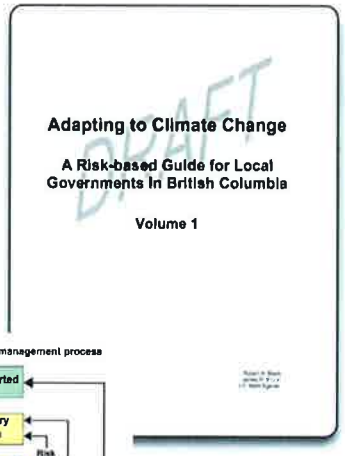
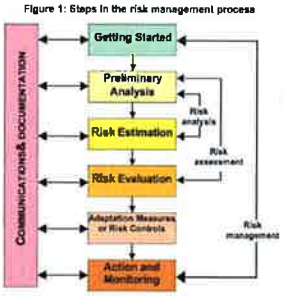


Purpose of Today's Workshop

- *Continuing from Nov 2011 Brandon Adaptation Workshop*
- *Brandon Workshop represents:*
  - *The initiation of a 6 step process of Risk Management*
  - *Process selected is "Adapting to Climate Change: A Risk-based Guide for Local Governments in British Columbia"*
    - *Aka "The BC Guide"*
- *Of the 6 steps in the BC Guide Process, November Workshop completed first 2 steps*
  - *Getting Started*
  - *Preliminary Analysis*





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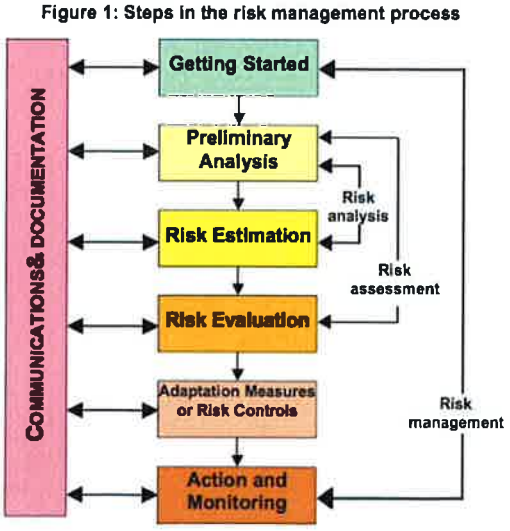
November Workshop: STEP 1

- STEP 1: Getting Started
- Manitoba representatives initiated the Risk Management Process at the Brandon Workshop (Nov. 2011) and their pre-workshop efforts (survey, follow-up, workshop teams, etc) are all part of STEP 1 of the Risk Management Process



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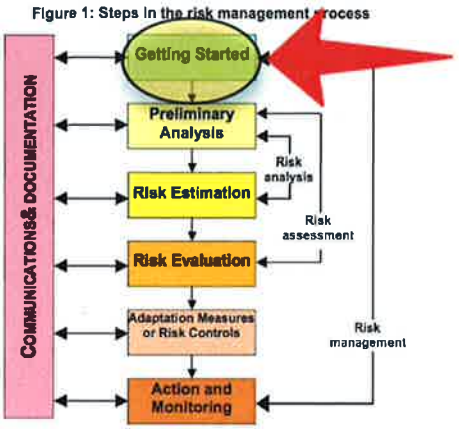
Risk Management Process

- In Getting Started (STEP 1), key tasks conducted were:
  - Beginning to identify specific problems or hazards, and associated risks to
    - People
    - Property
    - Environment
    - Activities
  - Key Risk issues are identified
  - Initial consideration to identify WHO may be affected
  - Consideration of all the different stakeholders, and their needs, concerns and probable issues



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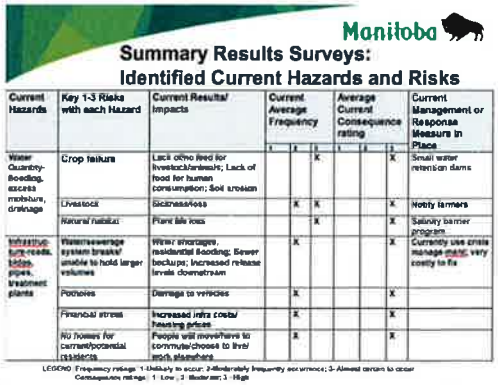
November Workshop: STEP 2

- STEP 2: PRELIMINARY ANALYSIS
- Participants worked in breakout groups and preliminary analysis was conducted on Pre-Workshop Survey Findings
- Key Steps involved:
  - *Review of early findings*
  - *Validation of findings*
  - *Revision of Summary Tables as required*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November Workshop: STEP 2

- STEP 2: PRELIMINARY ANALYSIS…
- "Identified Climate Risks" listing was developed
- TODAY, we begin by building on some of those results

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Summary of Current Municipal Climate Risks

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Manitoba

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Heat waves (7%)	- Elderly and children in increased risk of heat stroke and other negative impacts on health of people with chronic illnesses - Pressure on the healthcare system

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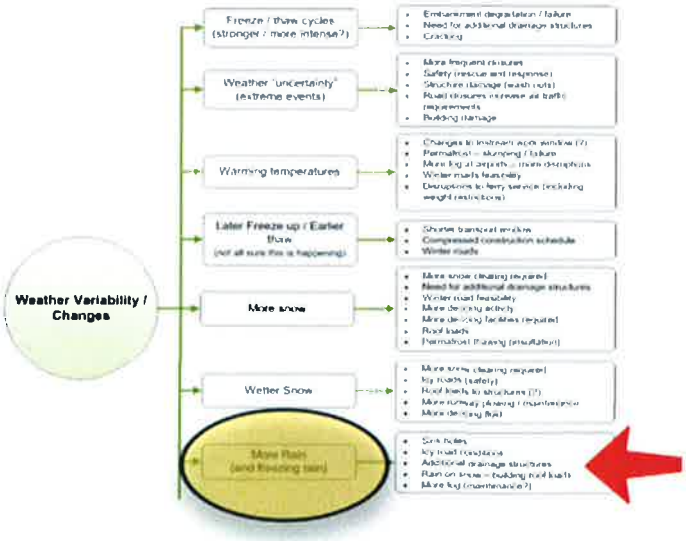
Completing STEP 2 from Workshop

- At the November Workshop, several climate hazards identified, Water Quantity was a primary Hazard of Concern
- Possible <u>impacts</u> of Water Quantity Hazard are
  - Flooding
  - Drought
- Each impact has associated <u>risk events</u> that need to be defined



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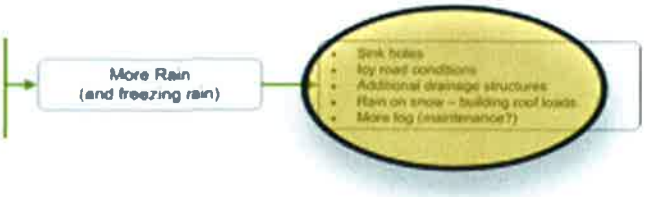
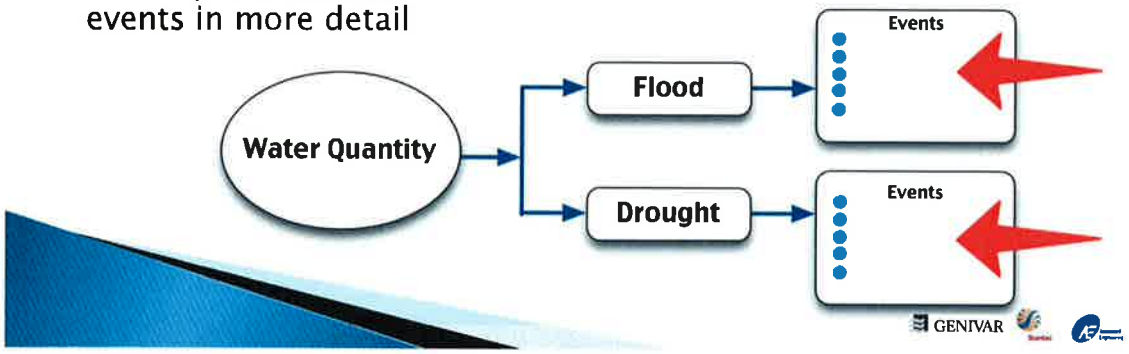
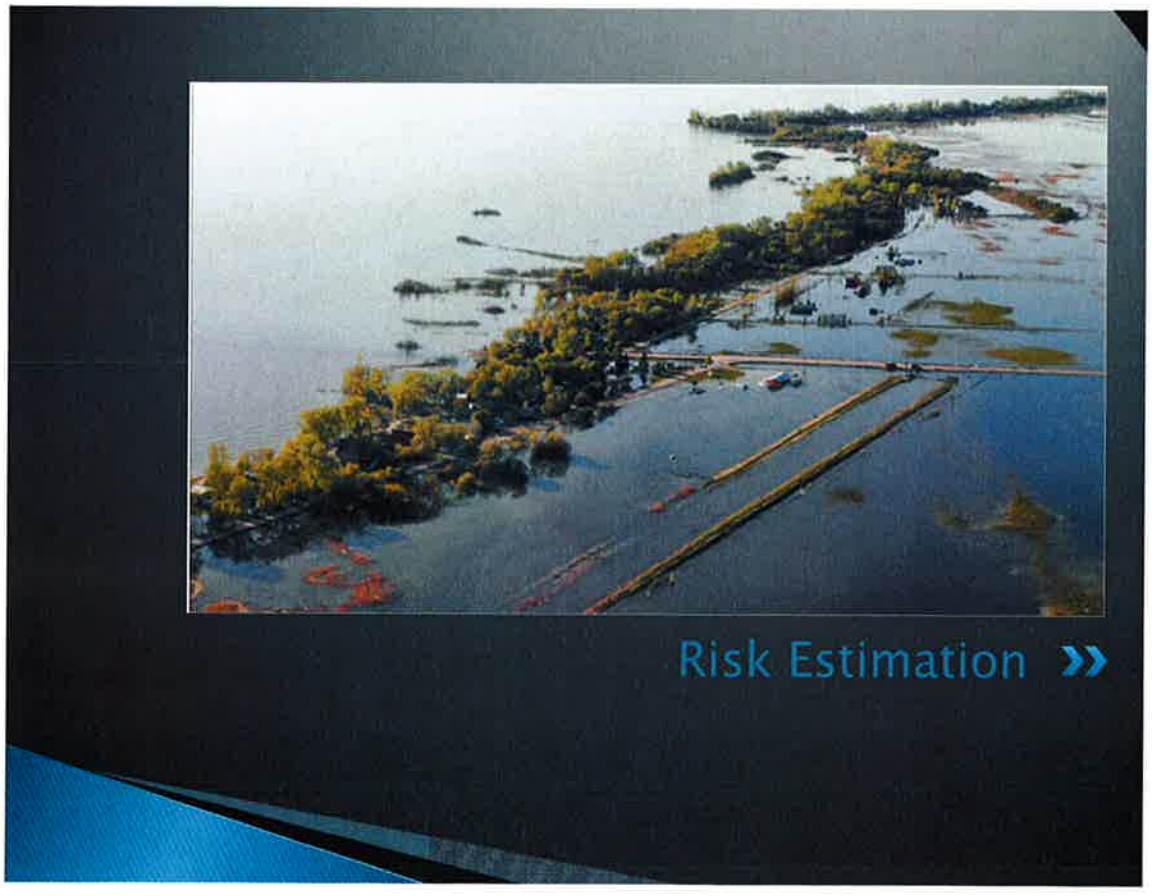
Instructions for First Breakout Group Activity

- Assemble into Breakout Groups
- As a group, discuss and create a list of potential risk events resulting from your chosen issue: Flood or Drought
- Once your list is generated, we will begin to analyze these risk events in more detail



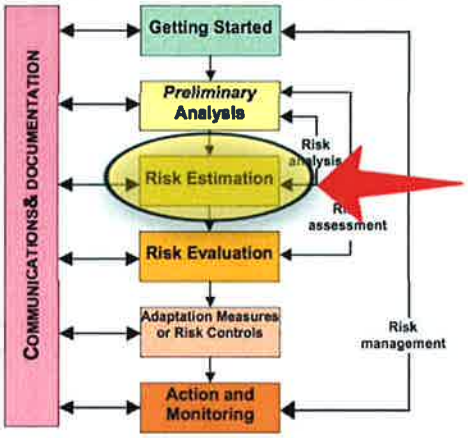




Moving Beyond November Workshop: STEP 3

- STEP 3: RISK ESTIMATION
- *Goal: more detailed consideration to frequency (probability) and consequences of the events in the risks identified in Step 2*
  - *Includes refinement of the initial Frequency and Consequence estimates*
  - *Can use a simple analysis as proposed in the BC Guide:*
    - *5 tier comparative rating system for Frequency (from "Occurs very often" to "Occurs almost never")*
    - *5 tier scale for Consequence severity (from "Very Minor Effects" to Extremely Serious Effects")*

Figure 1: Steps in the risk management process



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Risk Estimation: A Key Part of Any Risk Management Process

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Risk Estimation Primer

- *What is Risk?*
- *Risk = (Likelihood of an occurrence) X (Consequence of that occurrence)*
- *Key Questions:*
  - *How often (how likely) will it occur?*
  - *Assuming it were to certainly occur, what would be the potential consequences of the occurrence?*

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Risk Estimation: Frequency Rating Scale

Likelihood rating	*Description of Occurrence*
Virtually Certain (5)	May occur several times a year
Occurs Often (4)	May occur around once a year
Moderately Frequent (3)	May occur once every 10 years
Occasional Occurrence (2)	May arise once in 10 – 25 years
Very Unlikely (1)	Unlikely in the next 25 years

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Determining Consequence

- Consequence = "How bad is it likely to be?"
- Consider the consequences under several sub-categories, i.e.
  - Social Factors
    - Health & Safety
    - Displacement
    - Loss of Livelihood
  - Economic Factors
    - Property Damage
    - Financial Impact
    - Impact of Community Finances
  - Environmental Factors
    - Air
    - Water
    - Land
    - Ecosystems

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Risk Estimation: Considering Consequences in Key Areas

- *For Social, Economic, and Environmental Factors, etc, use qualitative descriptions to assign a severity rating.*

Severity Rating	Public Safety	Local economy	Social Factors	Environment and sustainability
	Potential Consequences			
Very Severe (5)	Large number of injury or loss of life	Regional decline leading to widespread business failure, loss of employment and hardship	The region would be seen as very unattractive, moribund and unable to support its community	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage
Major (4)	Isolated instances of serious injury or loss of life	Regional stagnation such that businesses are unable to thrive and employment does not keep pace with population growth	Severe and widespread decline in services and quality of life within the community	Severe loss of environmental amenity and a danger of continuing environmental damage
Moderate (3)	Small number of injury	Significant general reduction in economic performance relative to current forecasts	General appreciable decline in services	Isolated but significant instances of environmental damage that might be reversed with intensive efforts
Low (2)	Serious near misses or minor injuries	Individually significant but isolated areas of reduction in economic performance relative to current forecasts	Isolated but noticeable examples of decline in services	Minor instances of environmental damage that could be reversed
Very Low (1)	Appearance of a threat but no actual harm	Minor shortfall relative to current forecasts	There would be minor areas in which the region was unable to maintain its current services	No environmental damage

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Risk Estimation: Group Work Instructions

- Divide into your Breakout Groups
- You will be assessing the Risk Events associated with Flooding or Drought, as defined by your Group in the previous activity

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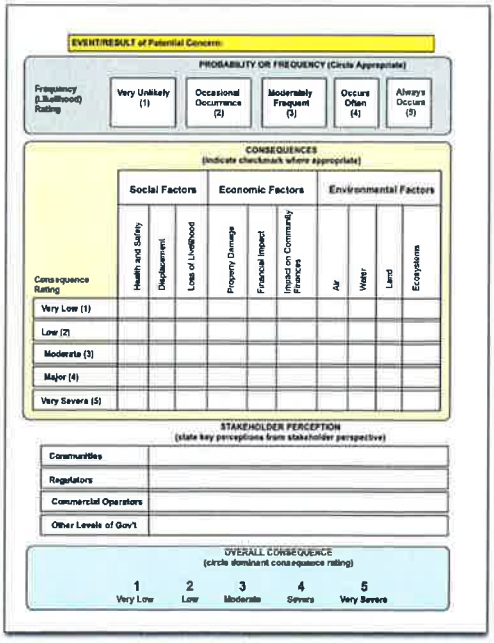
Risk Estimation: Group Work Instructions…

- ***Task 1:***
  - *For the given event or possible outcome, for example: wildfires, assign a Frequency (Likelihood) Rating Factor*
- ***Task 2:***
  - *For each of the Consequence Categories shown (Social, Economic, Environmental), make relative estimates of how severe consequences are expected to be in each of the key categories*
  - *For Environmental Factors, we would discuss impacts on air, water, land and ecosystems and assign relative consequence ratings to each, assuming the event occurs.* When completed Task 2, you will have checkmarks indicated for all displayed "Factors" in yellow box



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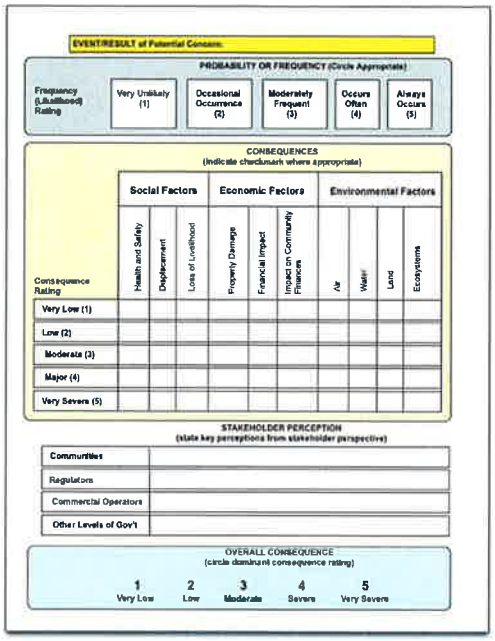
Risk Estimation: Group Work Instructions…

- ***Task 3:***
  - *Indicate in brief statement any key concerns/perceptions from stakeholders (enter detail in rows below yellow box)*
- ***Task 4:***
  - *Review your checkmarks as recorded in your Consequence portion of your FORM (yellow box)*
  - *Identify how many checkmarks fall into the different Consequence Ratings, choose the highest Consequence Rating with the most checkmarks across the various factors as the OVERALL CONSEQUENCE RATING (blue box)*



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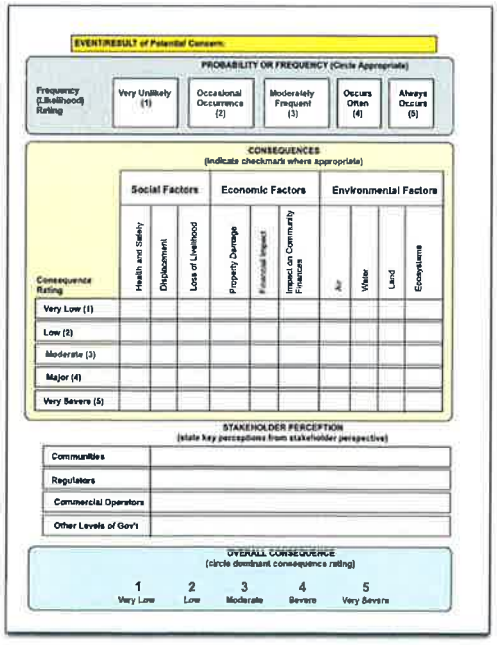
Risk Estimation: Plenary Review of Results

- *Group Discussion BREAKOUT GROUP WORK*



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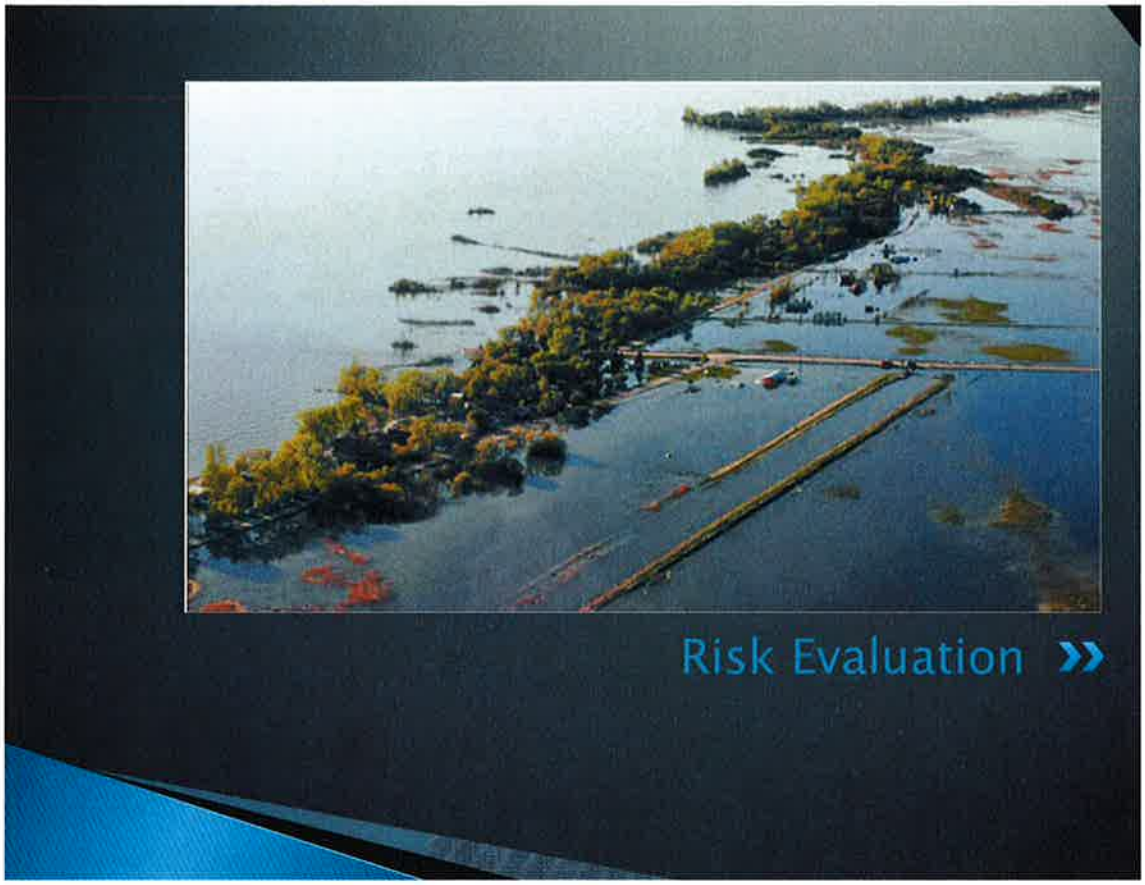

Risk Evaluation Primer

- *Recall that the definition of risk is:*
- *Risk= (Likelihood of an occurrence) X (Consequence of that occurrence)*
- *Up to this point in our Risk Management Process, we've created estimates for Frequency and Consequences of risk scenarios*
- *Now, in Risk Evaluation, we need to compare and RANK the risks*

Risk Evaluation Primer…

- *When RANKING RISK Scenarios, we are considering each RISK in terms of costs, benefits and acceptability, while considering the needs, issues and concerns of the people or groups affected or exposed to that RISK.*
- *This allows us to triage RISK, identifying unacceptable risks and ranking them for risk reduction (mitigation) or control measures*
- *We use a RISK EVALUATION MATRIX to evaluate the RISKS we are assessing.*

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Risk Evaluation Matrix

Likelihood	Consequence				
	Very Low (1)	*Low (2)*	*Moderate (3)*	*Major (4)*	*Extreme (5)*
Always Occurs (5)	Medium	Medium	High	Extreme	Extreme
Occurs Often (4)	Low	Medium	High	High	Extreme
Moderately Frequent (3)	Low	Medium	Medium	High	High
Occasional Occurrence (2)	Low	Low	Medium	Medium	Medium
Very Unlikely (1)	Low	Low	Low	Low	Medium

Extreme Risk= Immediate Action Required
High Risk= High priority risk control measures needed
Moderate Risk= Some risk controls needed to reduce risk to manageable levels
Low Risk=Risk controls likely not required
Negligible Risk = the risk is too small to warrant further consideration

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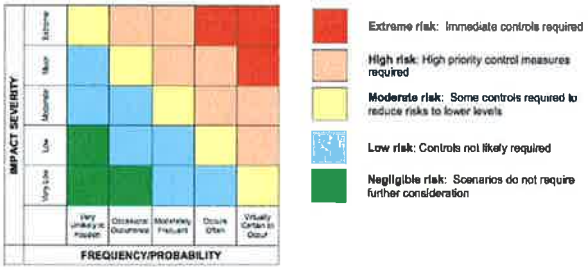
Risk Evaluation:
Group Work Instructions

- *Review your scores for assigned Frequency (Likelihood) Factor and also your OVERALL Consequence Factor Rating for each Event you examine.*
- *Using these Frequency and Consequence values assigned by your Workgroup, MAP your risk scenario events on the RISK EVALUATION MATRIX*



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Risk Evaluation:
Plenary Review of Results

- *Group Discussion BREAKOUT GROUP WORK*

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Identifying Adaptation Options Primer

- Adaptation: is preparing for the impacts of climate change
- Includes adjustments to reduce risks or take advantage of any potential benefits

Identifying Adaptation Options Primer

Adaptation Actions

Treating risks: often strategic planning & resource allocation (rather than short term, reactive)

- Avoiding risks e.g. change location of new housing developments
- Education public & staff awareness
- Regulatory and institutional e.g. urban planning

- Research for improved understanding
- Structural & technological solutions e.g. change in design of stormwater systems
- Spreading risks e.g. geographical diversification

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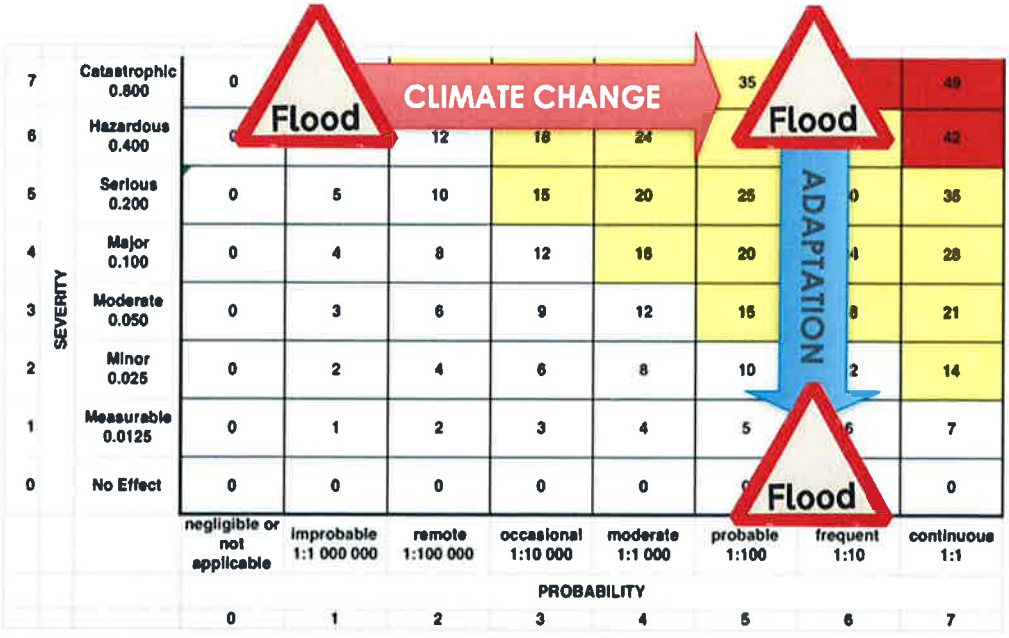
Climate Change Risk Mitigation Through Adaptation



Identifying Adaptation Options Primer

Adaptation Actions

- Under-adaptation & over-adaptation
- Balanced approach to managing climate & non-climate risks
- Integrating climate change risk management with the broader risk management processes
- Focus on higher priority risks

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Identifying Adaptation Options: Group Work Instructions

1. Return to your Breakout Work Groups
2. Look at each Risk Event your Group has assessed
3. Begin by considering the Risk Events with highest Risk Levels, and then proceed to the next highest Risk Event, etc.

RISK CONTROLS AND ADAPTATION MEASURES

RISK EVENT	Control or Adaptation Measure	Time Frame	Cost	Effectiveness	Acceptability	Comment/Evaluation

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Identifying Adaptation Options: Group Work Instructions…

4. Discuss and create a list of ideas to control risk or Adaptation Measures that could reduce the impact of the Risk Event when it occurs
5. Within your Group, discuss and note estimates of
   - Time Frames to Implement the Control or Adaptation
   - Approx. Magnitude of Cost to implement
   - Brief Statement on Effectiveness (fully control risk? Partial control?)
   - Would this adaptation option have high acceptability or could it be contentious?
   - Comment to add to your context


RISK CONTROLS AND ADAPTATION MEASURES

RISK EVENT	Control or Adaptation Measure	Time Frame	Cost	Effectiveness	Acceptability	Comment/Evaluation

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Identifying Adaptation Options: Plenary Review of Results

- *Group Discussion BREAKOUT GROUP WORK*

RISK CONTROLS AND ADAPTATION MEASURES

RISK EVENT	Control or Adaptation Measure	Time Frame	Cost	Effectiveness	Acceptability	Comment/Evaluation

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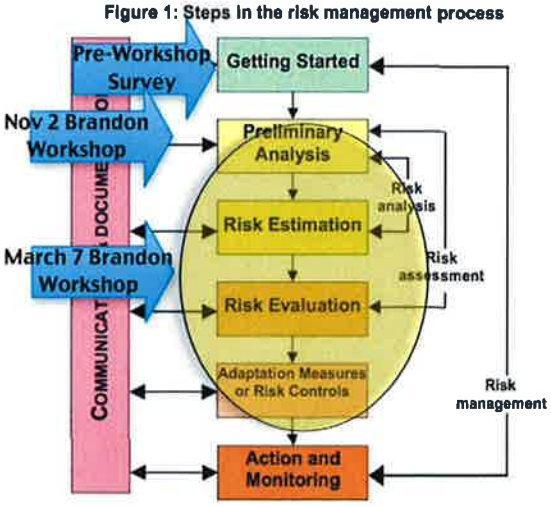
Next Steps

- Reporting on Today's Workshop
- Coordination with Steering Committee and Stakeholders on finalizing studies

Figure 1: Steps in the risk management process



Thank You

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APPENDIX E

Group Session Worksheets

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

RISK EVENTS LISTING*:

HAZARD = WATER QUANTITY IMPACT = DROUGHT RISK EVENTS:
Ag events: water shortage contributes to crop damage, reduced yields, wind erosion, too dry to fertilize, lack of snow cover impacts winter wheat, forage and perennial crops and impacts subsequent years, wells, sloughs and dugouts dry up, reduced soil moisture, pests and grass hoppers
Aquifer draw down, recharge rates,
Dust storms, air quality
Less water for domestic and industrial uses (allocation issues)

*Continuation of the November 2011 MAP workshop which completed MAP Guide Step 1: Getting Started (climate impacts and stakeholder identification), and Step 2: Preliminary Analysis (risk event frequency and consequence rating).

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

MAP STEP # 3
HAZARD = Water Quantity
IMPACT = Drought
EVENT/RESULT OF POTENTIAL CONCERN: Air Quality

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)		X						X		
Low (2)			X	X	X	X			X	
Moderate (3)										X
Major (4)	X									
Very Severe (5)							X			

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	High sensitivity to dust, fire, heat
Regulators	Response plan for smoke dispersion
Commercial Operators	Low profile if they are contributing, i.e. stubble burning
Other Levels of Government	Public health and safety concerns

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

MAP STEP # 3
HAZARD = Water Quantity
IMPACT = Drought
EVENT/RESULT OF POTENTIAL CONCERN: Water Quality

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)							X			
Low (2)				X						
Moderate (3)		X								
Major (4)	X		X		X	X			X	X
Very Severe (5)								X		

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	Very high interest and concern
Regulators	Monitoring of wells and acquifers
Commercial Operators	
Other Levels of Government	Public health and safety concerns

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

MAP STEP # 3
HAZARD = Water Quantity
IMPACT = Drought
EVENT/RESULT OF POTENTIAL CONCERN: Water Shortages

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)										
Low (2)		X					X			
Moderate (3)				X					X	
Major (4)	X		X		X	X				
Very Severe (5)								X		X

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	High degree of concern = high degree of engagement
Regulators	Are the necessary tools and resources in place?
Commercial Operators	What are the bottom-line impacts?
Other Levels of Government	Jurisdictional finger-pointing followed by interest in collaboration and cooperation.

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

MAP STEP # 3
HAZARD = Water Quantity
IMPACT = Drought
EVENT/RESULT OF POTENTIAL CONCERN: Crop Damage

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)										
Low (2)		X		X				X		
Moderate (3)	X									
Major (4)			X			X	X		X	X
Very Severe (5)					X					

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	Higher prices; reduced economic activity; impact on community finances depends upon length and severity of drought event. Process would benefit from weighting and more consequence choices.
Regulators	Infrastructure and storage
Commercial Operators	Higher wholesale process (different concerns depending upon Ag sector); distinction needed between damage to property vs. damage to property value
Other Levels of Government	Allocation issues; regional impacts; needed direction from government and scientists

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

STEP 4: RISK EVALUATION MATRIX – Drought Group

	CONSEQUENCE					
LIKELIHOOD		Very Low (1)	Low (2)	Moderate (3)	Severe (4)	Very Severe (5)
	Always Occurs (5)					
	Occurs Often (4)				Crop damage	
	Moderately Frequently (2)				Water shortage; Water quality	
	Occasional Occurrence (2)		Air Quality			
	Very Unlikely (1)					

Extreme Risk = immediate action required
High Risk = high priority risk controls measures needed
Moderate Risk = some risk controls needed to reduce risk to manageable levels
Low Risk = risk controls likely not required
Negligible Risk = the risk is too small to warrant further consideration

PRIORITY	
1	Crop damage
2	Water shortage/Water quality
3	
4	Air quality

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #1 – DROUGHT IMPACT

STEP 5: RISK CONTROLS AND ADAPTATION MEASURES – DROUGHT GROUP						
RISK EVENT	CONTROL OR ADAPTATION MEASURE	TIME FRAME	COST	EFFECTIVENESS	ACCEPTABILITY	COMMENT/EVALUATION
Crop Damage	Increased water storage	Short term	High	High	High	Need new provincial regulatory framework & water usage strategy. Provincial license needed to use water stored on own land. Producers working with thin margins.
	Irrigation	Short term	High	High	High	
	Drainage improvements	Short term	High	High	High	
	Wetland restoration	Medium term	Medium	High	Medium	Need EG&S tax credits & financial incentives
	Overall Water strategy	Medium term	Low	High	High	Ties in with improved land management & BMP's
	Crop Science	Ongoing	High	High	HIgh	Develop perennial wheat.
	Zero till	Ongoing	Low	High	High	
	Crop selection	Ongoing	Low	High	High	Nutrient management, e.g. pulse crops & legumes that fix nitrogen. Most of concern is over Lake Winnipeg not farmers.
	Pesticide use	Ongoing	Medium	High	High	Risk of grasshopper plagues.
Water Shortage	Increase Shellmouth Reservoir capacity	Short term	Medium	Medium	Depends	Farmers vs. cottagers. Provincial priorities: 1) crop production, 2) City of Wpg wastewater dilution, 3) municipal water supply.
	Wells	Medium term	Medium	High	High	Aquifer capacity – recharge issues with low snow pack
	Water rationing	? term	Low	High	Low	Xeroscape, low flow appliances
	Reuse/recycle	Short term	Low	High	Medium to High	Building code changes, provincial regulations.

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

RISK EVENTS LISTING*:

HAZARD = WATER QUANTITY IMPACT = FLOOD RISK EVENTS:
Basement flooding
Road closures
Infrastructure damage: roads, bridges, culverts, communications, etc.
Ag events: shift in ag planning, delayed planting, soil erosion, crop storage, equipment, nutrient movement
Business events: closures, revenue losses
People/community events: evacuation, stress, income losses, access to services, economic growth impairment, loss of community resiliency, population fragmentation, land availability
Governance events: costs of EMO operations & repairs to towns and RM's
Water quality: well and aquifer contamination, river contamination
Eco system events: riverbank erosion

*Continuation of the November 2011 MAP workshop which completed MAP Guide Step 1: Getting Started (climate impacts and stakeholder identification), and Step 2: Preliminary Analysis (risk event frequency and consequence rating).

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

MAP STEP #3
HAZARD = WATER QUANTITY
IMPACT = FLOOD
EVENT/RESULT OF POTENTIAL CONCERN: FISCAL IMPACTS

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)		X		X			X			
Low (2)	X		X							X
Moderate (3)					X			X	X	
Major (4)						X				
Very Severe (5)										

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	Increased taxes, slow growth, economic challenges, insurance changes/costs
Regulators	zoning
Commercial Operators	Business loss, employment reduction, insurance, productivity decline
Other Levels of Government	Revenue sharing (total cost accounting), transfer payments

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe
MAP STEP #3				

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

HAZARD = Water Quantity
IMPACT = Flood
EVENT/RESULT OF POTENTIAL CONCERN: Infrastructure Damage

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)							X			
Low (2)			X							X
Moderate (3)									X	
Major (4)	X	X						X		
Very Severe (5)				X	X	X				

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	Loss of services, school closures; major stress (physical, mental, financial)
Regulators	EMO response, operating procedures, code changes, design standards
Commercial Operators	Business closures, time and operating costs, insurance costs, emergency response time
Other Levels of Government	Relief efforts, investment, necessity of new by-laws and programs, need for life cycle costing

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

MAP STEP #3
HAZARD = Water Quantity
IMPACT = Flood
EVENT/RESULT OF POTENTIAL CONCERN: River Water Quality

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)		X		X			X		X	
Low (2)	X		X							
Moderate (3)						X				
Major (4)					X			X		X
Very Severe (5)										

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	Cost of water treatment; boil water advisories; recreational use impact
Regulators	Need for greater monitoring; future regulations
Commercial Operators	Increased costs; need for alternative sources like regional water; recreational opportunities
Other Levels of Government	Research and regulations; monitoring, generate projects

OVERALL CONSEQUENCE (circle dominant consequence rating)

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MAP STEP #3
HAZARD = Water Quantity
IMPACT = Flood
EVENT/RESULT OF POTENTIAL CONCERN: Shift in Agricultural Production

PROBABILITY OR FREQUENCY (Circle Appropriate)					
Frequency (Likelihood Rating	(1) Very Unlikely	(2) Occasional Occurrence	(3) Moderately Frequent	(4) Occurs Often	(5) Always Occurs

CONSEQUENCES
(Indicate checkmark where appropriate)

	Social Factors			Economic Factors			Environmental Factors			
CONSEQUENCE RATING	Health and Safety	Displacement	Loss of Livelihood	Property Damage	Financial Impact	Impact on Community Finances	Air	Water	Land	Ecosystems
Very Low (1)	X						X			
Low (2)				X						X
Moderate (3)		X	X						X	
Major (4)					X	X		X		
Very Severe (5)										

STAKEHOLDER PERCEPTION (State key perceptions from stakeholders' perspectives)	
Communities	Economics (less money to spend); zoning
Regulators	Need for crop insurance
Commercial Operators	Economic loss
Other Levels of Government	Municipal by-laws; program support and assistance

OVERALL CONSEQUENCE (circle dominant consequence rating)				
1 Very Low	2 Low	3 Moderate	4 Severe	5 Very Severe

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

STEP 4: RISK EVALUATION MATRIX – Flood Group

		CONSEQUENCE				
		Very Low (1)	Low (2)	Moderate (3)	Severe (4)	Very Severe (5)
LIKELIHOOD	Always Occurs (5)					
	Occurs Often (4)					
	Moderately Frequently (2)			Agricultural Production	Fiscal Impacts River Water Quality	Infrastructure Damage
	Occasional Occurrence (2)					
	Very Unlikely (1)					

Extreme Risk = immediate action required
High Risk = high priority risk controls measures needed
Moderate Risk = some risk controls needed to reduce risk to manageable levels
Low Risk = risk controls likely not required
Negligible Risk = the risk is too small to warrant further consideration

PRIORITY	
1	Infrastructure damage
2	Fiscal impacts
3	River Water Quality
4	Agricultural Production

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

STEP 5: RISK CONTROLS AND ADAPTATION MEASURES – FLOOD GROUP						
RISK EVENT	CONTROL OR ADAPTATION MEASURE	TIME FRAME	COST	EFFECTIVENESS	ACCEPTABILITY	COMMENT/ EVALUATION
Damage to Infrastructure	Peak shaving	10 to 15 yrs.	$$$	Fairly effective	OK to public	To lesson flood event; Environmental issues, cost/benefit
	New standards	now	$-$$ Low-Mod.	Very effective	OK to public	Build or upgrade to new standards; Depends on type of infrastructure.
	Strategic flood control					New or raised dykes; directives?
	Zoning					No-build zones
	Update flood risk map					
	Procedures – EMO Response					
	Infrastructure maintenance and inspection					
	Natural systems restoration					wetlands
	Change of use					Do not replace; Centralized service
Fiscal Impacts	Alternate infrastructure financing					PPP's
	Raise taxes			highly	Not at all	
	Review risk tolerance					
	Contract services	now	low	highly	low	Do not replace bridge (unpopular)
	Financial planning					
	Planning + risk-based planning					Government assistance; total cost accounting; stable funding

MUNICIPAL ADAPTIVE PLANNING (MAP) WORKSHOP
BRANDON MB, March 7, 2012
MAP Guide Summary Results
BREAKOUT GROUP #2 – FLOOD IMPACT

STEP 5: RISK CONTROLS AND ADAPTATION MEASURES – FLOOD GROUP…cont'd.						
RISK EVENT	CONTROL OR ADAPTATION MEASURE	TIME FRAME	COST	EFFECTIVENESS	ACCEPTABILITY	COMMENT/ EVALUATION
River water quality	Reduce flood event with large infra.					Peak shaving (Shellmouth Reservoir)
	Natural systems restoration					
	Temporary storage					
	Enhanced treatment					
	Alternate ? supplies					
	Education/ public awareness			required	high	
	Ecological promotion					
	CSO Separation					Reduce deleterious discharge in flood event.
	zoning					Review for contaminants in local lands.
	Monitoring/ gov't.					Quantity, quality, standards, Regulations.
Agricultural Production	Education					
	Crop diversification					
	Research					
	New practices					As affects marginal land restoration
	Flood forecasting					Better information, sooner and more accurate

APPENDIX F

Worksheet Summary

APPENDIX F – WORKSHEET SUMMARY

For the breakout sessions, workshop participants were broken down into two (2) groups: a Drought Group and a Flood Group. The groups were so named because Water Quantity was identified as a major Climate Hazard at the November 2011 MAP workshop and, associated with this, flooding and drought were identified by participants as "high frequency - high consequence" climate impacts threatening Manitoba triggered by the water quantity hazard. With this in mind, the groups were informed that they would be focusing on the flood and drought risks in completing Steps 3 through 5 of the Guide.

Breakout Session 1: Step 3 - Risk Estimation

The breakout groups were first asked to reprise a segment of the November 2011 workshop by listing risk events associated with their respective climate risks. This exercise would have been covered under Step 2 of the Guide.

Drought Group – Risk Event Listing: Several risk events were identified by the Drought Group mainly related to the agricultural sector, including:

- Crop damage, reduced yields, wind erosion, lack of snow cover, lack of water in sloughs and dugouts, reduced soil moisture, and pestilence.
- Aquifer draw-down and slow re-charge rates.
- Reduced air quality and increased dust storms.
- General water shortages for agricultural, industrial and domestic use, leading to allocation issues.

Flood Group – Risk Event Listing: The risk events listed by the Flood Group included several related to infrastructure damage and the impacts on people and communities:

- Infrastructure damage to roads, bridges, culverts, and communications.
- Agricultural events like delayed planting, soil erosion, equipment damage and crop damage.
- Business closures and revenue losses.
- Risks to people and communities like evacuation, stress, income losses, service disruptions, economic damage, and loss of community resiliency.
- Government costs to repair damage and operate emergency measures services.
- Reduced water quality, aquifer contamination, river contamination.
- Riverbank erosion and damage to riparian habitat.

With the major risk events identified, the groups were asked to select four (4) risk events as the subjects for completing Step 3 of the Guide, Risk Estimation. This step requires climate

risk adaptation teams to identify the following in relation to each of their chosen risk events:

1. Risk Event Frequency: from low to high frequency.

2. Risk Event Consequences: from very low to very high, across selected social, economic and environmental factors.

3. Stakeholder Perceptions: objective assessment as to how various stakeholder groups might perceive the risk event, the harm it could cause, their expectations for a response by authorities, etc.

4. Overall Consequence: Taking the preceding assessment into account, from very low to very severe.

The Guide simplifies this assessment process by using charts at each of the four Step 3 Risk Estimation stages. To aid the groups, these tables from the Guide were reproduced in a large scale and mounted on the wall for use by the group facilitators in recording the responses.

Drought Group – Risk Estimation: The Drought Group selected the following four (4) risk events for the Step 3 Risk Estimation: 1) Air Quality, 2) Water Quality, 3) Water Shortages, and 4) Crop Damage. Their findings are summarized below.

1. Air Quality: A reduction in air quality was predicted by the Drought Group to occur on an occasional basis. The consequences were identified as being major for health and safety, moderate for ecosystems and low to very low for the remaining most social, economic and environmental factors. In terms of stakeholder perceptions, "communities" were judged to be highly sensitive to reduced air quality events involving dust, smoke and heat on account of the related health and safety consequences. Reduced air quality was determined to have a low overall consequence.

2. Water Quality: A reduction in water quality was predicted to occur moderately frequently, with major consequences in terms of health and safety, loss of livelihoods, financial impacts and land and ecosystems. Reduced water quality will be a major concern for communities in relation to public health and safety and regulators in terms of water treatment and the condition of wells and aquifers. The overall consequence of reduced water quality was rated as severe.

3. Water Shortages: Water shortages are judged to occur on a moderately frequent basis. Consequences were rated as very severe for ecosystems and major for factors like health and safety, loss of livelihood, financial impact and impact on community

finances. It was believed that stakeholders would exhibit a high degree of concern and engagement over this risk event and would demand a quick response from authorities and a collaborative effort to alleviate the shortages. The overall consequence of water shortages was rated as severe.

4. Crop Damage: Crop damage was predicted to occur often in the event of drought, with a severe financial impact and a major impact in terms of livelihoods and community finances. Stakeholder perceptions would be shaped by the potential for higher food prices and damage to the local economy, and water allocation issues, requiring a prompt, coordinated response from the local and provincial levels of government. Crop damage was rated as having severe overall consequences.

Flood Group – Risk Estimation: The Flood Group selected the following four (4) risk events for the Step 3 Risk Evaluation assessment: Fiscal Impacts, Infrastructure Damage, River Water Quality, and Shift in Agricultural Production. Their findings are summarized below.

1. Fiscal Impacts: The negative fiscal impacts of flooding were determined to be a moderately frequent occurrence in the face of more frequent flooding from extreme rain events, with major consequences for municipal finances. Stakeholder perceptions would be shaped by the potential for increased taxes, slowed growth, economic challenges, business losses, job losses and a decline in productivity. Stakeholders will be looking to senior levels of government for financial assistance and support, and to regulators to ensure that flood damage is minimized through zoning and development restrictions. Negative fiscal impacts were judged to have severe overall consequences.

2. Infrastructure Damage: Infrastructure damage was judged to occur on a moderately frequent basis, with very severe consequences for properties, the economy and community finances, and major consequences in terms of health and safety and population displacement. Infrastructure damage will have potential consequences for all stakeholder groups in terms of service disruptions, business losses, and infrastructure repair costs. Infrastructure damage was rated as having very severe overall consequences.

3. River Water Quality: This risk event is rated as a moderately frequent event, with major financial impacts and consequences for the river ecosystem(s). Stakeholder perceptions will be shaped by issues of water quality, water treatment, the need for storage and alternative water sources, additional monitoring, and regulatory impacts. The overall consequences of reduced river water quality were rated as severe.

4. Shift in Agriculture Production: The shift in agriculture was determined to be a moderately frequent occurrence in response to the increased risk of flooding. Major

consequences were envisioned for the economy and communities in terms of financial impacts. The perceptions of stakeholders would be shaped by economic hardship, reduced incomes, and the need for a government response in terms of support programs and financial assistance. The overall consequence of a shift in agricultural production was rated as moderate.

Breakout Session #2: Step 4 – Risk Evaluation

Based on the Step 3 Risk Estimation assessment, the groups were tasked with using the BC Guide's Risk Evaluation Matrix to prioritize the risk events according to a ranking from negligible, requiring no action, to extreme, requiring immediate action.

Drought Group Risk Evaluation: The Drought Group ranked their four risk events as follows:

- Priority 1: Crop Damage – occurs often with severe consequences.
- Priority 2: Water Shortage & Water Quality (equally rated) – occurs moderately frequently with severe consequences.
- Priority 3: Air Quality – occurs occasionally with low consequences.

Flood Group Risk Evaluation: The Flood Group ranked their four risk events as follows:

- Priority 1: Infrastructure Damage – occurs moderately frequently with very severe consequences.
- Priority 2: Fiscal Impacts – occurs moderately frequently with severe consequences.
- Priority 3: River Water Quality – occurs moderately frequently with severe consequences.
- Priority 4: Agricultural Production (i.e. reduction in) –occurs moderately frequently with moderate consequences.

Breakout Session #3: Step 5 – Risk Controls and Adaptation Measures

Drought Group Risk Controls and Adaptation Measures:

1. Crop Damage: Control or adaptation measures to address crop damage caused by drought included increased water storage, irrigation, drainage improvements, wetland restoration, advances in crop science and alternative crop selection. A need was identified for a provincial water strategy, Ecological Goods and Services (EG&S) tax credits and financial incentives for agricultural producers to restore wetlands, and improved agricultural land management and Best Management Practices (BMPs). The adaptation measures were consistently rated as having a high degree of effectiveness and stakeholder acceptance. Improvements in drainage and water storage infrastructure were judged to be high cost adaptation measures.

2. Water Shortages: Control or adaptation measures included increasing the Shellmouth Reservoir capacity, back-up wells, water rationing and increased reuse/recycling. Changes to the Shellmouth Reservoir were seen as pitting farmers against cottagers. The impact of additional wells on aquifer levels was cited as a concern. The increasing use of water conserving appliances was seen as being a highly effective way of reducing per capita consumption.

(Note: Time constraints prevented the Drought Group from considering risk controls and adaptation measures for the water quality and air quality risk events.)

Flood Group Risk Controls and Adaptation Measures:

1. Damage to Infrastructure: Control or adaptation measures to address infrastructure damage included peak shaving of river levels, new standards for infrastructure design and construction, strategic flood control, zoning restrictions on flood-prone lands, and natural systems restoration. A program of constructing new dykes and increasing the height of existing dykes was regarded as necessary. New engineering design standards for infrastructure were regarded as having a low to medium cost impact while being very effective and acceptable to the public.

2. Fiscal Impacts: Control or adaptation measures to adapt to flooding included increased investment in flood-prevention infrastructure, funded by public-private partnerships or increased taxes, the latter of which was acknowledged as having a low public acceptability. A risk-tolerance review of all vulnerable infrastructure followed by appropriate remediation was also suggested as an adaptation measure.

3. River Water Quality: Control or adaptation measures included natural systems restoration, storm water retention to slow run-off, removal of contaminant sources from flood prone lands, improved municipal water treatment, Combined Sewer Overflow (CSO) separation, increased water quality monitoring, and increased public education and awareness.

4. Shifts in Agricultural Production: Control or adaptation measures included crop diversification, advances in crop science, and improved land management. Participants felt that marginal lands should be removed from production and restored.

APPENDIX G

Workshop Participant Survey Results

Municipal Adaptation Planning Workshop Follow-up Survey

Response Summary

Total Started Survey: 9
Total Completed Survey: 9 (100%)

PAGE: 1

1. Did the MAP workshop(s) increase your knowledge and understanding of the potential impacts of climate change on your community?

	Response Percent	Response Count
No.	0.0%	0
Somewhat.	22.2%	2
Yes.	77.8%	7
answered question		9
skipped question		0

2. Did the MAP workshop provide you with a working knowledge of the "BC Guide" municipal adaptive planning tool for identifying, evaluating, prioritizing and planning for "risk events" associated with climate change in Manitoba?

	Response Percent	Response Count
No.	0.0%	0
Somewhat.	33.3%	3
Yes.	66.7%	6
answered question		9
skipped question		0

3. In your opinion, how "user-friendly" is the "BC Guide" MAP process?

	Response Percent	Response Count
Fairly straightforward and easy to follow.	33.3%	3
User-friendly, but requires considerable time and dedicated effort.	66.7%	6
Difficult to apply without knowledgeable facilitators.	0.0%	0
answered question		9
skipped question		0

4. How easy would it be to apply a MAP tool like the "BC Guide" in your municipality? Create Chart Download

	Response Percent	Response Count
Not applicable.	37.5%	3
Impossible given our current financial and staff resources.	25.0%	2
Difficult, but could possibly manage a "high level" MAP process in order to identify priority risks and adaptation actions.	12.5%	1
We have the resources but no time.	25.0%	2
We have both time and resources to run a MAP process.	0.0%	0
	answered question	8
	skipped question	1

5. What level of priority do you think your municipality or organization is prepared to assign to climate change adaptation at the present time? Create Chart Download

	Response Percent	Response Count
Low priority.	22.2%	2
Moderate priority.	66.7%	6
High priority.	11.1%	1
	answered question	9
	skipped question	0

6. At what level should a MAP process like the BC Guide be implemented? Create Chart Download

	Response Percent	Response Count
Local or municipal level.	11.1%	1
Regional level (e.g. planning districts, watershed areas or conservation districts).	77.8%	7
Climate zones within province.	11.1%	1
At the provincial, departmental level.	0.0%	0
	answered question	9
	skipped question	0

7. In what areas might a MAP process like the "BC Guide" have value? (Check your top 5.) Create Chart Download

	Response Percent	Response Count
Conveying information on climate change impacts.	77.8%	7
	answered question	9
	skipped question	0

7. In what areas might a MAP process like the "BC Guide" have value? (Check your top 5.)	Create Chart	Download
High level starting point for climate change risk adaptation.	66.7%	6
Identifying stakeholders and determining who should "be at the table."	66.7%	6
Incorporating climate change adaptation planning into other planning processes.	88.9%	8
Getting the attention of senior levels of government on the plight of municipalities.	33.3%	3
Vehicle for engaging with government departments and agencies.	77.8%	7
All you really need for identifying high frequency/high consequence risk events and prioritizing adaptation measures and actions.	11.1%	1
Intriguing, but I want to know what other MAP tools or processes are available before signing on to the "BC Guide".	66.7%	6
	answered question	9
	skipped question	0

8. What might it take for municipalities, planning districts or conservation districts to begin engaging in adaptive planning to address climate change hazards? (Check your top 3.)	Create Chart	Download
	Response Percent	Response Count
Financial assistance.	66.7%	6
Provincial direction/facilitation/coordination.	77.8%	7
Local leadership.	55.6%	5
More or better data on regional climate impacts.	33.3%	3
Ideas for common adaptation options and measures.	0.0%	0
Resident demand for action.	22.2%	2
Pilot project somewhere else in Manitoba.	22.2%	2
Sense of urgency (i.e. more disasters).	44.4%	4
Partnerships.	22.2%	2
Other	0.0%	0
	answered question	9
	skipped question	0

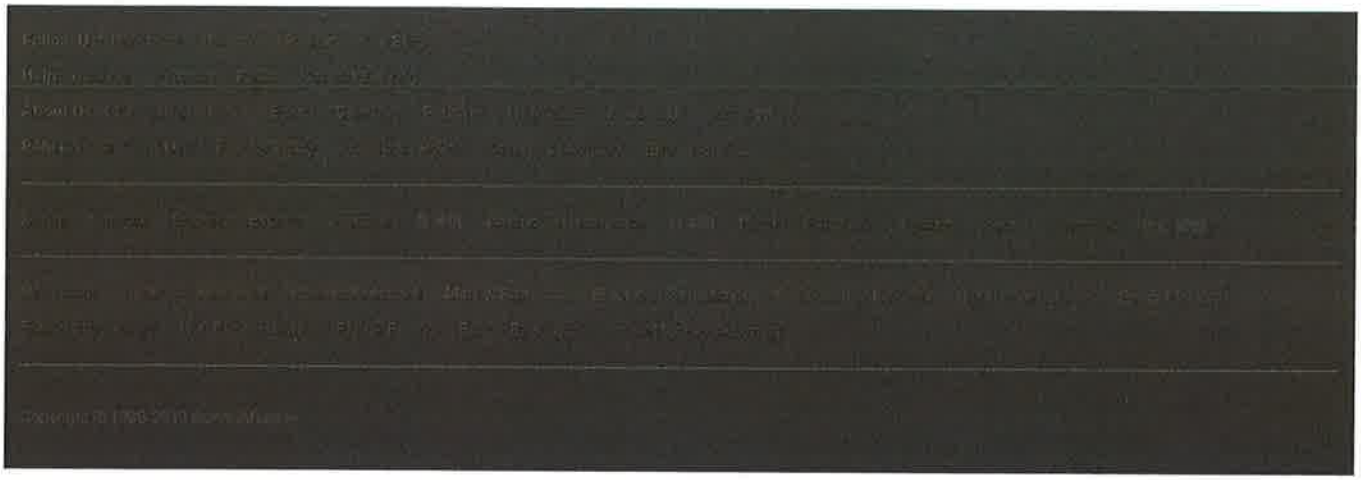
9. What adaptation options or measures do you think most municipalities would be able to implement given their powers and responsibilities? (List up to 5.)	Download	
	Response Percent	Response Count
1. Show Responses	100.0%	8
	answered question	8
	skipped question	1

9. What adaptation options or measures do you think most municipalities would be able to implement given their powers and responsibilities? (List up to 5.) Download

2. Show Responses	100.0%	8
3. Show Responses	87.5%	7
4. Show Responses	37.5%	3
5. Show Responses	37.5%	3
	answered question	8
	skipped question	1

10. Finally, which of the following points reflect how you personally feel about the usefulness of conducting a risk assessment process like the BC Guide at the local level? (Check all those that reflect your feelings.) Create Chart Download

	Response Percent	Response Count
Not very useful given limits of authority and jurisdiction.	0.0%	0
Not very useful in the absence of provincial involvement and oversight.	33.3%	3
Useful if only to get people thinking and talking about climate change.	44.4%	4
Useful for identifying what can be accomplished at a grass-roots level.	66.7%	6
Not very useful given the constraints and competing demands.	11.1%	1
Useful if incorporated into other local planning endeavors.	100.0%	9
	answered question	9
	skipped question	0



Response1

Consideration in mid to long term planning.
2/4/2012 2:18 PM View Responses
water conservation
27/3/2012 5:08 PM View Responses
Education and public awareness
27/3/2012 9:39 AM View Responses
Develop or update Emergency Plans
26/3/2012 11:27 AM View Responses
Require capital investments in new or expanded or replaced infrastructure in a manner that anticipates impacts of climate change at local and regional scale (i.e. use up-to date engineering specifications and capactities that includes reserve capacities that acknowledges peak flows/demands,stresses that are assocated with severe weather events).
20/3/2012 9:39 AM View Responses
Drainage Control
20/3/2012 8:18 AM View Responses
education
19/3/2012 3:59 PM View Responses
water supply infrastructure
19/3/2012 11:49 AM View Responses

Responses 2

Communication of information to residents
2/4/2012 2:18 PM View Responses
flood control
27/3/2012 5:08 PM View Responses
Zoning changes
27/3/2012 9:39 AM View Responses
Create and/or update operating procedures
26/3/2012 11:27 AM View Responses
Engage in integrated land and community development planning so as to recognize and plan for and mitigate against the adverse impacts associated with anticipated climate change impacts at local and regional scale (e.g. keeping most permanent development out of flood plains).
20/3/2012 9:39 AM View Responses
Water Management
20/3/2012 8:18 AM View Responses
infrastructure
19/3/2012 3:59 PM View Responses
local by-laws for conservation/water management
19/3/2012 11:49 AM View Responses

Actively develop and manage and maintain regional-scale infrastructure systems (e.g. piped water systems, drainage systems/flood control works etc,) to help dampen and spread risks and costs associated with adverse weather events (e.g. floods and droughts) which are symptomatice changes in climate over time.

20/3/2012 9:39 AM View Responses

Appendix H – Study References

- *Adapting to Climate Change, A Risk Based Guide for Local Governments in British Columbia, Volume 1*, Final Draft, February 10, 2010, Robert A. Black, James P.Bruce, I.D. Mark Egener, Summit Enterprises International (S.E.I.) Inc.

- *Adapting to Climate Change, A Risk Based Guide for Local Governments in British Columbia, Volume 2 (Workbook and Case Studies,* Final Draft, February 10, 2010, Robert A. Black, James P.Bruce, I.D. Mark Egener, Summit Enterprises International (S.E.I.) Inc.

- *Adapting to Climate Change, A Risk Based Guide for Ontario Municipalities*, December 12, 2006, Robert A. Black, James P.Bruce, I.D. Mark Egener, Summit Enterprises International (S.E.I.) Inc.