ICLEI
Local Governments for Sustainability

CHANGING CLIMATE, CHANGING COMMUNITIES:

Guide and Workbook for Municipal Climate Adaptation

CHANGING CLIMATE, CHANGING COMMUNITIES:

Guide and Workbook for Municipal Climate Adaptation

·I·C·L·E·I
Local Governments for Sustainability

This guide was made possible with the generous support of Natural Resources Canada: Climate Change Impacts and Adaptation Division.

PREFACE

Adapting to climate change is the new reality. Despite genuine efforts to mitigate climate change, leading scientists tell us that a changing climate is inevitable and we can expect increasing temperatures, more frequent storms and sea level rise. Many local governments are already at the centre of this reality; dealing with the effects of thawing permafrost, damaged infrastructure and heat waves. As practitioners of good governance, local governments must develop responses that protect their local citizens, environment and economy.

ICLEI is an association of local governments that are committed to sustainability. ICLEI works with its members to build the capacity of municipal staff and elected officials to fulfill this commitment. We develop process-based frameworks and build practical tools and resources to support implementation. This guide provides a milestone framework that leads local government practitioners through a process of initiation, research, planning, implementation and monitoring for climate adaptation planning. The workbook is filled with practical tools and exercises to support the milestone process, and the information annexes summarize a variety of policy and scientific resources that can be used to compliment your activities. The multifunctional nature of these resources is in response to the fact that while adaptation planning can be a long-term and complex process, there are exercises that can be done in the short term to support a longer-term process.

I encourage you to bring this guide to your community and put it to use. Tailor it to your needs. And, please share your experiences with ICLEI so we can ensure that the lessons you've learned on the ground in your community are shared with your peers across the country.

Megan Meaney
Director, ICLEI-Canada

Ten years ago, Delta started to think seriously about climate change and what we could do to mitigate and adapt to the impacts on our community and environment. We knew we had to look inward and so began a series of changes. We have promoted discussion, sometimes at the risk of ridicule, encouraged our staff to put their sound ideas into practice, and participated in national programs, like ICLEI Canada's adaptation toolkit pilot, when few others were interested.

But now the science is in and all sectors of government and private industry are rising to the climate change challenge. The timing couldn't be better. In the past few years, Delta has experienced climate change first hand with several severe weather events like storm surges and flooding in Boundary Bay Village. As a coastal community, Delta may be on the frontline of vulnerability, but it's certainly at the forefront for change.

We are privileged to have worked with ICLEI Canada to produce this very useful toolkit for communities across the nation. Congratulations to ICLEI Canada for completing *Changing Climate, Changing Communities*. The toolkit is relevant, practical and useful.

At the Corporation of Delta, we've shown that small changes result in huge dividends. The time for debate is over. Please join us now as we all do our best to meet the climate change challenge.

Mayor Lois Jackson
Municipal Corporation of Delta, BC

ABOUT THIS GUIDE

Today, the effects of climate change are being felt in communities across the country. These effects are set to become so pervasive that all levels of government and all sections of society will have a responsibility to become informed and to take appropriate action within their mandates to prepare for and adapt to them.

Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Adaptation is a compendium of resources that provide a milestone based framework to assist local governments in the creation of adaptation plans to address the relevant climate change impacts associated with their communities. Although climate change adaptation is a complex process, this guide aims to provide a straightforward methodology to adaptation planning using a five-milestone approach. Each milestone represents a fundamental step in the adaptation planning process, starting with the initiation of adaptation efforts (by building an adaptation team and identifying local stakeholders) and culminating with a monitoring and review process that analyzes the successes and reviews the challenges of the adaptation plan and its implementation.

Though presented sequentially, the milestone framework is not necessarily linear; rather, it can be an iterative process whereby adaptation goals and actions are continuously monitored based on new local conditions and information. Likewise the distinction between planning and implementation may be blurred so that actions that are already underway or may be implemented easily can be undertaken while other elements of planning are still ongoing.

Changing Climate, Changing Communities is a compendium of three distinct elements: a main guide, a workbook for practitioners, and a set of information annexes.

MAIN GUIDE

The main guide outlines the five milestones for climate adaptation and outlines how to implement each one. The guide can be used on its own or in coordination with the workbook and annexes which provide additional tools to assist in moving through the Milestone process.

WORKBOOK

Though the workbook is a non-compulsory component of the guide, it contains seventeen tools that operationalize the adaptation methodology identified in the main guide. The tools range from basic conceptual mappings to more complex matrices on adaptive capacity and risks associated with climate change impacts, each tool can be used to facilitate moving through the milestones.

INFORMATION ANNEXES

The third component of the compendium are the information annexes which supplement the main guide and includes information on regional climatic changes, adaptation options, and a synthesis of other resources, organized by topic, that can assist communities in planning for climate change.

Changing Climate, Changing Communities is aimed at municipal staff interested in working on climate change adaptation strategies. Staff from across all municipal departments can be involved in the process outlined in this resource; as it encourages an integrated approach to planning that requires examination of the environmental, economic, social, and health implications of climate change.

Although the need for adaptation planning is clear, it is important to recognize that there is no one way to approach planning for climate change. Adaptation planning, by its definition of responding to local impacts, requires a certain degree of 'right-sizing' or localizing, as any plan must be tailored to the community. This guide offers a methodology which can be tailored to any local government as dictated by the resources, capacity and priorities of the community.

Principles for Working on Climate Change Adaptation

As your community engages in a climate change adaptation planning process, the following principles[1] should be considered to help guide your work:

- **Balance of immediate and long-term needs:** Acknowledge that climate change impacts will continue to take shape over the long-term based on our actions today, but many impacts are already emerging. Communities must, therefore, ensure their approach is one that finds a balance between immediate and long-term needs.

- **Interaction must be supplemented with action:** Acknowledge that the complexity and transboundary nature of climate change impacts means that many stakeholders will need to act to develop a truly holistic response to those impacts, yet the coordination of such a large number of actors can be daunting. Communities must, therefore, commit to driving this initiative by identifying and following-through on the actions they can undertake themselves or directly influence without getting side-tracked or held back by the inaction of other stakeholders.

- **Commitment to act in the face of uncertainty:** Acknowledge the reality that human beings constantly have to act in the face of uncertainty and that acting on climate change is no different. The lack of certainty about how our climate is changing should not be seen as an impediment to taking action. Therefore, municipalities must commit to an approach that enables staff to make decisions in the face of uncertainty.

- **Recognizing existing work:** Acknowledge the work that your community is already doing which addresses climate change impacts (but which may not be labeled as "adaptation"). Where there is such work, it is important to incorporate any future adaptation planning with those existing efforts to ensure an integrated and comprehensive plan.

Approaches to Climate Change Adaptation Planning

There are a variety of approaches to adaptation planning that can be taken, each with its own focus and purpose. Exhibit 1 offers a brief overview of possible approaches and examples of where such an approach was used.

The methodology presented in this guide uses a hybrid approach which touches on elements from each of the approaches listed below and represents a widely applicable methodology. This approach was chosen to acknowledge the differences in how communities will proceed with this planning process as it would be the most relevant across the country.

The Changing Climate, Changing Communities Guide

This guide offers a five milestone methodology that local governments have become familiar with through the Partners for Climate Protection (PCP) program. The purpose of the guide is to convey a straightforward approach for how municipalities can investigate climate change impacts at a general level and devise strategies for addressing those impacts. There are many other guides available which take various approaches to adaptation planning. For instance, there are guides specific to risk and infrastructure (i.e. A Risk-Based Guide for Local Governments in British Columbia), climate change and health (i.e. Human Health in a Changing Climate), or profession specific (i.e. Engineers Canada or the Canadian Institute of Planners). This guide does not intend to supplant those resources, rather it is intended to provide a holistic process for how local communities can address the array of impacts likely to occur as a result of climate change. ICLEI encourages users of this guide to also utilize existing sector or impact specific resources to further advance their adaptation efforts.

Though this guide will be particularly valuable to local government staff, it is important to acknowledge the importance of involvement at the political level. By exposing locally elected officials to key elements of the guide, and including them at key points, staff can ensure that their adaptation planning and implementation efforts will have the political support, in the short- and long-term, that is necessary to successfully undertake an adaptation planning process.

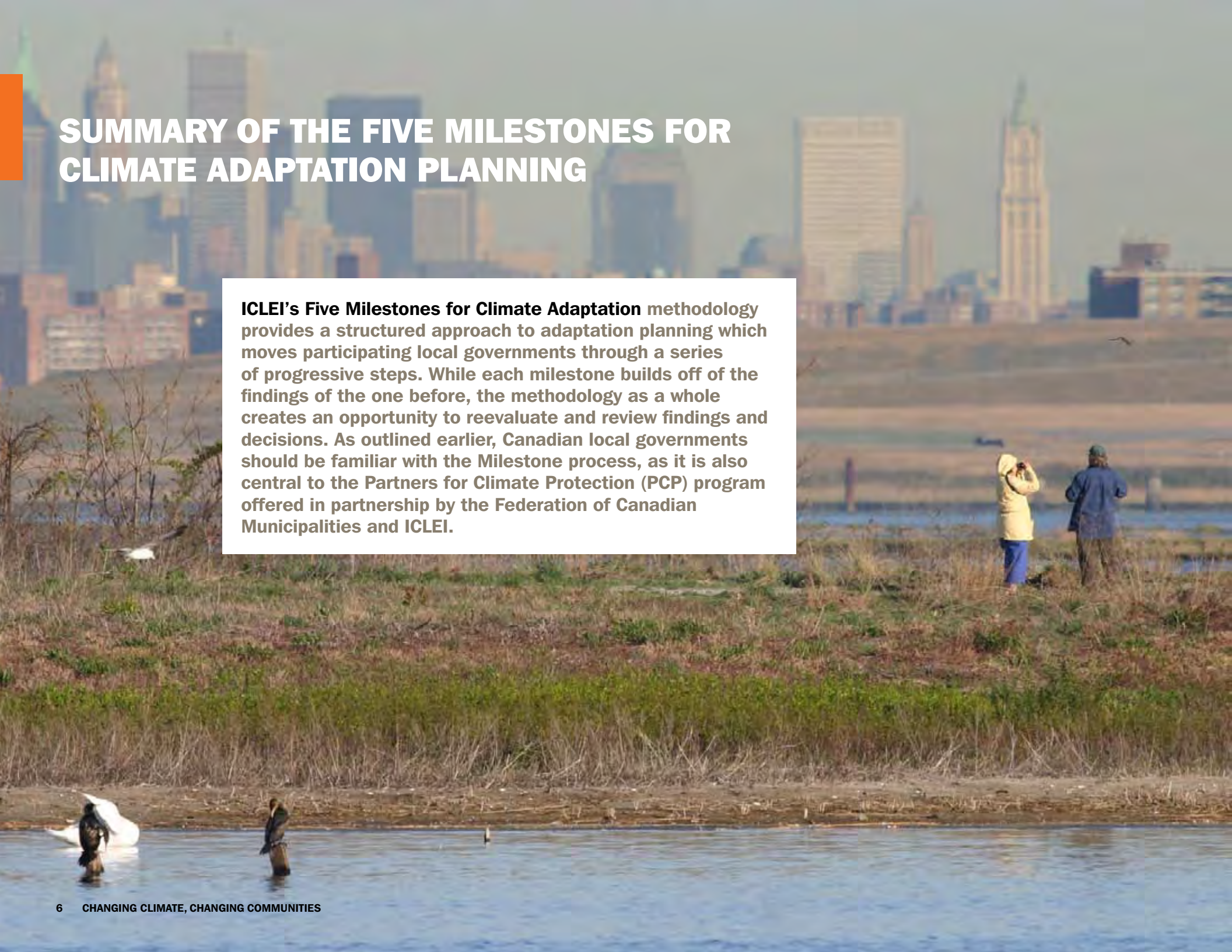
EXHIBIT 1

Approaches to Climate Change Adaptation Planning

SCOPE	KEY FEATURES	EXAMPLES
Sectoral/Department Specific	• Initiated by a single department or sector • May spark a city wide municipal plan	• Quebec City, QC *Environmental Services Adaptation Plan*
Municipal Operations Plan	• Municipal operations plan for all departments • Top down	• King County, WA (USA) *2007 Climate Plan*
Community Wide	• Community involvement • Multi-stakeholder	• Keene, NH (USA) *Climate Resilient Communities Action Plan*
Hybrid	• May be led by a single department but planned for the municipality • Expanded one department at a time • Community driven (i.e. resident from a flooded area) pushes community into action • May be driven by a weather event (i.e. flooding)	• Delta, BC *Climate Change Initiative* • Toronto, ON *Ahead of the Storm*

SUMMARY OF THE FIVE MILESTONES FOR CLIMATE ADAPTATION PLANNING

ICLEI's Five Milestones for Climate Adaptation methodology provides a structured approach to adaptation planning which moves participating local governments through a series of progressive steps. While each milestone builds off of the findings of the one before, the methodology as a whole creates an opportunity to reevaluate and review findings and decisions. As outlined earlier, Canadian local governments should be familiar with the Milestone process, as it is also central to the Partners for Climate Protection (PCP) program offered in partnership by the Federation of Canadian Municipalities and ICLEI.



MILESTONE ONE: INITIATE

The first milestone is meant to start the process of planning for adaptation. Within this milestone communities will identify possible internal and external stakeholders that should be part of a climate change adaptation team. From here they will assess their existing knowledge on how regional climate is changing and begin to brainstorm anticipated climate change impacts, positive and negative, relevant to their community. As part of this milestone, it is important to establish political support for the process and identify a climate change champion to lead your community's efforts and/or help keep momentum for the process.

MILESTONE TWO: RESEARCH

The second milestone is meant to further develop your community's understanding of climate change impacts and the major service areas which are likely to feel these impacts most acutely. Within this milestone you will scope the climate change impacts for your region and conduct both a vulnerability and risk assessment.

MILESTONE THREE: PLAN

Based on the impacts previously identified, the third milestone provides guidance on how to establish a vision and set adaptation goals and objectives, identify adaptation options, and examine possible constraints and drivers to action. From there you will begin drafting your Adaptation Action Plan, within which you will establish baseline data, address financing and budget issues, create an implementation schedule, determine who is responsible for implementation, and estimate how implementation progress will be measured and evaluated. With this information you will then finalize your Adaptation Action Plan.

MILESTONE FOUR: IMPLEMENT

In the fourth milestone, you will work to ensure that you have the approval and support of council, municipal staff and the community. You will also make sure that you have the appropriate implementation tools to ensure your success.

MILESTONE FIVE: MONITOR/REVIEW

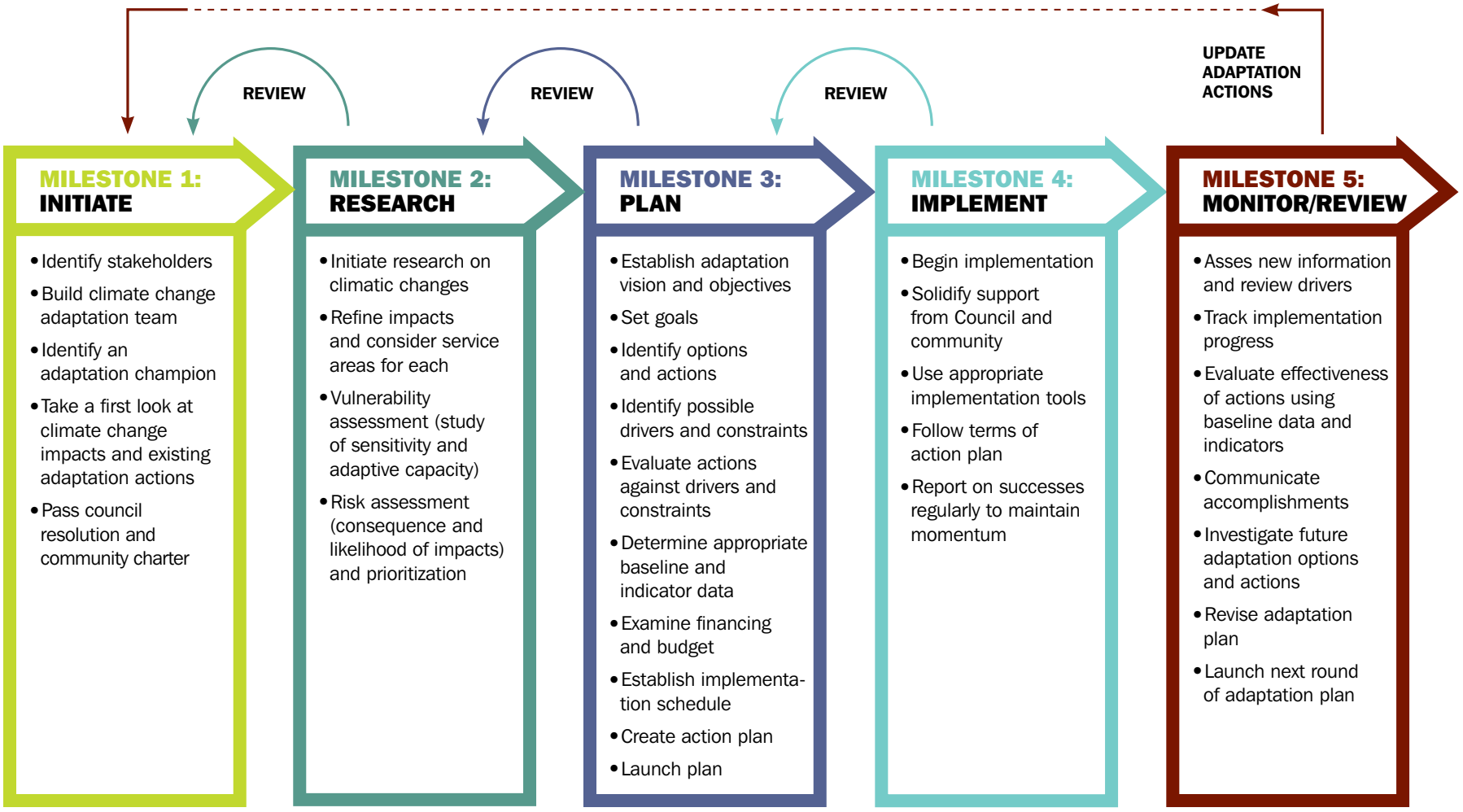
The fifth and final milestone serves to assess whether the goals and objectives previously set by your community have been achieved, identify any problems that have been encountered and develop solutions. Additionally, the fifth milestone helps you to communicate progress to the general public.

EXHIBIT 2

Basic Milestone Framework

EXHIBIT 3

Milestone Framework



GLOSSARY [2]

TERM	DESCRIPTION
Adaptation	Includes any initiatives or actions in response to actual or projected climate change impacts and which reduce the affects of climate change on built, natural and social systems.
Adaptive Capacity	The ability of built, natural and social systems to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.
Climate Change	Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.
Extreme Events	Extreme events refer to meteorological conditions that are rare for a particular place and/or time, such as an intense storm or heat wave and are beyond the normal range of activity. They can be the result of sudden and drastic changes in temperature, precipitation and sea-level or they may be the result of a more gradual, but prolonged, shift in temperature or precipitation that is beyond the normal range. Such events include severe thunderstorms, heat waves, floods, droughts, ice storms, fires etc. *Extreme Weather Event* is an event that is rare within its statistical reference distribution at a particular place; it would normally be as rare as or rarer than the 10th or 90th percentile. *Extreme Climate Event* is an average of a number of weather events over a certain period of time, an average which is itself extreme (e.g. rainfall over a season).
Impact	The effects of existing or forecasted changes in climate on built, natural, and human systems. One can distinguish between potential impacts (impacts that may occur given a projected change in climate, without considering adaptation) and residual impacts (impacts of climate change that would occur after adaptation).
Maladaptation	Any changes in built, natural, or human systems that inadvertently increases vulnerability to climate stimuli; an adaptation that does not succeed in reducing vulnerability but instead increases it.
Mitigation	The promotion of policy, regulatory and project-based measures that contribute to the stabilization or reduction of greenhouse gas concentrations in the atmosphere. Renewable energy programs, energy efficiency frameworks and substitution of fossil fuels are examples of climate change mitigation measures.
Resiliance	The capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure.
Risk	Risk can be considered as the combination of an event, its likelihood and its consequences – risk equals the probability of climate hazard multiplied by the consequence of that event.
Sensitivity	The degree to which a given system is directly or indirectly affected (either adversely or beneficially) by climatic conditions (i.e. temperature increases) or a specific climate change impact (i.e. increased flooding).
Systems	The built, natural and human networks that provide services or activities within a municipality.
Vulnerability	The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of both the sensitivity and the adaptive capacity of a given sector.

CLIMATE CHANGE PRIMER

INTRODUCTION TO ADAPTATION

Climate change is already being felt in towns and cities across the country. Canadian communities are becoming increasingly vulnerable to a range of impacts including rising temperatures, more frequent and intense storms and sea level rise. Municipal services and infrastructure are increasingly being affected by these events.

The Intergovernmental Panel on Climate Change (IPCC) has concluded that the evidence for climate change is now "incontrovertible" and that most of the observed temperature increases since the middle of the 20th century have been caused by increasing concentrations of greenhouse gases resulting from human activity such as the burning of fossil fuels and deforestation.[3] There is much evidence of this rapid warming around the world: retreating glaciers; thinning sea-ice; decreased snow cover; melting permafrost; changing growing seasons; and rising sea levels.[4]

Across Canada, warmer temperatures have supported the rapid spread of invasive animal and plant species, melting of arctic and glacial ice, and increased heat stress among vulnerable populations. While at the same time exacerbating Canadians concern about extreme weather events, including ice storms, floods, and forest fires.

Within only a handful of decades the climate in Canada is expected to experience more significant changes, including increased temperatures, increased risk of flooding, drought, forest fires, disease and various other impacts. While these are some of the national changes, it is important to note that each region of the country will be impacted differently by climate change.

"ADAPTATION to climate change can include any activity that reduces the negative impacts of climate change and/or takes advantage of new opportunities that may be presented. This includes activities that are taken before impacts are observed (anticipatory) and after impacts have been felt (reactive). Both anticipatory and reactive adaptation can be planned (i.e. the result of deliberate policy decisions), and reactive adaptation can also occur spontaneously. In most circumstances, anticipatory adaptations will incur lower long-term costs and be more effective than reactive adaptations. Successful adaptation does not mean that negative impacts will not occur, only that they will be less severe than would be experienced had no adaptation occurred."

NRCan. (2009) *Adaptation 101: What is Adaptation?* <http://adaptation.nrcan.gc.ca/101/adapt_e.php> [accessed January 9, 2010]

Mitigation measures are designed to reduce the emission of greenhouse gases (GHGs) that contribute to climate change and are meant to offer long-term benefits. Recognizing that current GHG concentrations in the atmosphere are already having an impact on the Earth's climate, climate change adaptation is necessary to moderate harm and take advantage of opportunities.[5] Hundreds of Canadian municipalities have already undertaken climate change efforts with mitigation work and have successfully reduced their emissions. However, with the increasing effects of climate change becoming apparent, municipalities are beginning to assess their vulnerability to the changes that are already underway, and to develop responses that protect their citizens and their economies. While neither adaptation nor mitigation actions alone can prevent significant climate change impacts, taken together they form a comprehensive climate change response strategy that will prepare communities for the climate impacts underway while working to avoid even worse future affects.

Mitigation is necessary to reduce the rate and magnitude of climate change, while adaptation is essential to reduce the damages from climate change that cannot be avoided.

NRCan. (2009) *Adaptation 101: What is Adaptation?* <http://adaptation.nrcan.gc.ca/101/adapt_e.php> [accessed January 9, 2010]

GLOBAL CLIMATE CHANGE

During the past century, the global climate has gotten warmer. Increased temperatures have been accompanied by a number of other observed changes in the global climate (Exhibit 4). Experts indicate that the average Northern hemispheric temperature during the past 50 years has been higher than at any other time during at least the past 1300 years.[6]

EXHIBIT 4

Observed changes in climate and weather conditions [7]

INDICATOR	CHANGE	COMMENTS
Air temperature	Increased 0.74°C Increased 0.13°C per decade	1906-2005 Rate (last 50 years)
Ocean temperature	Increased to depths of 3000 m	
Sea level	Rose 1.8 mm/annually Rose 0.17 m	Rate (1961-2003) Total (1900-2000)
Snow cover	Declined	Northern Hemisphere
Mountain glaciers	Widespread retreat	Since 1900
Arctic sea-ice extent	Decreased 2.7% per decade	Rate (1978-2005)
Permafrost extent	Decreased by roughly 7%	Since 1900
Heavy precipitation events	Increased in frequency	
Droughts	Increased in intensity and duration	Since 1970s
Heat waves	Increased in frequency	
Topical cyclones	Increased in intensity	Since 1970s

During the next two decades, the IPCC estimates that average global temperature will increase by 0.2°C per decade.[8] Even if the atmospheric concentrations of all GHGs were to be kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected globally.[9] The greatest warming is expected to occur over land and at high northern latitudes, in places such as Canada.[10] Higher temperatures will be accompanied by continued reductions in snow cover, sea ice, and an increase in permafrost thaw.[11] Based on increasing evidence, scientists have projected that days of extreme heat in the summer will also become more common, winter temperatures will be significantly warmer than current temperatures and heavy precipitation events will occur more frequently.[12]

CLIMATE CHANGE AND CANADA

In Canada, over the past fifty years, climate change has resulted in increases in temperatures across much of the country, changes in precipitation patterns, reduced sea-ice cover, shifting hydrological conditions and changes in extreme weather events.[13] The changes on many physical and biological systems, such as ice and snow cover, river, lake and sea levels, and plant and animal distributions are unequivocal.[14] In addition, increases in the occurrence of heat waves, forest fires, storm-surge flooding, coastal erosion and other climate related hazards are the result of changes in the climate.[15]

To Find Out More...
- **Information Annex One and Two**
- ***From Impacts to Adaptation: Canada in a Changing Climate,*** Natural Resources Canada

Temperature

On average, Canada has warmed by more than 1.3°C since 1948, a rate of warming that is approximately twice the global average.[16] All regions of Canada have experienced warming however the greatest temperature increases have been in the Yukon and Northwest Territories.[17] Under a medium emissions scenario, Canada is expected to warm 2°C by 2050 and 4°C by 2080.[18] Seasonally, Canada is expected to experience summertime warming of at least 2.5°C but this may be as much as 3.5°C, with the exception of the Arctic coast (at 1°C) where the absence of summertime sea ice will greatly moderate this summertime warming.[19] Winter warming is expected to be most pronounced in the Hudson Bay and high Arctic regions. In Northwestern Canada, winter temperatures already have increased more than 3°C between 1948 and 2003.[20]

Precipitation

Canada has, on average, become wetter during the past half century, with the average precipitation across the country increasing by about 12%.[21] When averaged annually, the largest percentage increase in precipitation has occurred in the high Arctic (25-45%), while parts of Southern Canada (particularly in the Prairies) have seen little change (~5%) or even a decrease in precipitation in some areas.[22] With winter precipitation, most of southern Ontario, except the western part which has seen an increase in lake effect snow, has experienced a significant decline in summer and winter precipitation.[23] In contrast, Southern British Columbia and Southeastern Canada have regions with significant increases in precipitation in spring and autumn.[24]

Changes in Freshwater Levels

Due to recent declines in the volume of glacial melt water in Western Canada, precipitation change and increased evaporation, water resources across much of Canada have been altered.[25] In the Great Lakes areas, for example, a 1°C increase in mean annual temperature has been associated with a 7-8% increase in the actual evaportranspiration (AET) rates, resulting in a decrease in water availability.

Changes in Seawater Levels

The magnitude of sea-level rise along Canadian coastlines also varies.[26] For example, in some parts of Canada, such as Hudson Bay, land has continued to emerge despite rising global sea levels whereas along most of the Atlantic coastline, the rate of sea level rise has doubled.[27] Relative sea-level changes will continue to exhibit similar patterns to those observed in the twentieth century. Therefore, those areas which are currently subsiding (e.g. Beauford Sea coast, Atlantic coastlines and Fraser River Delta) will experience the most impacts.[28]

Extreme Events

In general Canada has seen a change in the frequency of extreme temperature and precipitation events from 1950 to 2003. Such changes include fewer cold days, more extreme warm days, and more days with extreme precipitation.[29] Many of the most severe and costly impacts will be associated with projected increases in the frequency and magnitude of extreme events and the associated natural disasters such as flooding due to high-intensity rainfall and storm surges, ice and wind storms, heat waves and drought.[30] Flooding in particular is among the most prominent climate hazards Canadian communities face, and has been responsible for some of Canada's worst disasters.[31] Exhibit 5 lists examples of extreme events, and their associated costs, from across Canada between 1991 – 2005. More rapid and extensive snowmelt associated with rising temperatures and increasingly intense rainfall associated with summer storms could heighten the flood risk in many Canadian communities. In addition, serious disruptions to critical municipal infrastructure such as transportation, water treatment and distribution, and energy transmission have already occurred as a result of severe ice storms and are expected to occur more frequently in the future.[32]

Globally, the number of severe damage-causing storms has increased from an average of 150 per year in the early 1980s to between 250 and 300 per year in the period from 2000 to 2004.[33] In Canada, scientific models show shorter return periods of extreme weather events – that is, the estimated interval of time between occurrences – in the future.[34] Although there is some debate as to the connections between extreme events and climate change, it is important to consider the consequences of these events and their implications for communities across Canada.

EXHIBIT 5

Some observed impacts of changing climate on physical and biological systems in Canada [35]

PICTURES (shown on p. 13)	EVENT AND DATE	REGION	ESTIMATED COSTS	DEATHS	INJURIES	EVACUATIONS
1	**Ice storm, 1998**	Ontario, Quebec, Atlantic Canada	$5.4 billion	28	945	17,800
2	**Saguenay flood, 1996**	Quebec	$1.7 billion	10	0	15,825
3	**Calgary hailstorm, 1991**	Prairies	$884 million	0	0	0
4	**Red River flood, 1997**	Prairies	$817 million	0	0	25,447
5	**BC/Alberta wildfires, 2003**	British Columbia	$700 million	3	unknown	45,000
6	**Toronto extreme rain, 2005**	Ontario	Greater than $500 million	0	0	0
7	**Southern Alberta floods, 2005**	Prairies	Greater than $400 million	4	unknown	>2000
8	**Calgary hailstorm, 1996**	Prairies	$305 million	0	0	0
9	**Hurricane Juan, 2003**	Atlantic Canada	$200 million	8	unknown	unknown

IMPORTANCE OF LOCAL GOVERNMENT ACTION

Local governments need to begin adapting by taking steps to prepare for the existing and future impacts associated with a changing climate. These impacts can already be felt across the country – in large urban centres, in small-rural communities, and everywhere in between. Municipal decision makers have a unique opportunity to begin preparing for a changing climate as they will be on the front lines of responding to its impacts and therefore, have an interest in preparing for them.

As local governments are responsible for key service areas that will be affected by climate change: infrastructure, parks and recreation, health, and transportation. They are on the front lines of preparing for climate change impacts and have a responsibility to respond through strategic adaptation planning.

There are many reasons that local and regional governments are well positioned to plan for climate change:

- As climate change will affect a broad range of municipal assets and government services, operations and policy areas, preparing for climate change is a matter of risk management and good governance. Municipal governments have the responsibility of ensuring the safety, health and welfare of their communities both now and in the future.[36]

- Local and regional governments are in a position to tailor climate change adaptation strategies to their local circumstances and to the unique set of climate change impacts they expect to face.

- Anticipatory adaptation planning can increase future benefits and reduce future risks associated with climate change. Being proactive in planning for climate change can create opportunities for modifying present policies that can decrease vulnerability while also creating opportunities for capitalizing on some of the benefits of climate change.

"... As responsible public leaders, we cannot afford the luxury of not preparing. We know now that some impacts are inevitable and we know that these impacts will affect many of the essential services and functions that our governments are expected to provide. We must prepare for the impacts underway while we work to avoid even worse future effects."

Ron Sims, Executive, King County, WA

Local Government Action Mechanisms

There are five key mechanisms available to local governments to utilize and drive local action on climate change adaptation.[37] These are:

Land use and urban planning

A key role of local government is to manage local places in a coordinated, planned way that reflects the community's shared vision adapting to climate change.

Licensing and regulation

Local governments can utilize their powers to set the local regulatory environment through assessment and approval processes, the use of surcharges and rebates, and through the enforcement of local laws, to implement and enforce adaptive policies.

Facilitation, advocacy and leadership

Local government is in close contact with community organizations, businesses, residents and other stakeholders at the local level. This influence can be used to develop shared understandings and encourage whole community responses to climate change.

Community service delivery, community development and civic engagement

Local governments are committed to preserving the safety, health and wellbeing of residents and visitors, and to ensuring active civic participation.

Workforce development

As responsible corporate citizens, local governments can lead the way in ensuring good occupational health and safety systems including through the reduction of workplace risks.

Through these mechanisms local governments can use direct and indirect influences to support and foster communities that can adapt to a changing climate.

Legal Liability

Climate change awareness is strengthening the discussion into the prospect of legal liability related to adaptation. A growing number of legal professionals are looking at how failure to adapt to known and expected climate change realities may expose communities and governments to legal actions by individuals or others for property damage and personal injury.[38] Beyond financial compensation, the implications of this heightened exposure to legal liability include investor risk aversion, decreased confidence in governments, and backlogs in infrastructure projects.

Legal liability for failure to adapt infrastructure to climate change derives from the common law principles of negligence, nuisance, strict liability, and occupier's liability legislation. For example, a local government may be found negligent if it demonstrated awareness of a particular climate risk, such as the risk that decreased lake levels will result in the failure of an above-ground water system and affect water quality, but did not address the risk.[39] For infrastructure practitioners, reliance on existing codes, standards and related instruments would likely prove an insufficient defense against negligence, particularly if it is known that the codes or standards were inadequate under changing environmental conditions.[40] As the impacts of climate change intensify, infrastructure practitioners also need to be aware of potential changes in professional liability insurance.

Although Canada does not have legislation that specifically addresses obligations or responsibilities on climate change adaptation, it may not be reasonable for infrastructure decision-makers to seriously dispute the significance of climate risks, but ignoring the risks may not guarantee immunity to legal liability. In some communities, the prospect of legal liability will likely be a significant driver of climate change adaptation responses in the future.

EXHIBIT 6

Benefits and Challenges of Adaptation Planning

BENEFITS OF ADAPTATION PLANNING	CHALLENGES OF ADAPTATION PLANNING
• Insurance against future risk • Reducing vulnerability • Creating opportunities • Lower long-term costs • Reduced risk	• Degree of uncertainty • Nature of scientific information (constantly changing) • Benefits of advance planning may only appear when impact occurs • Limited resources and/or political support

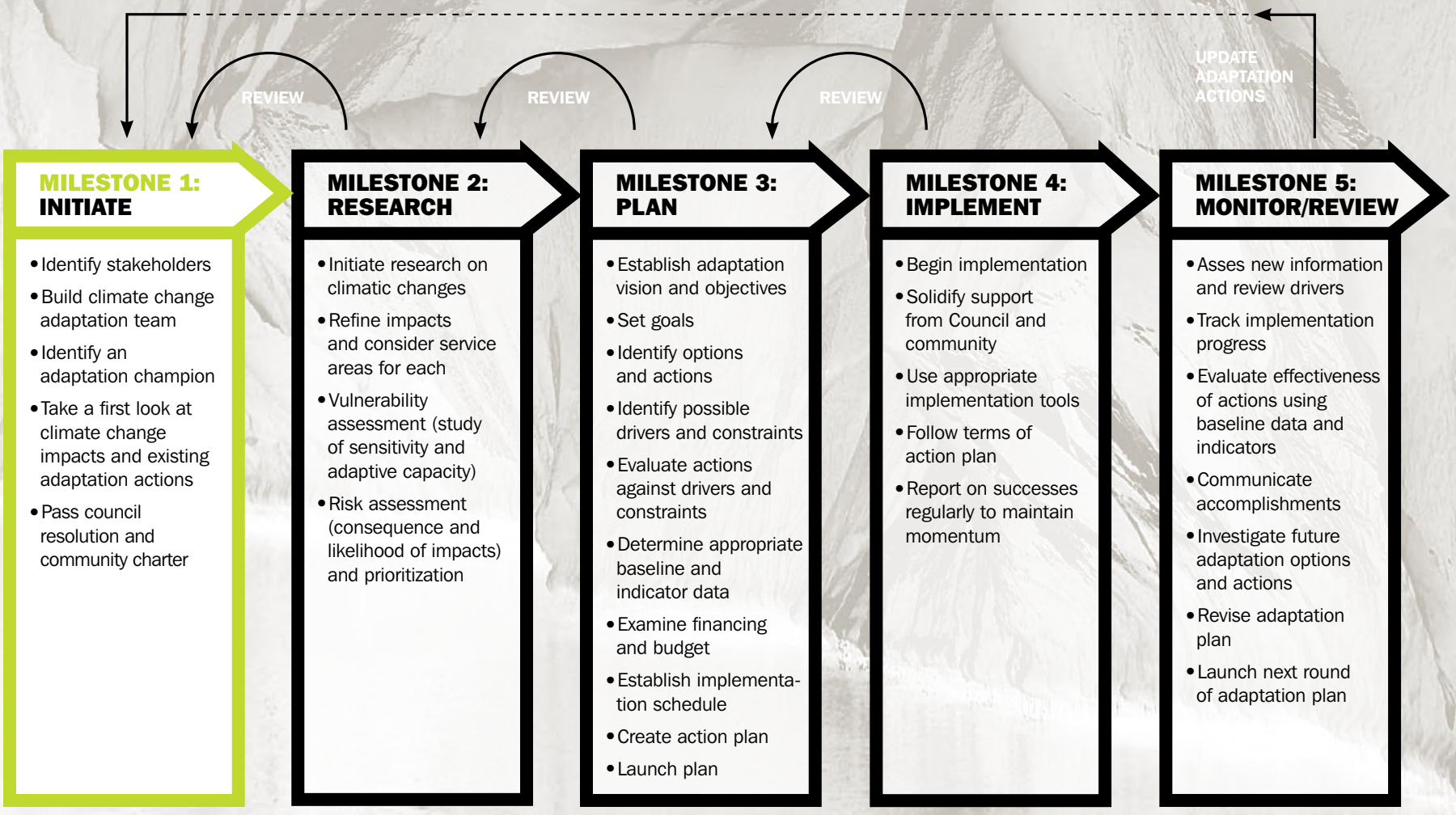
LOOKING AHEAD

It is clear that climatic changes are affecting communities across Canada. The unique position of municipalities as the level of government closest to residents along with their specific action mechanisms, allows for the development of locally tailored and integrated adaptation plans that can have measurable results in improving local adaptive capacity. Taking practical steps early, with the best information available, enables your community to reduce future climate change related risks.

The remainder of this compendium of resources is focused on helping your local community undertake a climate adaptation process. Use these resources as needed to help increase your community's capacity to prepare for climate change.

ENDNOTES

1. ICLEI Oceania (2009): Local Government Climate Change Adaptation Toolkit. Melbourne, Australia: ICLEI Oceania.
2. Glossary terms have been adapted from Bizikova, L., Neale, T., Burton, I. (2008). *Canadian Communities' Guidebook for Adaptation to Climate Change: Including an approach to generate mitigation co-benefits in the context of sustainable development*. First Edition. Environment Canada and University of British Columbia, Vancouver.
3. Watson, R. T., and the Core Writing Team (eds.) (2001). *Climate Change 2001: Synthesis Report*. Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press: Cambridge, UK. Available for download at http://www.ipcc.ch/ipccreports/tar/vol4/index.htm
4. McCarthy, J. J., Canziani, O. F., Leary, N. A., Dokken, D. J., and White, K. S. (eds.) (2001). *Climate Change 2001: The Scientific Basis – Contribution of Working Group 1 to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge University Press: Cambridge, UK. Available for download at http://www.ipcc.ch/ipccreports/tar/vol4/index.php?idp=75
5. Bernstein, L. et al. (2007) *Climate Change 2007: Synthesis Report – Summary for Policy Makers*. Cambridge University Press: Cambridge, UK. Available for download at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf
6. Hengeveld, H. Bush, E., Edwards, P., and Lacroix, J. (2008). *Frequently Asked Questions about the Science of Climate Change*. Environment Canada. Available for download at http://www.ec.gc.ca/scitech/2A953C90-CC12-42B2-BD0A-B51FECC2AEC3/FAQ_e.pdf
7. Solomon S., Qin, D., Manning, M., Chen, Z., Marquis, M. Averty, K.B., Tignor, M., and Miller, H.L., (eds.) (2007). *Climate Change 2007: Summary for Policy Makers – The Physical Science Basis.* Cambridge University Press, Cambridge, UK and New York, New York. Available for Download at http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf
8. *Ibid*
9. Bernstein, L. et al. (2007) *Climate Change 2007: Synthesis Report – Summary for Policy Makers*. Cambridge University Press: Cambridge, UK. Available for download at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf
10. Warren, F.J. and Egginton, P.A. (2008) *Chapter 2: Background – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
11. Solomon S., Qin, D., Manning, M., Chen, Z., Marquis, M. Averty, K.B., Tignor, M., and Miller, H.L., (eds.) (2007). *Climate Change 2007: Summary for Policy Makers – The Physical Science Basis*. Cambridge University Press, Cambridge, UK and New York, New York. Available for Download at http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf
12. Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
13. *Ibid*
14. Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.
15. *Ibid*
16. Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background Information – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
17. *Ibid*
18. *Ibid*
19. McBean, Gordon and Henstra, Dan (2009). *Background Report Climate Change and Extreme Weather: Designing Adaptation Policy*. Available for download at http://www.sfu.ca/act/documents/05_09-EWE_Background_Report_WEB.pdf
20. Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background Information – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
21. *Ibid*
22. *Ibid*
23. *Ibid*
24. *Ibid*
25. *Ibid*
26. *Ibid*
27. *Ibid*
28. *Ibid*
29. *Ibid*
30. *Ibid*
31. McBean, Gordon and Henstra, Dan (2009). *Background Report Climate Change and Extreme Weather: Designing Adaptation Policy*. Available for download at http://www.sfu.ca/act/documents/05_09-EWE_Background_Report_WEB.pdf
32. *Ibid*
33. Bruce, J.P. and Haites, E. (2008). *Canada in an International Context - From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J.Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 387-424.
34. McBean, Gordon and Henstra, Dan (2009). B*ackground Report Climate Change and Extreme Weather: Designing Adaptation Policy*. Available for download at http://www.sfu.ca/act/documents/05_09-EWE_Background_Report_WEB.pdf
35. Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.
36. Adapted from ICLEI Oceania (2009): Cities for Safe and Healthy Communities Data Inventory. Melbourne, Australia: ICLEI Oceania.
37. Snover, et al., (2007) *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments*. In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA.
38. National Round Table on the Environment and the Economy. (2009). *True North: Adapting Infrastructure to Climate Change in Northern Canada*. Ottawa: NRTEE. Available for download at http://www.nrtee-trnee.com/eng/publications/true-north/true-north-eng.pdf
39. *Ibid*
40. *Ibid*


REVIEW
REVIEW
REVIEW
UPDATE ADAPTATION ACTIONS
MILESTONE 1: INITIATE
• Identify stakeholders
• Build climate change adaptation team
• Identify an adaptation champion
• Take a first look at climate change impacts and existing adaptation actions
• Pass council resolution and community charter
MILESTONE 2: RESEARCH
• Initiate research on climatic changes
• Refine impacts and consider service areas for each
• Vulnerability assessment (study of sensitivity and adaptive capacity)
• Risk assessment (consequence and likelihood of impacts) and prioritization
MILESTONE 3: PLAN
• Establish adaptation vision and objectives
• Set goals
• Identify options and actions
• Identify possible drivers and constraints
• Evaluate actions against drivers and constraints
• Determine appropriate baseline and indicator data
• Examine financing and budget
• Establish implementation schedule
• Create action plan
• Launch plan
MILESTONE 4: IMPLEMENT
• Begin implementation
• Solidify support from Council and community
• Use appropriate implementation tools
• Follow terms of action plan
• Report on successes regularly to maintain momentum
MILESTONE 5: MONITOR/REVIEW
• Asses new information and review drivers
• Track implementation progress
• Evaluate effectiveness of actions using baseline data and indicators
• Communicate accomplishments
• Investigate future adaptation options and actions
• Revise adaptation plan
• Launch next round of adaptation plan

MILESTONE 1:

INITIATE

MILESTONE 1: INITIATE

Milestone One, *Initiate*, involves the first steps of your climate change adaptation effort. In this chapter you will go through the process of establishing the context for your adaptation plan, building your adaptation team, identifying an adaptation champion, and solidifying the adaptation planning process through a political commitment.

PURPOSE	OUTPUTS
To initiate your climate change adaptation planning process and build political as well as community support for the process.	✔ List of possible stakeholders ✔ A climate change adaptation team ✔ A climate change adaptation champion ✔ A first look at how climate change will affect your community ✔ List of existing municipal actions that improve adaptive capacity ✔ Identification of municipal plans and activities that could include adaptation components ✔ Council resolution which entrenches your communities' commitment to the adaptation planning process

COMMUNITIES AND ADAPTATION

There are a variety of reasons motivating communities to pursue adaptation planning. Some communities are motivated by events, such as flooding or wildfires that have occurred or are expected to occur, while others have a history of proactive community leadership and are building on that footing when it comes to adaptation planning. What will drive an adaptation effort in your community will be based on some combination of political will, financial resources, personnel, and public support. Exhibit 7 offers a list of possible drivers and corresponding questions to consider for moving forward with adaptation planning.

As you consider these questions, it may be helpful to use the answers to start identifying an initial list of adaptation goals that are relevant to your community. You will go through a formal process of identifying a vision and goals for your adaptation plan in Milestone Three, however, having a sense of where you would like the community to be in terms of climate change response may help to move forward through the initiation phase.

EXHIBIT 7

Possible drivers for adaptation planning

DRIVER	QUESTIONS TO CONSIDER
Past [extreme] events (i.e. flooding, fire where there was damage to people or infrastructure)	What extreme weather events has your community already experienced? What happened? What were the damages and associated costs? How has the climate changed in your experience?
Anticipated events (i.e. increased frequency and more extreme events)	How well prepared is your community if an extreme event occurs? Especially if such an event becomes more frequent or severe as a result of climate change.
Identified vulnerability (i.e. study which examines the vulnerability of the community to climate change impacts and/or anecdotal evidence of changes in the community)	What climate change impacts are the most likely to impact your community? How has the climate changed in your experience?
Funding opportunities	Are there any federal or provincial funding opportunities available to your community? Can you leverage existing funding?
Co-benefits	What are some existing sustainability priorities your community has? How can adaptation planning help meet these priorities? Are there any opportunities associated with climate change that could arise for your community (i.e. job creation)? Are there ways in which your community can address both climate change adaptation and mitigation in the same plan?
Political Pressure	Are there residents or community groups that are pushing the municipality to act on climate change?
Work in other areas that also address vulnerability, resilience or adaptation	What adaptation initiatives exist in your community that may not be labelled as such? What actions has your community taken thus far to prepare for changes in climate? What about changes to infrastructure (specifically technology)?

IDENTIFYING POTENTIAL STAKEHOLDERS

Although this exercise will inform the building of your adaptation team, it is also an exercise in surveying those individuals and groups which will likely be needed more broadly throughout your community's adaptation initiative. The list of potential stakeholders that you identify in this exercise will include more than those that can reasonably be included on your team, however, it is important to engage in a stakeholder identification process to establish a foundation for communication and input with a wide-net of internal and external stakeholders.

Involving a variety of stakeholders is an important component to securing widespread support for the implementation of adaptation actions. Many of the challenges of adapting to climate change can be overcome by developing working relationships with both internal and external stakeholders. Relationships between and among local governments, utilities, universities, non-governmental organizations, community-based entities and business organizations are helpful in turning the abstract idea of planning for climate change into concrete joint activities. Identifying stakeholders will also help to further establish the context of your adaptation plan by refining how far reaching your adaptation activities will be.

Gathering a few key colleagues to determine who your potential stakeholders are is a good way to ensure that you are drawing from a broad spectrum of departments, working areas and the community. If you are working in a smaller community, it may be that a single or pair of individual(s) will be conducting this activity.

Regardless of your approach, be sure to consider stakeholders that may be outside of your immediate working area (for example, if you generally work with environmental groups and a university partner, it will be important to consider including developers, Chamber of Commerce representatives, etc. which may be outside of your immediate sphere of influence). When identifying potential stakeholders either for your adaptation team, or to be involved in key communication and input points along the way, it is important to be as specific as possible and identify:

- Internal stakeholders with responsibility for management of climate change impacts such as infrastructure, public communications, natural resources, economic development and emergency services (this will help later on when identifying potential adaptation team members).

- Existing relationships with external stakeholders, such as regional alliances of local governments, environment or community groups, universities, local businesses, industry associations, insurers, utilities, scientific research bodies and other levels of government.

- External stakeholders with whom you do not have an existing relationship but which may be valuable to your community's adaptation process.

Once you have brainstormed a list of all possible stakeholders, discuss with your colleagues which stakeholders will be the most relevant to the adaptation planning process. You may also want to use this refined list of stakeholders to help inform the make-up of your climate change adaptation team.

1 *Worksheet 1 uses the idea of spheres of influence to assist in identifying stakeholders and their relationship to your community.*

CASE STUDY

ENGAGING STAKEHOLDERS

Raising awareness and engaging stakeholders in Boston, MA

In the City of Boston, their adaptation planning research team contracted the Metropolitan Area Planning Council (MAPC), a regional planning agency, to coordinate stakeholder involvement across the 101 towns and cities that make up the Boston Metropolitan area. MAPC prepared a brochure which invited stakeholders to get involved and highlighted several extreme weather events. Resulting from the success of the brochure, Boston had approximately 30 stakeholders participate in their Stakeholder Advisory Group which met several times throughout the five-year adaptation planning project.

Penney, J. and Wieditz, I. (2007). *Cities Preparing for Climate Change: A study of six urban regions*. Clean Air Partnership: Toronto, Canada.

BUILDING YOUR CLIMATE CHANGE ADAPTATION TEAM

When forming your adaptation team, try to ensure a diversity of expertise which draws on all relevant departments or programs. This process can draw from the stakeholder identification activity done previously and can include as many or as few individuals as is appropriate for your community. The team can be any mix of stakeholders (internal or external) that you, as a community, are comfortable with. Where possible, try and draw on the expertise within your municipal network. Keep in mind that the more people there are on the team, the more comprehensive your dialogue and resulting adaptation plan will be, however, the logistics of scheduling and managing meetings can become increasingly difficult with more participants.

There are both pros and cons to having a team that is made up of only staff or one that is a mix of both internal and external individuals. It may be the case that working internally allows for more frank and open discussions and it may be more efficient as members are likely to be familiar with each other and common processes. On the other hand, having a team that is made up of both internal and external members may result in a more comprehensive mandate and show members of the public that your local authority is keen to engage with the community and work together.

The number and background of your team members will vary. The team makeup that is appropriate for your community will depend on the specific impacts likely to occur in your region; the infrastructure and policies that will be affected; and how your local government intends to interact with other stakeholders and the public to prepare for climate change.[41] As such, it is important to take a first look at impacts at the beginning of your adaptation process, so as to bring on additional members to your adaptation team as your community's needs may change and evolve over time.

Consider This…

If you are a small community your staffing capacity may be limited. In such cases it might be necessary to involve individuals outside of your organization including scientific authorities, business community leaders, and/or provincial or federal agencies as participants of your adaptation team.

EXHIBIT 8

Potential Participants in a Climate Change Adaptation Team

DEPARTMENTS		
Agriculture	Environment	Police
Coastal Zone Management	Finance and Administration	Port and Harbour Management
Communications	Fire Services	Public Health
Economic Development, Culture and Tourism	Housing	Transportation
Emergency Management	Legal Services	Water
Energy	Parks and Recreations	Waste
Engineering	Planning and Zoning	

CASE STUDY

Building a Team – An Interagency FireSmart Committee in Kamloops, BC

In response to a growing concern about the frequency and severity of wildfires in Kamloops, the City established the Interagency FireSmart Committee, a multi-stakeholder team to coordinate wildfire responses. Drawing from a variety of stakeholder groups, team members include individuals from the City of Kamloops Fire Rescue Services; City of Kamloops Parks, Recreation, and Cultural Services Department; Ministry of Forests and Range; Thompson-Nicola Regional District; City of Kamloops Development and Engineering Services Department; and the British Columbia Office of the Fire Commissioner.

In addition to the participation of these stakeholders, the City of Kamloops also created a Community Wildfire Planning Group which consists of additional subject experts. The purpose of the FireSmart Committee is to recommend and support initiatives in order to reduce the risk of wildfire losses within the City boundaries. In 2007, the Committee produced a *Community Wildfire Protection Plan* which outlined the City's actions to date and contains a number of future recommendations to reduce the risk of life, property and environmental losses directly or indirectly related to wildfires within the City. The Kamloops inter-agency FireSmart Committee will collectively and collaboratively monitor and evaluate the Plan on a regular basis. For more information on Kamloops approach to adaptation or to get a copy of the *Community Wildfire Protection Plan* visit http://www.kamloops.ca/firerescue/wildfire/wildfireoverview.shtml

Developing a Mandate

Working with your team, you will need to develop a mandate for the adaptation team. The following questions are intended to help guide the development of the mandate:

- Is your adaptation team being established as a permanent working group?
- What are the ultimate deliverables the team is responsible for?
- How much time does the team have to accomplish these deliverables?
- What resources are available for the team to accomplish its work?
- What authority does the team have?
- To whom is the team accountable?

A clear and strong mandate will not only help the team with its work but will also give legitimacy to the work that is being carried out from an outside perspective.

Selecting a Team Leader

With your adaptation team and mandate in place, your next step is to designate someone as the team leader. This person will have the responsibility of assembling the team and leading its efforts. Given that your adaptation team will cross a variety of departments, it is important that the team leader have a strong understanding of municipal operations, be centrally located, have a good grasp of the community's concerns, and should be able to communicate well with colleagues from other departments or divisions. The team leader should also have authority to work with staff members from all departments; though they will not be the direct manager of all team members they should ideally have authority to require deliverables from the departments represented on the team. With the help of the team mandate and the appropriate authority, the team leader should be able to count on the willingness of departments to contribute.

Consider This…

It may be helpful to kick-off your community's adaptation efforts with trainings for staff, the community and other stakeholders on relevant climate science and predicted impacts. This also provides an opportunity to begin to think about sectors that would be most impacted by a changing climate. You can look to external organizations to conduct this training or, if the resources are available to you internally, you could have municipal staff do it.

2 *Worksheet 2 offers additional guidance on creating your adaptation team.*

Now that you've created your adaptation team you may want to revisit your list of stakeholders to ensure that the list is still relevant and there aren't any key stakeholders missing.

Selecting a Climate Change Adaptation Champion

Outreach will play a major role in building and maintaining support for your adaptation effort; therefore it is a good idea to identify an adaptation champion to lead outreach activities. In some cases you will have existing support from individuals for your climate change work, while in other cases you may have to develop a new champion. Selecting an appropriate champion will help solidify the awareness and long-term commitment from your local government to the planning process. Your adaptation champion should commit to this process and the responsibility of being the public spokesperson on adaptation to the community.

Potential champions include, but are not limited to, current (or former) elected officials, key business leaders, long-range planners, or other respected members of the community. It will generally be the case that your champion and team leader will be different individuals.[42] If, however, you feel that it is most appropriate for your community to have one individual that is both your adaptation team leader and champion this can also work.

Consider This…

Your community may want to hold a press event to introduce the Adaptation Champion. The event can kick off your adaptation effort and showcase publicly your commitment to the planning process.

CASE STUDY

Selecting an Adaptation Champion – A Climate Change Adaptation Champion in Toronto, ON

"While stopping the release of greenhouse gases remains our first priority, it's apparent that some degree of climate change has already begun. In developing an adaptation strategy, the City of Toronto is taking steps to prevent negative impacts associated with the realities of a changing climate while proceeding with actions designed to combat further change."

Mayor David Miller, Spring 2008

Ahead of the Storm: Preparing Toronto for Climate Change **is the City's adaptation plan which outlines a series of actions to improve Toronto's resilience to climate change including:**

- **A series of short-term actions beginning in 2008 that will help prevent and/or minimize the impacts of climate change in Toronto;**
- **A series of actions that will guide the City's development of a comprehensive, long-term strategy to adapt to climate change.**

Ahead of the Storm **was unanimously endorsed by City Council in July, 2008. Mayor David Miller has been a champion for the City's adaptation planning and the on-going implementation that it will involve.**

CASE STUDY

Championing Adaptation – An Advocate in Homer, AK

In September 2006, Mayor James Hornaday returned from a national convention on climate change which emphasized the critical role of local governments in reducing greenhouse gas (GHG) emissions and helping communities to begin preparing for unavoidable changes in the climate. Subsequently, in an effort foster leadership in climate protection, the Homer Global Warming Task Force (GWTF) was formed thanks to Mayor Hornaday's commitment to reduce the impact of climate change on the community. With further support from the Mayor, City Council approved the mandate of the task force via a council resolution in January 2007 which commissioned the GWTF to research and make recommendations to City Council on how to reduce GHG's and the impact of climate change on Homer's environment, economy, infrastructure and future development.

The resulting report, the Homer Climate Action Plan (CAP), was produced involving a number of stakeholders including the Alaska Marine Conservation Council, Sustainable Homer, Homer Chamber of Commerce, Alaska Conservation Solutions, Alaska Islands and Ocean Visitor Center, and ICLEI. To review the report visit www.ci.homer.ak.usCLPL.pdf

A FIRST LOOK AT CLIMATE IMPACTS

Once your adaptation team is formed, it is important to assess what common understanding exists about climate change and how it affects your community. As part of Milestone Two, *Research*, you will complete a more in-depth analysis of the effects of climate change on your region; however it is important to look at these questions at the beginning of the process so that you can ascertain what is already known about climate change and its impacts. Take this opportunity to brainstorm how climate change is impacting (or how it will impact) your community, what you already know about climate change, and how your community currently addresses climate change impacts via informal adaptation actions or existing policies that might include adaptation components. This will be a good opportunity to gather your adaptation team to brainstorm with, you may also want to consider bringing in additional people from various departments as this will help ensure that a broad spectrum of potential impacts is covered.

This initial brainstorming session is where you will lay the groundwork for identifying areas which will require further research and what resources are easily available to you now. You may wish to look at the basic question of *"How could climate change affect my region, and do these impacts pose a risk for my community?"*

Climatic Change:
Refers to the changes in climate variables including precipitation and temperature, as well as changes in sea and lake levels and the frequency and intensity of extreme events.

Impact:
The effects of existing or forecasted changes in climate on built, natural, and human systems.

IMPACTS AND SYSTEMS THINKING

Climate change impacts will be cumulative and often synergistic. As such, it is important to look at climatic changes and their impacts on a range of systems – physical, social, economic, and ecological. By looking at the variety of systems that are being affected, impacts on one system can be understood in the context of their relationships with other systems rather than in isolation (i.e. the effects of sewage system failures both on the physical sewer infrastructure and on the wider ecological system).

By examining the linkages and interactions between impacts and the entirety of the municipal system, the effect and nature of the climatic change will be better understood. Acknowledging that a change in one area of a system can adversely affect another area of the system, promotes organizational communication at all levels in order to avoid the silo effect.

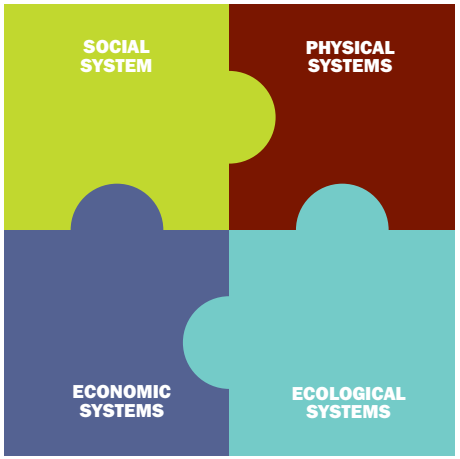
It is important to recognize that repeated or continued stresses, such as those posed by climate change impacts, can increase vulnerability, particularly when they occur in combination with other stress-inducing factors (such as population growth) and at high enough frequencies to prevent recuperation.[43]

Physical Systems

Climate change presents a variety of challenges for the physical infrastructure of communities. Expected climate changes will increase maintenance and protection costs, replacement costs and the loss of assets across the country.[44] Physical systems can include: dykes, culverts, roadways, bridges, buildings, sewer systems, and levees.

EXHIBIT 9

Impacts and Systems



Social Systems

Expected changes in precipitation, water levels, and temperatures will affect the complex social systems in communities across the country. Some impacts include: the health of individuals and particularly vulnerable populations; incidents of environmental refugees and displaced persons; limitations in the livelihoods of certain populations while improving the livelihoods of others; and increases in the need for (and alteration of) emergency response plans. These impacts focused on social systems will also be exacerbated by non-climate related phenomenon (i.e. economic downturn, civil conflict, etc.).

Economic Systems

Economic systems will be affected by climate change in a variety of ways: extreme events will cause significant economic losses; changing climate conditions will affect the production, price, and demand for goods and services; costs related to public health and safety will also result from climate change impacts.[45]

Climate change will also have a profound impact on the insurance industry.[46] The cost of insurance for homes and businesses, for example, has increased in recent years in regions where new research shows that the expected future damage is higher than historical damage.[47]

Consider This…

More than 1600 communities in Canada obtain 30% or more of their employment income from agriculture, forestry, fishing and hunting. The vulnerability of resource dependent communities to climate change reflects the high climate sensitivity, limited economic diversification and restricted access to services of many natural resource based industries.

Ecological Systems

Ecological systems will be profoundly affected by climatic changes. The impacts can range from: changes in abundance and/or distribution of species, large shifts in species ranges, increased fragmentation of habitats, and wildfire frequency and severity. Temperature and precipitation fluctuations will affect growing seasons, plant productivity, as well as animal habitat, migration patterns, breeding and survival rates, the incidence of insect infestations, and habitat diversity.[48]

In particular, ecological consequences will not be felt in isolation and should be considered in tandem when looking at climate change impacts. For example, vegetation and insects will shift in response to climate change and as a result, tourism and other recreational activities, such as bird watching, will be affected along with sectors such as agriculture, forestry and urban park management.[49]

Part One: A first look at climate change impacts

Having looked at the relationship among systems, Worksheet 3 *A First Look* is meant to assist your adaptation team with determining a preliminary understanding of climate change impacts and their effects on a variety of systems (physical, ecological, social, etc.) in your community, prior to having conducting research.

Some questions to get your team started include:

- What extreme weather events has your community already experienced? What were the impacts of those events?
- How well prepared is your community if such an event occurs again? Especially if such an event becomes more frequent or severe as a result of climate change?
- Based on your existing knowledge what climatic changes are the most likely to impact your community?
- Are there any opportunities associated with climate change that could arise for your community?

Part Two: First look at existing municipal actions

Before delving into the research stage in Milestone Two, it is helpful to take stock of existing actions that improve the adaptive capacity of your community; keep a list of actions that are already underway and even planned actions that might be relevant to the adaptation planning process. This will help your team evaluate where there are existing actions addressing weather related impacts, how these actions can be revised to accommodate for climate change and where there is a need for more action. Where actions exist that already address some aspect of climate impacts, consider how that impact is likely to change in the future and how the action might be revised to accommodate further climatic changes. For example, consider emergency management and response work, infrastructure maintenance, and public health actions. As you look at these existing actions, keep the impacts you've brainstormed previously in mind: Do any of these existing actions address the impacts you've identified? Can the actions be amended to account for climate changes?

Adaptive Capacity: Describes the ability of the built, natural and social systems to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Part Three: First look at existing plans and policies

As with actions, there may be existing plans and policies within your community that already address adaptation but perhaps aren't labelled as such; likewise there may be plans and policies that should include adaptation provisions in the future. Look into the variety of plans that exist across departments (i.e. Transportation Master Plans, Cycling Master Plans, Environmental Master Plans, etc.), as well as any other strategic policy documents (i.e. Official Community Plans, Long-term Sustainability Visions, Strategic Plans, etc.) and take stock of the way these plans may already include some elements of adaptation and which of these plans should in future iterations, include climate change adaptation components.

3 *Worksheet 3 will assist your team with a preliminary scan of existing knowledge on climate change impacts, actions which are already address elements of adaptation and look at the policies, plans, or other municipal decisions that pertain (or could include) adaptation elements.*

The information from Worksheet 3 will be the basis for communicating how climate change impacts will affect various service areas in your community to both internal and external audiences.

ISSUE BRIEFS

It is important that staff and decision makers from all departments within your local government are made aware of the importance of adaptation planning. Since adaptation actions will be required across most (if not all) departments, informing staff and managers from these departments early on in the process about projected climate change and the related impacts will help build support for the planning process. It will be helpful to the process if decision makers and individuals with influence are made aware of the importance of climate impacts within their spheres of responsibility and understand that there are realistic and practical measures that can be taken to reduce vulnerability.[50]

Issue briefs (as outlined in Worksheet 4) are a way in which various departments can communicate with each other. They may go by another name in your community, such as framework documents, memos or interdepartmental communications, however they all accomplish the same goal of interdepartmental communication.

Likewise, issue briefs can be used to communicate to the key stakeholders identified in Worksheet 1. They can help in communicating that the community is undertaking an adaptation planning process and offer information on how individuals or organizations can become involved.

4 *Worksheet 4 provides a sample issue brief which can be used to communicate both internally with other municipal staff and externally with stakeholder groups.*

PASSING A COUNCIL RESOLUTION

Though this guide will be particularly valuable to local government staff, it is important to acknowledge the importance of political level involvement in adaptation planning. By exposing local elected officials to key elements of the guide, and including them at significant points, staff can ensure that their efforts will have political support in the long-term. In this way, solidifying the adaptation planning process through a political commitment is an important component of Milestone One.

In making a political commitment to the adaptation planning process, you are ensuring that this process will continue in spite of possible political changes in the community. This commitment is not specific to particular impacts or corresponding actions, rather the council resolution is simply committing the community to examine climate change impacts and move forward with preparing a climate response plan. This kind of political declaration can provide a useful foundation to which your government, your future adaptation team and your successors will be able to refer. Passing a resolution highlights the importance elected officials place on climate change and serves as another opportunity to educate the public and local government staff on impacts, while also securing a path towards action and implementation far into the future.

CASE STUDY ***Passing a Resolution - Establishing the Miami-Dade Country Climate Change Advisory Task Force***

Through the adoption of Ordinance 06-113, the Board of County Commissioners established the Miami-Dade County Climate Change Advisory Task Force (CCATF) in July, 2006. The CCATF acts as an advisory body to the Board of County Commissioners recommending both mitigation and adaptation measures in response to potential climate change impacts. Through these recommendations the CCATF is working with the Board and the Mayor to solidify Miami-Dade's commitment to climate change adaptation planning and greenhouse gas reduction measures.

As your team develops a resolution for your community you may also want to consider:

- The provincial or territorial position on climate change and adaptation planning;
- How existing plans address climate change impacts and adaptation planning; and,
- How to involve internal and/or external stakeholders.

5 *Worksheet 5 provides a sample council resolution which will help in drafting your community's own climate change adaptation council resolution.*

WHERE SHOULD YOU BE NOW?

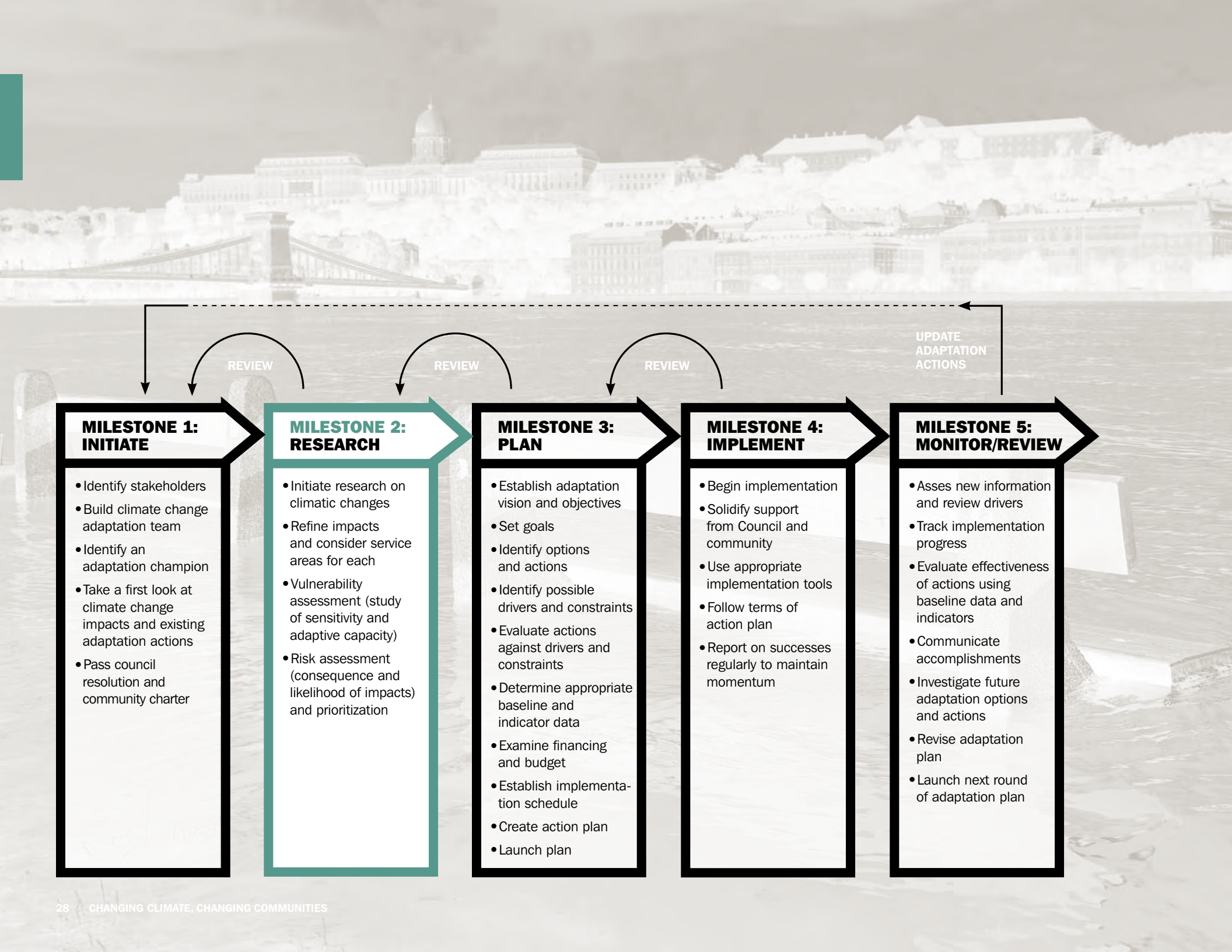
Upon finishing Milestone One you should have formed an interdepartmental (and possibly external) climate change adaptation team with a clear and transparent mandate; the team should be spearheaded by a team leader and likewise an Adaptation Champion should be identified who will build support and advocate for your adaptation planning efforts. Through the first steps of this milestone, you will have a sense of what the perceived climate change impacts are for your community (and how you may already be responding to some of these). Moving onto Milestone Two, *Research*, your adaptation team will delve deeper into the specific climatic changes that will affect your region and accordingly will refine the climate change impacts associated with these.

SUMMARY OF OUTPUTS

- **List of identified stakeholders**
- **A climate change adaptation team**
- **A climate change adaptation champion**
- **A first look at how climate change will affect your community**
- **List of existing municipal actions that improve adaptive capacity**
- **Identification of municipal plans that could involve adaptation components**
- **Council resolution which entrenches your communities' commitment to the adaptation planning process**

ENDNOTES

41. ICLEI Oceania (2009): Local Government Climate Change Adaptation Toolkit. Melbourne, Australia: ICLEI Oceania.
42. *Ibid*
43. Sauchyn, D. and Kulshreshtha, S. (2008). *Chapters 7: Prairies – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 275-328
44. *Ibid*
45. Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.
46. Bruce, J.P. and Haites, E. (2008). *Canada in an International Context – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J.Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 387-424.
47. *Ibid*
48. Sauchyn, D. and Kulshreshtha, S. (2008). *Chapters 7: Prairies – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 275-328
49. *Ibid*
50. Penney, J. and Wieditz, I. (2007). *Cities Preparing for Climate Change: A study of six urban regions.* Clean Air Partnership: Toronto, Canada.


REVIEW
REVIEW
REVIEW
UPDATE ADAPTATION ACTIONS
MILESTONE 1: INITIATE
• Identify stakeholders
• Build climate change adaptation team
• Identify an adaptation champion
• Take a first look at climate change impacts and existing adaptation actions
• Pass council resolution and community charter
MILESTONE 2: RESEARCH
• Initiate research on climatic changes
• Refine impacts and consider service areas for each
• Vulnerability assessment (study of sensitivity and adaptive capacity)
• Risk assessment (consequence and likelihood of impacts) and prioritization
MILESTONE 3: PLAN
• Establish adaptation vision and objectives
• Set goals
• Identify options and actions
• Identify possible drivers and constraints
• Evaluate actions against drivers and constraints
• Determine appropriate baseline and indicator data
• Examine financing and budget
• Establish implementation schedule
• Create action plan
• Launch plan
MILESTONE 4: IMPLEMENT
• Begin implementation
• Solidify support from Council and community
• Use appropriate implementation tools
• Follow terms of action plan
• Report on successes regularly to maintain momentum
MILESTONE 5: MONITOR/REVIEW
• Asses new information and review drivers
• Track implementation progress
• Evaluate effectiveness of actions using baseline data and indicators
• Communicate accomplishments
• Investigate future adaptation options and actions
• Revise adaptation plan
• Launch next round of adaptation plan

MILESTONE 2:

RESEARCH

MILESTONE 2: RESEARCH

This chapter begins the research phase of your climate adaptation planning efforts. This segment of the planning process will provide a critical foundation on which all later stages of your adaptation effort will rest. An important part of assessing climate change impacts is not only obtaining information about changes in basic climatic variables such as temperature and precipitation, but also gathering information on what these changes will mean for the resources, infrastructure and residents of your community.

In Milestone Two, you will delve deeper into climatic changes and their impacts, how these impacts affect the service areas in your community, and the vulnerability and level of resulting risk your community faces.

PURPOSE	OUTPUTS
To research the climatic changes and impacts for your region and identify the main service areas that will be impacted by those changes.	✔ A list of impact statements and the service areas that will be directly or indirectly affected ✔ A vulnerability assessment ✔ A risk assessment ✔ A prioritized list of impacts – based on vulnerability and risk assessment

CHECKING BACK

Adaptation planning is an iterative process which requires a degree of continuous assessment. As you progress through Milestone Two, be sure to keep track of how new conditions within your community as well as new data on how the climate may be changing might affect the decisions you've taken in Milestone One. Examples of conditions that might influence your decisions include:

- Changes in staff (additions or decreases);
- New positions that have been created; and
- New stakeholders that might be of interest.

Maintaining the relevance and accuracy of your information throughout the planning process is extremely important as the information you collect informs the decisions you will make in the future. Monitoring and review will be articulated more formally in Milestone Five; however it will help down the road to establish a process of reflecting on the outcomes of the previous Milestone at each phase of the adaptation planning process.

CLIMATE CHANGE

As Exhibit 9 demonstrates, Canada is expected to get hotter, wetter and experience more instances of extreme events. Many of the most severe and costly climate change impacts will be associated with projected increases in the frequency and magnitude of extreme climate events and associated natural disasters. These events include flooding due to high-intensity rainfall and storm surges, ice and wind storms, hail, heat waves and drought. An understanding of future extreme events is particularly important for the design and maintenance of infrastructure, emergency management, and community health and safety and should be integrated into your adaptation planning efforts.[51]

In addition to increasing the intensity and frequency of impacts already being observed, a changing climate will bring new risks to some areas, including the introduction of vector-borne diseases into areas where climate conditions have inhibited survival of vector hosts in the past.[52]

The cumulative nature of impacts, and the associated uncertainties, makes it likely that climate change will produce some 'surprises'. However, as is the case for all human and managed natural systems, the magnitude of impacts can be reduced through adaptation.[53]

To Find Out More...
- **Information Annexes**

> **"Extreme weather events can become natural disasters when they strike vulnerable communities that are unable to manage the risk and are unprepared to cope with the hazard. People in Canada can be affected by natural disasters in other countries through indirect impacts on the availability and cost of goods and services, changes in financial markets, and requests for donations of money, clothing and food. An example was the spike in oil and gas prices in Canada following Hurricane Katrina in 2005, and the storm's impact on Gulf oil production."**
>
> Bruce, J.P. and Haites, E. (2008). *Canada in an International Context – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J.Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 387-424.

EXHIBIT 9

Summary of Projected Climatic Changes for Canada [54]

NATIONAL	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Annual temperature increase of 1.1°C from 1950-2000	Projected increase of 2°C by 2050 and 4°C by 2080	Projected increase by 2050 of 1°C and 2°C by 2080	Projected increase by 2050 of 5°C and 8°C by 2080	The values that are used for medium, low and high emissions scenarios reflect the average median projected change in temperature across six Canadian cities.
Annual Average Precipitation	Average precipitation increase of 29 mm from 1950-2000	Projected increase of 138 mm by 2050 and 171 mm by 2080	Projected increase of 46 mm by 2050 and 29 mm by 2080	Projected increase of 271 mm by 2050 and 333 mm by 2080	The values that are used for medium, low and high emissions scenarios reflect the average median projected change in precipitation across six Canadian cities.
Extreme Weather	There is evidence to suggest that extreme weather events, such as winter cyclonic storms, summer heat and drought, and flooding are increasing in intensity and frequency. These rapid rates of change may exceed certain coping thresholds.	N/A	N/A	N/A	Note: Not all extreme events can be linked to climate change however extreme weather events, such as flooding, wind storms, drought, ice storms, tornados and wild fires, highlight the vulnerability of Canadian communities and critical infrastructure to climate change.
CHANGES IN WATER LEVELS Rivers and Lakes	Water levels in Canada vary considerably over space and time.	N/A	N/A	N/A	N/A
Prairies	N/A	Projected decrease of ~9% in winter and spring stream flows by 2050.	N/A	N/A	N/A
Great Lakes	A 1°C increase in mean annual temperature is associated with a 7-8% increase in the evapotranspiration rates (AET) resulting in decrease water availability in the Great Lakes.	Water levels in the Great Lakes are generally projected to drop in the future.	N/A	N/A	N/A
CHANGES IN WATER LEVELS Sea	N/A	N/A	N/A	N/A	N/A
Atlantic Canada	Between 1911-2000 sea level has risen ~30cm	2000-2100 sea level is projected to increase 50-70cm	N/A	N/A	N/A
Pacific Canada	Average sea levels have risen 4-12 cm along pacific coast (E.g. high water sea levels in Vancouver increased by 16-34 cm) [55]	N/A	N/A	N/A	N/A

INITIATING YOUR RESEARCH

Having taken a first look at the climatic changes that your community has already experienced in Milestone One, it is now important to carry out research into the specific ways in which you region's climate may change. There are many sources of information on climate change, ranging from national and regional reports to basic fact sheets. Begin by collecting information on key climatic variables such as precipitation, temperature, changes in water levels and extreme weather events.

Exhibit 10 provides a list of organizations that collect or produce climate data, specific to each region of Canada. The information annexes also include resources ranging from regionally-focused climate change reports, to fact sheets and websites, which can help your team with researching projected changes in regional climate.

Note: At the time of publishing, only British Columbia, Prairies, and Atlantic Canada's Regional Adaptation Collaboratives had been announced. For more information on Regional Adaptation Collaboratives see the Natural Resources Canada website: http://adaptation.nrcan.gc.ca/collab/index_e.php

EXHIBIT 10

Sample Organizations with ClimateData by Region

REGION	ORGANIZATIONS	WEBSITE
International	• Intergovernmental Panel on Climate Change (IPCC) • Pew Center of Global Climate Change • Red Cross/Red Crescent Climate Centre • UK Climate Impacts Programme	http://www.ipcc.ch/index.htm http://www.pewclimate.org http://www.climatecentre.org/ http://www.ukcip.org.uk
National	• Canadian Climate Change Scenario Network • Canadian Institute of Planners • Centre for Indigenous Environmental Resources • Engineers Canada • Environment Canada • Environmental Systems Research Institute Canada • The Federation of Canadian Municipalities • International Association of Emergency Managers Canada • Natural Resources Canada's National and Regional Assessments • Ouranos • Policy Research Initiative	http://www.cccsn.ca http://www.cip-icu.ca http://www.cier.ca http://www.engineerscanada.ca http://www.ec.gc.ca http://www.esricanada.com/english/955.asp http://www.fcm.ca http://www.iaem-canada.ca/html/home/html/ http://www.nrcan.ca http://www.ouranos.ca http://www.policyresesarch.gc.ca
Atlantic Canada	• Atlantic Climate Adaptation Solutions • ClimAdapt	http://adaptation.nrcan.gc.ca/collab/index_e.php http://www.climadapt.com/aboutus.html
British Columbia	• British Columbia Regional Adaptation Collaborative • Pacific Climate Impacts Consortium • Pacific Institute for Climate Solutions • Professional Engineers and Geoscientists of BC (APEGBC) • Provincial Emergency Program	http://adaptation.nrcan.gc.ca/collab/index_e.php http://pacificclimate.org/ http://www.pics.uvic.ca/research/details.php?id=13899 http://www.apeg.bc.ca http://www.pep.bc.ca/index.html
Northern Canada	• Arctic Change • Canadian Polar Information Network • Northern Climate Exchange • Taiga Net	http://www.arctic.noaa.gov/detect/ http://www.polarcom.gc.ca http://www.taiga.net/nce/index.html http://www.taiga.net
Ontario	• Emergency Management Ontario • Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) • Professional Engineers Ontario	http://www.emergencymanagementontario.ca/english/home.html http://www.climateontario.ca http://www.peo.on.ca
Prairies	• Alberta Emergency Management Agency • Prairie Adaptation Research Collaborative (PARC)	http://www.aema.alberta.ca/ http://www.parc.ca
Quebec	• Climat Municipalités • Ouranos	http://www.mddep.gouv.qc.ca/programmes/climat-municipalites/ http://www.ouranos.ca

One place to begin your research is with department heads and staff from your within your municipal government. By drawing on the expertise that exists internally, you can determine the type of information that is currently available and where there are gaps that require more research. Other options include collecting information through more formal staff meetings, special workshops, or informal discussions. Interviews with long-time residents, examining government records, and reviewing media archives (i.e. newspapers and magazines) are also effective ways of gathering more information on the impacts of notable past climate and weather events.[56]

The range of information available will vary from one community to another and can depend on where the community is located. Unfortunately, it may be difficult to find information on projected climatic changes by region that is sufficiently detailed for planning. One option for dealing with such limited information is to look at how sensitive your community was to past climate and weather events. Observed impacts can help a community assess their historic ability to respond and can inform adaptation planning in the future. This information can also be helpful in determining what type of climatic changes the community has been vulnerable to in the past and how important it is to plan for those changes in the future.

Consider This…

Some communities are already seeing climatic changes. For example in 2005, Toronto experienced the hottest summer on record where temperatures exceeded 30ºC for a total of 41 days. The City had to issue 8 heat alerts, 18 extreme heat alerts and 48 smog advisories. Extreme temperatures are expected to continue as the frequency of hot days (above 30ºC) in Toronto is expected to increase from 12 to 35 by 2050. Observed changes can be a good resource for communities as they help indicate adaptive capacity.

McBean, Gordon and Henstra, Dan (2009). *Background Report Climate Change and Extreme Weather: Designing Adaptation Policy*. Available for download at http://www.sfu.ca/act/documents/05_09-EWE_Background_Report_WEB.pdf

Anecdotal evidence may also be helpful if your community is faced with limited information. For example, memories of Aboriginal elders in the Arctic can help to supplement archeological records and ethno-historical accounts to provide more detailed information of how periodic, irregular and often dramatic ecosystems changes, triggered by periods of warming or cooling and extreme weather events, have influenced human life in the Arctic.[57]

CASE STUDY

Creating Partnerships to Increase Local Adaptive Capacity in Annapolis Royal, NS

Annapolis Royal, situated below sea level, has been flooding in certain key areas. The community, concerned about the risks associated with flooding during extreme weather events and notably spring tidal surges, went to the Town to explore the risks. Town staff in turn looked to the citizen-based group, Clean Annapolis River Project (CARP), to assess the Town's vulnerability to storm surges. The limited resources at the Town's disposal made this partnership mutually beneficial; and highlights a successful way to integrate other stakeholders into the land-use planning process. By knowing the risks, the Town was able to take preventative measures, and produce a set of initiatives that increase infrastructure stability, increase emergency preparedness and involve members of the public with emergency scenarios. After the risk assessment was complete, it became clear that adaptation action cannot remain isolated to one town/community, but rather, adopted by an entire region. Various surrounding communities were contacted to administer a large-scale risk assessment.

Partnerships

Partnerships (with local NGOs, non-profit organizations, local businesses and universities) are also valuable strategies that have been used by numerous communities across Canada in their adaptation efforts. See Exhibit 11 for a list of community's that have partnered with citizen-based groups, universities, other levels of government and neighbouring communities in their adaptation efforts.

EXHIBIT 11

Community Partnerships on Adaptation Planning

COMMUNITY	PARTNER	PARTNERSHIP
Annapolis Royal, Nova Scotia	Clean Annapolis River Project (CARP)	Annapolis Royal partnered with CARP, a citizen-based group, to conduct an assessment of the Town's vulnerability to storm surges.
Delta, British Columbia	University of British Columbia	Delta partnered with the University of British Columbia to create visualizations of how the community might look under alternative climate futures. Different scenarios of sea level rise and changing land and energy use were projected out to the year 2100. Workshops were then held to explore residents' reaction to the scenarios and to different response strategies.
Halifax Regional Municipality, Nova Scotia	The Federation of Canadian Municipalities Green Municipal Funds; Natural Resources Canada; Environment Canada; Nova Scotia Department of Energy; select members of ClimAdapat; community groups and local businesses	Halifax Regional Municipality launched ClimateSmart, a collaboration between public and private sectors that helps to mainstream climate change mitigation and adaptation into municipal planning and decision-making.
Kamloops, British Columbia	Thompson Rivers University	Kamloops partnered with Thompson Rivers University on a pilot project involving integrated approaches to surface fuel management and alternative noxious weed management in the hopes of mitigating wildfires in the surrounding area of the community.
London, Ontario	University of Western Ontario	Researchers at the University of Western Ontario conducted a preliminary analysis of London's rainfall intensity, duration and frequency curves in the context of a changing climate. The study formed the basis for revised engineering standards for the City's storm water management system and London's Adaptation Strategy.
Le Goulet, New Brunswick	University of Moncton	Le Goulet partnered with the University of Moncton to produce a comprehensive local plan to adapt to the impacts of climate change and specifically rising sea levels.

Working with Limited Information

Working with limited information, may require you to extrapolate relevant data from more general or nationally based sources. Much of the data on climate change impacts is presented within ranges (i.e. range of increases in temperature, precipitation, etc.) as it is difficult to determine absolute numbers when using climate models. It is important to remember that the idea of adaptation planning is to plan for various scenarios. Therefore, try and formulate high, medium, and low emissions scenarios to work from for each climatic change and adjust your potential responses according to the different scenarios.

It may also be the case that you are faced with too much information. In this case, use the questions below to refine your research and determine the most relevant information:

- What is the most basic information necessary to make an educated decision?
- How trusted is each source of information? Consider if the information presented has been peer-reviewed; did it emerge from a scientific study; does it come from an organization with a particular agenda; how recent is it; what is the level of certainty assigned to the information, etc.
- How closely does the information relate to your specific context? (region, ecosystem, community, etc.)
- Who is producing the information and are they regarded as an expert?
- Which organizations conduct research in your community or region pertinent to climate change?
- Who is the intended audience for the information?

Determining how much information is necessary will depend on your community and your experience with climate change. Also keep in mind that for some topics, your community may need more detailed information before actions can be derived.

RECORDING RESEARCH FINDINGS

Once you feel comfortable with the information you have collected and have determined that it is sufficient to base your adaptation plan on, you should make a commitment to monitoring the science that supports your climatic change scenarios to ensure that your planning process is drawing upon the most relevant and up to date information available.

Throughout your research you may also encounter reports on specific areas or topics of interest. Keep track of this information as it will be important later in the process.

As your team conducts research, track the information you collect and record:

- the source of information;
- the timeframe of any future projections (e.g. 2020s);
- the date ranges for any historical data;
- the range of expected change (e.g. 1.5°C-2.5°C annually); and,
- the extent of seasonal variability.

6a *Worksheet 6(a) can be used to record your research and other information on relevant climate changes.*

CASE STUDY ***Using Local Knowledge to Plan for a Changing Climate in Dawson, YT***

Northern Canada is due to experience rapid climatic changes, and this poses many challenges for the isolated communities that depend on specific resources and sound infrastructures. The northern community of Dawson, Yukon Territory acknowledged the strong need for adaptation planning and the residents played a key role in the production of the final community adaptation plan. In response to data gaps in the community, the City's activities shifted as local community members and their knowledge provided the informational resources to account for previous climatic changes. Local knowledge formed the basis of building a community-based climate change scenario. From such changes, they set out five different adaptation projects that respond to problems, such as infrastructure collapse, limitation of resources, changing resources and cultural shifts. As a result, the community is aware of the changes in their region and had an invested stake in the adaptation planning process.

REFINING IMPACTS AND IDENTIFYING SERVICE AREAS

Once you have identified how climate change is likely to affect your community, you should start thinking about how those changes will impact your community's services areas.

Also note that while it is important to emphasize that climate change will have negative impacts that community's need to plan for, it is also relevant to consider the positive impacts and subsequent opportunities that are associated with climate change. For example, one such opportunity might be longer shipping seasons due to decreased sea, river and lake ice cover, however lower lake and river levels could have other negative impacts on transportation which should be considered in tandem.[58] While it is likely that there will be some common impacts for Canadian communities, it is important to understand how climatic changes will uniquely affect local conditions.

Service areas are the areas in which a government or community manages, plans, or makes policy affecting the services and activities associated with built, natural, and social systems.

Whether positive or negative, impacts should be recorded consistently and should each address a similar scale. A description of an impact should include an identification of the 'someone' or 'something' that will be impacted, the specific way it will be impacted, and the reason the impact may occur. For example, "summer drought" is not a strong impact statement; but "increased demand on water supply due to summer drought" would be. Notice how the latter description answers all of the "what", "why" and "how" questions, and that the impact is a result of changes to climatic conditions, namely precipitation. Get as specific as possible, including whatever level of detail the reports you are consulting can provide.

Exhibit 12 provides a variety of sample impacts and identifies which service areas will be affected either directly (with an "X") or indirectly (with an "O"). This is not an exhaustive list; rather this table is meant to provide a few examples and should act as a starting point to get your team thinking about how climate change impacts will affect your operations and how to document impact statements.

Consider This…
Documenting assumptions and key information within your records is important as it will help to minimize inconsistent treatment of scientific data, incomplete transparency and poor archiving or protection of information. By carefully documenting sources (both written and verbal) you will help to ensure that other and future staff are able to understand your work.

6b *Worksheet 6(b) offers more instruction on refining impact statements and identifying relevant service areas.*

EXHIBIT 12

Impacts on Service Areas

CLIMATIC CHANGE Increased Temperatures in Summer	Agricultural Services	Biodiversity	Corporate Services	Economic Development	Culture and Tourism	Energy Services	Emergency Management	Fire Services	Environment	Forestry and Forestry Services	Housing	Parks and Recreation	Police	Public Health	Water Supply	Waste Management
Increased demand on energy due to increased cooling needs in summer			X	O	O	X	X				X		O	X	O	
Longer growing seasons which increases agriculture potential	X	X	X	O	O				X	X		X			O	
Decreased tourism in snow industries				X	X											
Loss of native plant and animal species (extinction or migration)	O	X			O				X	X		X				
Increased incidences of water and food borne illnesses due to warmer weather	O	O		O	O		O		O	O		O	O	X	X	
Increase in invasive species due to more favourable climate	X	X	O	O	O				X	X		X		O		
Increases in frequency and intensity of fires due to hotter and drier seasons	O	X	O		O		O	X	X	X	O	O	O	O	O	
Increased frequency of insect outbreaks due to warmer weather	X	X		O	O		O		X	X		X		X		O
Spread of infectious disease/ vector borne illnesses in summer			O	O	X		O		O	O	O	O		X	O	O
Increased demand on water supply due to summer drought	X	O	X	O	O			O	O	O	O	X		X	X	

VULNERABILITY ASSESSMENT

Vulnerability refers to the susceptibility of a given service area to harm arising from climate change impacts.[59] Vulnerability is a function of a service area's sensitivity to climate change and its capacity to adapt to climate change impacts (or adaptive capacity). A vulnerability assessment can be one of the more intensive components of Milestone Two: however it is important to spend the time conducting a thorough assessment so you are integrating an external dimension, namely sensitivity to climate, into your examination of your service areas. A vulnerability assessment also necessitates an understanding of both biophysical and socioeconomic implications as the focus is more on understanding the processes involved with climate change impacts and the factors that influence sensitivity and adaptive capacity.[60] This understanding will assist with the development of suitable adaptation actions later in Milestone Three.

While conducting your vulnerability assessment, consider the following questions:

Is the service area already able to accommodate existing weather patterns and changes in climate? For example, emergency response and fire services already have methods for addressing changes in climate (i.e. increased or decreased precipitation).

Are there barriers to a service area's ability to accommodate changes in climate? For example, the number of competing uses of a service area; the number of organizations involved in managing a service area; or the service area's biological, geographic or physical barriers might limit its flexibility.

Is the service area already stressed in ways that will limit its ability to accommodate changes in climate? An example is a community that has recently experienced economic downturn and does not have the resources to replace existing road culverts.[61]

It is important to note that the perspective on vulnerability assessment presented here, is one methodology looking at sensitivity and adaptive capacity; other methodologies exist which touch on these and other themes (i.e. exposure) and can offer a more quantitative approach for analyzing vulnerability.

Sensitivity Assessment

To determine how sensitive a service area is to projected changes in climate, consider the following questions:

- How exposed is the service area to the impacts of climate change?
- Is the service area subject to existing stresses?
- Will climate change cause the demand for a resource or service to exceed its supply or current abilities?
- Does the service area have limiting factors that may be affected by climate change?
- Are there measures that are presently in place that are able to provide a buffer against expected future changes?
- With regard to ecological sensitivity – is there a plant and animal species of concern in your service area that is currently located near the limits of its range?

The table to the right (Exhibit 13) assesses the sensitivity of water supply (sample service area) to the increased demand on water supply due to summer drought (impact). In order to: assess the service area's sensitivity to an impact first determine which climatic changes affect the impact in question and next identify how the service area is affected by these changes. The first step is to assess whether the service area is subject to any existing stress and whether the impact will exacerbate that stress. The final step is to assign a value (out of 5) representing the sensitivity of the service area to the climate change impact. See Exhibit 14 for the 1 – 5 Sensitivity Scale.

Adaptive Capacity

In addition to sensitivity, assessing vulnerability requires consideration of the main stressors, both climatic and non-climatic, as well as the socioeconomic influences on adaptive capacity.[62] Adaptive capacity describes the ability of built, natural and human systems to accommodate changes in climate with minimum disruption or additional cost.[63] To measure adaptive capacity, consider the projected impacts for your community and assess how those impacts will affect the systems in your service areas. Think about how the key determinants listed could affect your community's adaptive capacity. Also consider the extent to which current plans, policies and regulations account for the indentified set of climate variables and their future changes? By increasing adaptive capacity, a systems vulnerability to current and future climate is reduced.

Consider This…

ADAPTIVE CAPACITY AND RESILIENCE

Resilience refers to the capacity of a system, community, or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. Although similar to adaptive capacity, resilience also refers to the degree to which a community or society can organize itself and learn from past disasters.

(United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction [UN/ISDR] [2004] Living with Risk: A global review of disaster risk reduction initiatives. United Nations Publication: Geneva.)

EXHIBIT 13

Sensitivity Assessment for Water [64]

IMPACT	INCREASED DEMAND ON WATER SUPPLY DUE TO SUMMER DROUGHT
SERVICE AREA	**WATER SUPPLY**
Which climatic changes affect the functioning of this service area?	1. Temperature (warmer temperatures expected across all seasons under all climate change scenarios, especially during summer months) 2. Precipitation (less rain in summer and snow in winter)
How is the service area affected by these changes today?	1. Warm winter and spring temperatures lead to lower snowpack and earlier snowmelt, increasing summer drought 2. Warmer summer temperatures increase evaporation rates and demand on water 3. Lower winter precipitation lowers winter snowpack, reducing water supply
Is the service area subject to any existing stress?	Water shortages have occurred in the past during particularly hot summer months.
If so, how will the impact exacerbate that stress?	More frequent hot spells with no rain may result in more shortages.
If the impact occurs, will it affect the functionality of the service area?	Yes – Functionality will become unmanageable (S5)

EXHIBIT 14

Sensitivity Scale

If the impact occurs, will it affect the functionality of the service area?				
No – Functionality will stay the same (S1)	Unlikely – Function-ality will likely stay the same (S2)	Yes – Functionality is likely to get worse (S3)	Yes – Functionality will get worse (S4)	Yes – Functionality will become unmanageable (S5)

There are several key determinants of adaptive capacity:[65]

- **Economic resources:** Wealthier individuals, communities, regions, and nations are likely to be better able to bear the costs of adaptation to climate change than poorer ones.
- **Technology:** Lack of technology can impede adaptation.
- **Information and skills:** Information and trained personnel are required to assess and implement successful adaptation options.
- **Social Capital:** Connections between and within social networks improve the capacity of individuals and groups to prepare for and withstand impacts.
- **Institutions:** Nations with well-developed social institutions are believed to have greater adaptive capacity than those with less effective institutions.
- **Equity:** Some believe that adaptive capacity is greater where there are government institutions and arrangements in place that allow equitable access to resources.

Consider This…

In Canada adaptive capacity is generally high, owing to high levels of education, access to technology, and strong and effective institutions. As a result, Canada is well positioned to take action on adapting to climate change. However, there are significant differences in the ability to adapt among different sub-regions and population groups, resulting in differing vulnerabilities to climate change.

Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.

Keep in mind that due to the difficulty in measuring adaptive capacity, proxy indicators, such as per capita income, education level and population density, can also be used for some of the determinants.[66]

Although local governments often have similar determinants, it is important to recognize that there are differences in the adaptive capacity of urban centers and rural communities. Exhibit 15 provides a quick look at some of the strengths and limitations of both urban and rural communities.

EXHIBIT 15

General Differences in Adaptive Capacity between Urban and Rural Communities [67]

URBAN CENTERS	RURAL COMMUNITIES
STRENGTHS	**STRENGTHS**
• Greater access to financial resources • Diversified economies • Greater access to services (e.g. health care, social services, education) • Easier access to technology • Higher education levels • Well-developed emergency response capacity • Highly developed institutions	• Strong social capital • Strong social networks • Strong attachments to community • Strong traditional and local knowledge • High rates of volunteerism
LIMITATIONS	**LIMITATIONS**
• Higher costs of living • More air quality and heat stress issues • Lack of knowledge of climate change impacts and adaptation issues • Larger dependant populations (e.g. elderly and poorer residents) • High dependence on critical, but aging, infrastructure • Issues of overlapping jurisdictions that complicate decision-making processes	• Limited economic resources • Less diversified economies • Higher reliance on natural resource sectors • Isolation and limited access to services • Lack of knowledge of climate change impacts and adaptation issues • Lower proportion of population with technical training

Assessing Adaptive Capacity

Exhibit 16 provides a sample adaptive capacity assessment. Use the information from the sensitivity assessment completed earlier to frame the linkages between the climatic change, the effect on the service area and whether that service area can adapt to those changes. Based on that information, your team can assess the ability of the service area to accommodate these changes with little or no cost or disruption. Using the 1 – 5 Adaptive Capacity Scale in Exhibit 17, assign a value to represent the adaptive capacity of the service area and be sure to explain the reason for that assigned value.

EXHIBIT 16

Assessing the Adaptive Capacity of a Service Area [68]

IMPACT	INCREASED DEMAND ON WATER SUPPLY DUE TO SUMMER DROUGHT
SERVICE AREA	**WATER SUPPLY**
Can the service area adjust to the projected impact with minimal cost and disruption?	No - Will require substantial costs ($$$$$) and staff intervention (AC1)
Explain Response	Unable to “adapt” snowpack to warmer temperatures; limited options for expanding water supply and summer demand has already been greater than supply at times.

EXHIBIT 17

Adaptive Capacity Scale

Can the service area adjust to the projected impact with minimal cost and disruption?				
No – Will require substantial costs ($$$$$) and staff intervention (AC1)	No – Will require significant costs ($$$$) and staff intervention (AC2)	Maybe – Will require some costs ($$$) and staff interven-tions (AC3)	Yes – But will require some slight costs ($$) and staff intervention (AC4)	Yes – No to little costs ($) and staff intervention are necessary (AC5)

7 *Worksheet 7 provides tables for conducting both sensitivity and adaptive capacity assessments.*

With both assessments complete, the vulnerability of each service area can be determined. Those service areas with high sensitivity and low adaptive capacity are highly vulnerable; those with low sensitivity and high adaptive capacity have low vulnerability; and those service areas that have both high sensitivity and high adaptive capacity have a medium vulnerability.

CASE STUDY ***Assessing Vulnerability – A Analysis of Climate Change Impacts in Toronto, ON***

The City of Toronto conducted a *Scan of Climate Change Impacts* (2006) to determine which systems within the City are the most vulnerable to climate change impacts. The report concluded that the City's infrastructure systems – such as water supply, transportation of people and goods, health services and energy supply – are key points of vulnerability. The vulnerability assessment was followed by an assessment of initiatives in other cities which are adapting to climate change to determine the best course of action for the City of Toronto. Both reports can be found at http://www.cleanairpartnership.org/reports_cities_preparing

RISK ASSESSMENT

Risk is the combination of an event's likelihood and its consequences – risk therefore equals the probability of a climate hazard multiplied by the consequence of that event.

Risk = Likelihood x Consequence

CONSEQUENCE	LIKELIHOOD
What are the known or estimated consequences (economic, ecological, social, and legal) of a particular climate change impact?	How likely is it that a projected impact will occur? Some climatic changes, such as increasing average temperatures and seal level rise, have more certainty while the frequency of extreme events has less.

Use the results from the vulnerability assessment (those impacts labeled as having high vulnerability) along with research on projected climatic changes to estimate the consequence and likelihood of specific impacts. The likelihood assessment, together with the consequence evaluation, will constitute the risk score for each impact.

Exhibit 18 and 19, along with the exercises found in Worksheet 8 will guide you through assessing risk [Note: this risk assessment cannot be conducted without using the information found in Worksheet 8].

EXHIBIT 18

Risk Score for Impacts

		INCREASED DEMAND ON WATER SUPPLY DUE TO SUMMER DROUGHT	**INCREASED DEMAND ON ENERGY** DUE TO INCREASED COOLING NEEDS IN SUMMER	**CONTAMINATION OF STREAMS AND/OR LAKES** DUE TO SEWER OVERFLOW
CONSEQUENCE RATING	PUBLIC SAFETY (OUT OF) /5	3	4	3
	LOCAL ECONOMY AND GROWTH (OUT OF) /5	2	2	2
	COMMUNITY AND LIFESTYLE (OUT OF) /5	3	3	4
	ENVIRONMENT AND SUSTAINBILITY (OUT OF) /5	3	3	4
	PUBLIC ADMINISTRATION (OUT OF) /5	3	3	3
	CONSEQUENCE TOTAL (OUT OF) /25 (A)	14	15	16
LIKELIHOOD RATING	(OUT OF) /5 (B)	4	4	3
RISK SCORE	= A X B (OUT OF) /125	56	60	48

Note: the scale used in Exhibit 18 and Worksheet 8 assigns a low score of 1 and a high score of 5.

8 *Worksheet 8 provides more detailed instructions for assigning risk ratings for the impacts identified earlier.*

EXHIBIT 19

Risk Spectrum

Once you have completed Worksheet 8 you will have the risk score for each impact. The final step in Milestone Two is to organize the impacts according to the risk score from extreme to low; this will prepare your team to assign actions to each of the impacts that were assessed.

To prepare you for Milestone Three, begin considering the following questions:

- What are the extreme risks? Do they revolve around one specific climatic change?
- What are the lower risks?
- Are all of the extreme risks very costly to address?
- Which risks require political support?
- Which risks have dire consequences if not acted upon?
- Are we already considering these as risks within the community?

Consider This...

The Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol developed by Engineers Canada is another risk assessment tool that is being used to assess the vulnerability of individual facilities or types of infrastructure (buildings; storm water and wastewater systems; water resources; roads, bridges and other transportation infrastructure). The protocol along with a variety of Canada-wide assessments can be accessed at http://www.pievc.ca/e/index_.cfm

WHERE SHOULD YOU BE NOW?

Upon completing Milestone Two, you will have undertaken research on the climatic changes that will affect your community and subsequently developed a list of impacts. You will also have conducted a vulnerability and risk assessment and should now have a list of impacts which have been prioritized by their risk score.

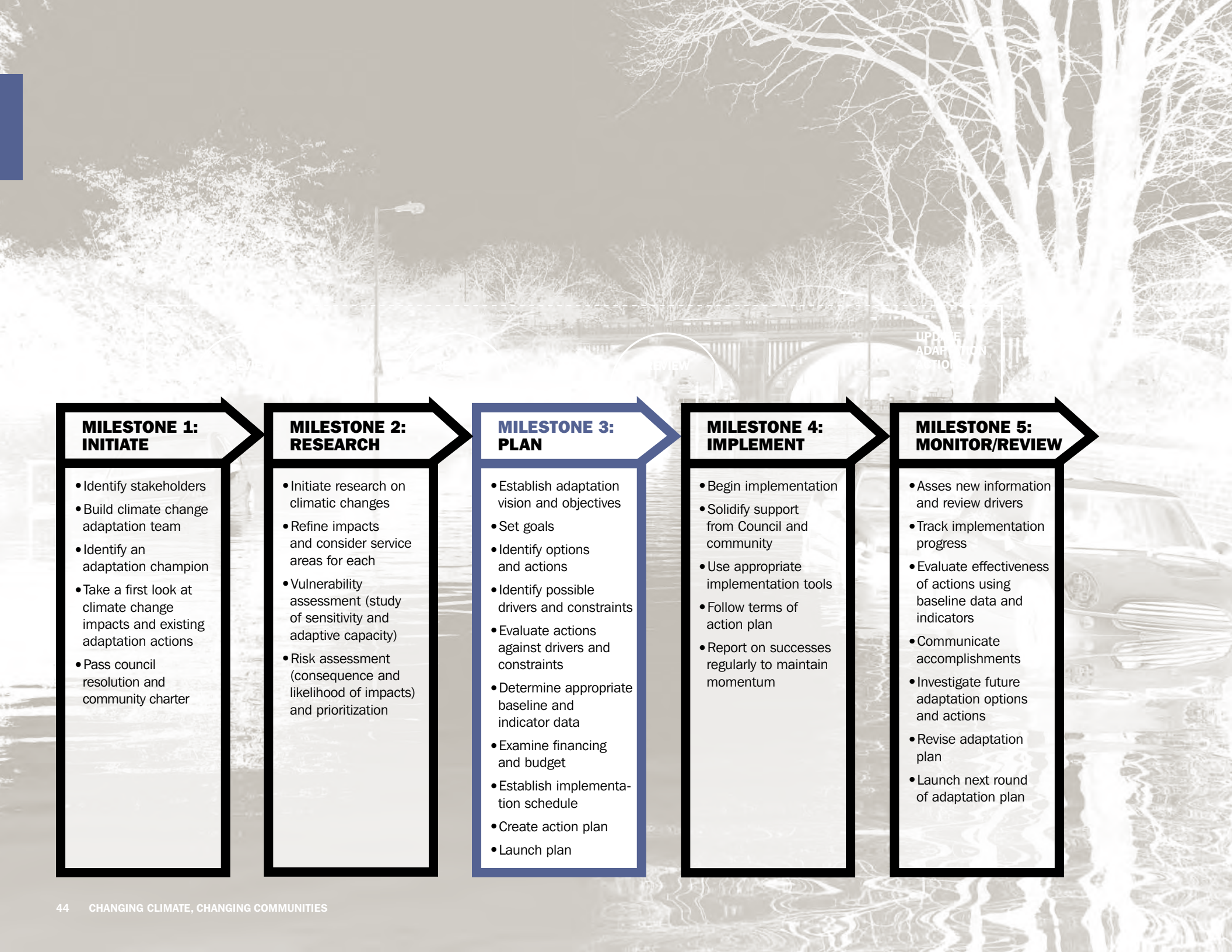
In Milestone Three, *Plan*, you will establish a vision, set goals, and identify both short and long terms actions to tackle the impacts that you have indentified.

SUMMARY OF OUTPUTS

- **A comprehensive understanding of climatic changes and impacts for your community**
- **A list of impact statements and the primary and secondary service areas affected**
- **A vulnerability assessment**
- **A risk assessment**
- **A prioritized list of impacts – based on vulnerability and risk assessment**

ENDNOTES

51. Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.
52. *Ibid*
53. *Ibid*
54. Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background Information - From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
55. Government of British Columbia. (2004). *Weather, Climate and the Future: B.C.'s Plan*. Available for download at http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs/373154/actions.pdf
56. Snover, A.K., et al. (2007) *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments*. In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA
57. Furgal, C., and Prowse, T.D. (2008): *Northern Canada – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 57-118
58. Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.
59. Snover, A.K., et al. (2007) Preparing for Climate Change: A Guidebook for Local, Regional and State Governments. In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA
60. Warren, F.J. and Egginton, P.A. (2008). Chapter 2: Background Information - From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
61. Snover, A.K., et al. (2007) *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments*. In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA
62. *Ibid*
63. Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background Information – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
64. Snover, A.K., et al. (2007) *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments*. In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA
65. Smit, B. et al. (2001). *Adaptation to Climate Change in the Context of Sustainable Development and Equity; In Climate Change 2001: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, (eds.) J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken and K.S. White. Cambridge University Press, Cambridge, U.K., and New York, N.Y., U.S.A. Available for download at http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm
66. Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background Information – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
67. Lemmen, D.S., Warren, F.J. and J. Lacroix. (2008). *Synthesis – From Impacts to Adaptation: Canada in a Changing Climate 2007*, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 1- 20.
68. Snover, A.K., et al. (2007) *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments*. In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA



MILESTONE 1: INITIATE

- Identify stakeholders
- Build climate change adaptation team
- Identify an adaptation champion
- Take a first look at climate change impacts and existing adaptation actions
- Pass council resolution and community charter

MILESTONE 2: RESEARCH

- Initiate research on climatic changes
- Refine impacts and consider service areas for each
- Vulnerability assessment (study of sensitivity and adaptive capacity)
- Risk assessment (consequence and likelihood of impacts) and prioritization

MILESTONE 3: PLAN

- Establish adaptation vision and objectives
- Set goals
- Identify options and actions
- Identify possible drivers and constraints
- Evaluate actions against drivers and constraints
- Determine appropriate baseline and indicator data
- Examine financing and budget
- Establish implementation schedule
- Create action plan
- Launch plan

MILESTONE 4: IMPLEMENT

- Begin implementation
- Solidify support from Council and community
- Use appropriate implementation tools
- Follow terms of action plan
- Report on successes regularly to maintain momentum

MILESTONE 5: MONITOR/REVIEW

- Asses new information and review drivers
- Track implementation progress
- Evaluate effectiveness of actions using baseline data and indicators
- Communicate accomplishments
- Investigate future adaptation options and actions
- Revise adaptation plan
- Launch next round of adaptation plan

MILESTONE 3:

PLAN

MILESTONE 3: PLAN

Milestone Three, *Plan*, will help you establish a vision, goals and objectives for your community's adaptation effort. In addition, in this chapter you will use the impacts you identified as well as the results of the vulnerability and risk assessment that you conducted in the previous milestone to help you prioritize the impacts your community faces. Based on these priorities you will develop both short and long term actions to address significant impacts. As you develop your actions, you will also examine the constraints and drivers which may affect your ability to implement your actions. From there you will address the financial aspects of these actions. Finally, using this information you will create and finalize your climate change adaptation action plan.

PURPOSE	OUTPUTS
To establish your short and long terms adaptation actions and finalize your climate change adaptation plan.	✔ Vision ✔ Goals and Objectives ✔ List of Adaptation Actions ✔ Financial implications of your plan

CHECK BACK

As you proceed through Milestone Three, be sure to keep track of how new conditions within your community might affect the decisions you've taken in the preceding milestones. One way to ensure that your research stays up-to-date is to make a commitment to monitoring the information that you've used to identify the climate change impacts in your community. As future climate projections change, for example, you may find that you need to reassess the vulnerability and risks associated with those changes for your community – be sure that the projections are significant enough to warrant the reassessment. Likewise be sure to consider any internal changes with the community that might affect the make-up of your adaptation team, larger stakeholder network, or political support for your effort.

ESTABLISHING A CLIMATE ADAPTATION VISION

Establishing a vision for you adaptation plan provides an opportunity to integrate your adaptation goals into the broader vision of your entire community. This is not a necessary step; however it is a useful exercise and will help your community set your adaptation goals and objectives a little later on. Engaging the community in visioning exercises may help to solidify their support and commitment to climate change adaptation (be careful to not let the visioning process slow your community down in the overall development of your adaptation plan).

An adaptation vision is a statement on where you want your community to be in the future with regard to climate change adaptation. For local governments embarking on the adaptation planning process a vision will help to: establish what a climate resilient community looks like; articulate where you'd like to see your community in the future; and will be something to refer back to throughout the planning process and while implementing adaptation actions.

A vision statement also acts as a call to action and can be a catalyst to inspire change; as such it is an important element to include in your adaptation plan. Ideally, it should incorporate the values that are important to your community while also communicating the purpose and intended outcome of your climate adaptation plan.

Key questions to consider while establishing your vision:

- What are you trying to accomplish with your climate change adaptation plan?
- What does a well adapted community look like?
- What sort of climate change impacts will affect your region?
- Who is your target audience: council, stakeholders, and/or citizens?
- Will the Adaptation Plan be a key public document?

Consider This…

There are both pros and cons to community engagement; specifically as to the types and frequency of such engagement (for example: asking for input too frequently may lead to stakeholder burnout, however, not including the public in various stages can result in aggravation and loss of interest). It is important to consider these factors as you seek public input throughout the planning process.

EXHIBIT 20

Sample Vision Statements

COMMUNITY	VISION
Keene, NH	"The impacts associated with a changing climate are already being felt in Keene. From more frequent and severe flooding, to changes in annual snowfall amount, to the infestation of non-native plant and animal species, to increases in the total number of high heat index days and more numerous poor air quality days, the City has come to recognize that these changes are ultimately impacting the community's built, natural, and social environments. To address these changes, the City of Keene has committed to the Climate Change Adaptation Plan to help make the community resilient to the effects of climate change. The City of Keene strives to be a protected and sustainable community which prioritizes public safety and climate protection."
North Vancouver, BC	"The City of North Vancouver's vision is to be a vibrant, diverse, and highly liveable community that strives to balance the social, economic and environmental needs of our community."
St. John, NB	"Our Saint John, Canada's first city, leads the nation as an example of a sustainable community. Our Saint John was born of the water. Like the tides we live by, we are responsive to the constant changes in our environment, economy and society. Our Saint John is a liveable city designed for people where everyone can feel at home. We are diverse in cultures, rich in arts, full of exciting entertainment and recreational activities. Our Saint John provides educational excellence and life-long-learning opportunities to help people reach their full potential. Our dynamic economy is built on creativity, innovation and entrepreneurial spirit. Our Saint John is a population of problem solvers where each individual and organization has a vital role to play. It is a place where leadership is based on transparency, integrity and trust. Our Saint John is a place where we overcome our challenges and live our dreams. This is our Saint John."
Toronto Environment Office, City of Toronto, ON	"The Toronto Environment Office works to be a recognized centre of environmental excellence for the City, providing the leadership and building the partnerships to ensure a clean, green and sustainable future for all."

Remember that your vision is meant to inspire, energize and help create a picture of your resilient community.

SETTING YOUR ADAPTATION GOALS AND OBJECTIVES

Goals

Once you have completed your vision, your team can now develop adaptation goals. Goals should be phrased in reference to the climatic changes that are threatening your community. They will act as high level intentions which a community will strive towards. Goals are general statements about the expectations of a program or plan, for example:

- Increasing public awareness of climate change and its projected impacts on our community.
- Increasing technical capacity to prepare for climate change impacts.
- Increasing adaptive capacity of built, natural and human systems in our community.

CASE STUDY ***Setting Goals – Climate Resilient Community Goals and Objectives in Keene, NH***

Based on their top ranking risks, Keene, New Hampshire's Climate Resilient Communities Committee members divided into three teams (one per service area) and developed a set of goals and objectives for each impact. The goals and objectives were identified as ways in which the City government could begin efforts to adapt to climate change.

For example, one goal was to "reduce the likelihood of structural damage resulting from predicted increases in severe weather events." The objectives (or targets) which accompanied that goals included: a) encourage more pitched roofs and incorporate design standards that consider snow stacking and ice falling zones; b) identify a 200-year floodplain and prevent future development in these areas; and c) Investigate design standards for buildings that currently handle weather conditions similar to the climate forecast New England can expected in the future.

For more information on Keene's goals and objectives see *Adapting to Climate Change: Planning a Climate Resilient Community (2007)* at http://www.ci.keene.nh.us.

Objectives

Now that you have identified community goals, you can set specific objectives. Objectives refer to the ways in which your community intends to overcome the impacts that have been identified (in Worksheet 6b) and represent the path towards achieving your vision. Some objectives might be specific, while others might be broad and thus more challenging to measure.

Remember that adaptation objectives will vary from one community to another based on a variety of factors, including: types and magnitude of projected climatic changes and impacts; level of support for adaptation efforts; and service areas on which your community has direct influence. Some examples of objectives include:

- Expand and diversify water supply
- Increased drought preparedness
- Reduce shoreline erosion
- Reduce the impact of extreme heat events
- Reduce flooding and erosion impacts on infrastructure
- Improving energy conservation
- Lower the ecological footprint of existing buildings
- Engage energy providers to enhance local renewable energy generation opportunities
- Support the local agricultural economy
- Protect local habitats and migration routes

9 *Worksheet 9 offers guidance on visioning and setting goals and objectives.*

IDENTIFYING ADAPTATION OPTIONS

Based on your high priority impacts (identified through the risk assessment in Milestone Two) and your community's objectives, your team can now begin the process of developing adaptation options for how to overcome the impacts of climate change. These options should be broken down into short- and long-term time frames, and should reflect your community's vision and the objectives that you have identified previously.

Adaptation options include a wide range of actions or activities and will likely involve some combination of the following:

- **Modifying policies, plans, practices and procedures:** Existing by-laws, codes, regulations, policies, development plans, and operating practices may have to be modified in order to adapt for climate change impacts.

- **Building new or upgrading existing infrastructure:** Examples of this include expanding stormwater collection systems, expanding wastewater treatment capacity, increasing bridge heights or strengthening levees.

- **Improving community awareness and public education:** To generate support for adaptation efforts your municipality will likely need to use outreach and education actions. These can also be useful to effect voluntary change at the individual level, such as water or energy conservation.

- **Varying and/or diversifying your options:** By developing "safeguards" against climate change impacts you can increase the preparedness of your community. Examples can include: diversifying your community's economic base to move away from sources that will be negatively affected by climate change (i.e. coastal recreation); developing new groundwater sources to expand water supply; or diversifying your energy supply to include renewable energy to both help mitigate climate change impacts and reduce demand from the electric grid during heat waves.

10 *Worksheet 10 will help you identify adaptation options and relevant departments.*

These options will be refined later through an assessment of drivers and constraints in Worksheet 11.

SELECTING OPTIONS

There are many factors that will affect the type of actions your community includes in your final adaptation plan, including the resources that are available and the extent of your community's vulnerability to specific climate change impacts.

As you develop your adaptation options, keep in mind that these should not only address the climate change impacts which your community is facing, but should do so in a sustainable way. Specifically, they should not impede any wider sustainability efforts.

For example: if not given proper consideration, adaptation actions can increase local greenhouse gas emissions unless they are considered together, and likewise mitigation measures can actually increase a community's vulnerability to climate change impacts.[69]

For that reason it may be relevant to consider adaptation actions which have co-benefits i.e. those that benefit both adaptation and mitigation efforts. For more information on adaptation-mitigation co-benefits see the Drivers section below. In addition, the *Canadian Communities' Guidebook for Adaptation to Climate Change* produced by Environment Canada helps to identify those actions that support sustainability efforts while at the same time improving resilience.

Alternatives... It is likely that there will be actions that can be carried out now. Although it is important to include these actions within your final plan, it is not be necessary to wait for a formal plan before implementing them. In such cases, it may be valid to go ahead with the action before more formal planning has occurred.

CASE STUDY

Leading By Example – Department of Environmental Services Adaptation Plan in Quebec City, QC

In 2006, Quebec City decided to create an adaptation plan for its Environmental Services department. This proactive approach was driven by the desire to reduce both the costs and negative effects of a changing climate on the City's operations and infrastructure. During the development of the plan, it was recognized that many actions existed in management plans that could be considered adaptation actions as they serve to reduce vulnerability to climactic changes. Therefore, throughout the planning and consultation process, staff was encouraged to identify both existing and new adaptation measures. Both were included in the final adaptation plan which commits the Environmental Services department to consider the impacts of a changing climate in all of its operations, projects, plans and bylaws. However, the majority of adaptation actions included in the plan target the aquatic environment and drinking water in Quebec City as these are areas of high vulnerability.

DRIVERS

Similarly to the drivers that influenced you to begin adaptation planning, there are also factors that can drive the implementation of an action. In many cases, the drivers of action will be the co-benefits and opportunities which result from the implementation of that action. Co-benefit strategies are those which aim for the win-win options and have multiple benefits and which often build the most momentum and support. For example, a co-beneficial action may be one that addresses both adaptation and mitigation goals, or it might be an action which is both cost effective and will increase local adaptive capacity.

Other possible drivers include:

- Externally identified vulnerabilities – an academic study which examines the vulnerability of the community may spur interest and action on climate change impacts;
- Funding opportunities – funding becomes available to develop and implement adaptation actions;
- Economies of scale – it may be more cost effective to split the cost of implementing an action over many departments as the issues are cross-boundary and results can be valuable across many departments, therefore interest from multiple departments may drive implementation;
- Co-benefits – strategies which aim for the win-win options and have multiple benefits;
- Fear of inaction – the fear of being adversely affected by climate change impacts;
- Damage to infrastructure – damaged infrastructure due to a climatic change might spur the implementation of actions to replace or update inadequate infrastructure; and
- A localized weather event that drew attention to the need for preparedness actions.

Constraints

In addition to drivers for the implementation process, there are also a variety of constraints which may affect your community's ability to implement adaptation actions. Whether or not to include constraints in your formal adaptation plan will be the decision of your adaptation team, however, considering these constraints while drafting the plan is necessary for both setting timelines and allocating staff responsibilities.

Constraints may be scientific, social, operational, environmental or financial. To identify any applicable constraints consider the following questions:

- Do you have enough scientific information to act?
- How much support (financial, personnel, infrastructure) do you have? How much do you need? Where or with whom might you find what you don't currently have?
- Is the identified option possible within your community's policy context – does your government have the power to change the policies that are influenced by climate change?
- Who has the authority in your local government to enact adaptation actions? Are they already involved in the planning process?
- Do you have sufficient support from council to carry out an option?
- How would a change in political leadership alter the implementation of an option?
- Who will you need to convince that action needs to happen now?
- How much time do you need to develop and implement each option?
- What resources do you have already? What else might you need? Are these internally or externally available?
- How will the environment be impacted? Is this impact positive or negative?
- Will the option have implications for mitigation activities?

Constraints that may influence implementation:

- Lack of available information
- Cost
- Staff capacity
- Number of departments involved
- Silo thinking
- Lack of messaging
- Need for external resources
- Lack of agreement on severity and timing of climate change impacts
- Political will
- Competing or short timelines
- Effects on mitigation activities
- Provincial or territorial legislation

11 *Worksheet 11 provides more detailed information on drivers and constraints and how to identify them. The worksheet will also assist in identifying possible ways to overcome them.*

CREATING A BASELINE

While developing your adaptation plan, you will develop a set of indicators that can be used as a baseline against which the effectiveness of your community's adaptation actions can be gauged. These indicators can also help assess how your community's vulnerabilities are changing based on implemented actions and whether these actions increase or decrease your community's adaptive capacity or sensitivity to climate change impacts.

Collecting Baseline Data

Adaptation baseline data provides a record of a community's current condition as it relates to vulnerability and risk. In order to create a baseline your team will need to identify a set of indicators which can be used to record your community's current conditions.

The process of establishing baseline data can range from exhaustive (touching on sensitivities, adaptive capacity, exposure, etc.) to cursory (selecting only one or two sample indicators). Keep in mind that the more information that is gathered at this stage, the better equipped your community will be to communicate the successes of your adaptation actions later in Milestone Five. Collecting baseline data is also a good opportunity to utilize the help of students, volunteers and/or interns.

Consider This…
Collecting baseline data can also be used as an entry point to your community's adaptation work. The City of Boston took this approach and created a baseline prior even to their first look or vulnerability assessment.

Indicators

Indicators should be precise, clear and easy to understand. The specific indicators for your community will vary based on the actions that you have indentified but can include quantitative data (e.g. the quantity of infrastructure that has been replaced, the amount of cooling centers that have been opened, etc.) or more qualitative data on the activities that have been carried out by city staff (e.g. number of reports on the effects of climate change creation of opportunities for collaboration, public awareness on the issue of climate change, etc.).

For example, if your objective is to increase public awareness of climate change and its projected impact on your community there are a variety of indicators that can be used to measure public awareness including:

- Attendance sheets from public meetings on climate change;
- Tracking "hits" on community-sponsored or community-run web-pages; and
- Surveys examining whether elected or public officials understand how climate change impacts relate to major decision making and how those decisions either reduce or increase climate change vulnerabilities or risks.

Such indicators will help your community assess the effectiveness and success of your adaptation plan over time and determine areas which require further planning and/or action.

12 *Worksheet 12 offers more guidance on how to establish baseline data using indicators and provides sample indicators that can be used to track changes in sensitivity and adaptive capacity.*

DRAFTING YOUR CLIMATE ADAPTATION PLAN

After having considered drivers and constraints, the actions that you have identified will make up your climate adaptation plan. In order to move from a general list of adaptation actions to a more formalized plan you will need to identify, for each action: when it can be implemented; sources of funding for its implementation; and assign responsibilities for implementation to relevant departments.

Short-term or immediate actions might include ones that can be done quickly, for a low cost or as part of routine operations; whereas long-term or ongoing actions might require changes to by-laws, planning documents, or a dramatic increase in a departments operating budget. To determine timelines for short-and long-term actions, your adaptation team should consider the specific circumstances in your community and the specific impacts you've identified. Likewise, in the action plan, you will want to include actions which have already begun but will be expanded to address the impacts that have been identified.

Whether or not action is required immediately can often be determined by the imminence of the impact the action is meant to address. If the impact requires immediate action, due to safety concerns for example, than it will likely require immediate and short term actions. Keep in mind that such short term actions may also have to be supplemented by longer term and ongoing actions. One example would be the replacement of a specific culvert or storm drain where the short-term action is the physical replacement and the longer term action being changes to the policies regarding the frequency of infrastructure replacement or the sizing of all new culverts.

Consider This...

Consider that certain low consequence impacts may be easily addressed in the short term and may give the community a success to celebrate. For example, changes in animal and bird migration patterns may be addressed through a public awareness and education campaign that promotes the protection and maintenance of these species migratory path and creates awareness around the importance of bird habitats. Such a short-term action (such as a public event on the species) is both low cost and low resource intensive but gives the community an accomplishment to celebrate and report against, without any significant expenditure.

For each action it is important to identify:

- A responsible department – this will be the department charged with implementing the action;
- Other relevant department (s) – any other departments that should be involved with planning and/or implementation;
- Timeline – is this action ongoing, immediate, future – when should it start and how long will it take to complete;
- Costs – what are the anticipated costs of an action – this can be represented with symbols (i.e. $, $$, $$$, $$$$) or with words (i.e. negligible, variable/fixed, significant) this estimate is not meant to act as a budget but rather an estimate of the expected costs;
- Funding – can this be funded by an existing budget, through third-party funding, future budgets, etc.;
- Benefit – what will be the environmental, social, or environmental benefit associated with implementing this action;
- Target - what are your community's objectives and actions striving to accomplish within a defined timeframe? What are the numerical standards to measure progress against?

- Indicators - what is the baseline information required to measure the effectiveness of the action against (i.e. the amount of existing permeable surface, number and size of urban hot spots, number of policies that include climate change adaptation considerations, etc.). [Refer to Worksheet 12 for more information]
- Pre-cursors to action – what steps need to be taken to enable the implementation of an action (i.e. research studies, establishing partnerships, etc); and
- Other factors – what other factors are important to consider for this action (pre-planning needs, major sub-tasks, potential barriers, etc.).

In some cases there may be existing municipal actions or measures which lesson a community's vulnerability to climate change. In Milestone One, your adaptation team would have done a preliminary scan of such actions. If appropriate, this list of existing actions can also be included in your community's final adaptation plan.

Sub-tasks should be developed where necessary and should include a relevant order for implementation if one task depends upon the successful implementation of another task.

It is also important to build in a certain degree of flexibility into the plan. As new information becomes available you may find that actions or timelines need to be revised. Adaptation planning is an ongoing process as climate change science is constantly evolving. As social, economic, and environmental conditions change your original assumptions may also need to change. There is more detail on the process of monitoring and review in Milestone Five.

Alternatives... Some community's are addressing adaptation without formalizing their process via the creation of a Preparedness Plan. If this approach suits your community better, it is possible to create a list of adaptation actions to share with relevant stakeholders.

Financing

Financing adaptation actions is an important element to your adaptation plan, however as stated earlier, it cannot be the sole reason for pursuing or postponing action. When budgeting for climate change adaptation it will be important to consider the following questions:[70]

- Which actions can be incorporated into existing projects or expenditures?
- Which actions will require new expenditures?
- Is there a payback period for the action? (e.g. an action with a mitigation co-benefit may have a payback period associated with it)
- What are the potential savings over the lifetime of the improvement? Will replacing a piece of infrastructure with better technology save costs over the use of the older technology?
- What are the project's life cycle costs?
- Is funding available in the existing municipal budget?
- What alternative funding sources exist?
- Are there legal or insurance costs associated with inaction? How do these compare to the costs of building or replacement?

Your adaptation team will likely have to seek the input of senior management and department heads to find specific answers to the questions above. Making a detailed financial plan, or at least considering the financing mechanisms in as much detail as possible, will make your adaptation plan much more comprehensive and will ease with the implementation phase in Milestone Four.

Setting Targets

Although your community may already have mechanisms which can help to determine whether you are meeting your goals and objectives, it will be important to set specific targets to measure the progress and success in meeting your adaptation objectives and actions. These targets should be included within your adaptation plan as they will provide a benchmark for your community's successes and challenges.

To the extent possible, identify what your community's objectives and actions are striving to accomplish within a defined timeframe (e.g. develop a downtown food co-op by 2015 or designate reliable shelters for extreme heat events by 2012) and any numerical standards to measure progress against (e.g. improving energy conservation by 25% or increase local food production by 20%). Numerical standards will only be possible in cases where baseline data is available (i.e. energy use prior to an adaptation action). In some instances, baseline inventories from Milestone One of the *Partners for Climate Protection* program can be used to supply this information.

Estimate How Progress will be Measured and Evaluated

A method to monitor the progress and effectiveness of your community's actions should be included in the action plan in preparation for the fifth and final Milestone, *Monitor and Review*. Building monitoring and review activities into your plan can contribute to its long-term success. How frequently your community assesses the progress towards your adaptation objectives will depend on a variety of factors including the nature of your planning processes, your community's budget cycle, and the implementation timeline for associated actions. The indicators that are established are a natural starting point for monitoring and review; add to these by outlining the specific times at which progress will be measured.

Building in measuring points on an annual basis can act as a mechanism to build and continue momentum for the adaptation process as your community moves through the implementation phase in Milestone Four.

Identify Possible Funding Sources

Where funding does not exist within existing budgets, there may be other options to securing funding for adaptation activities. Seeking external or third-party funding can be an excellent way to start off any adaptation action. The following table (Exhibit 21) provides an example of possible funding sources and the types of actions that they can help to finance:

EXHIBIT 21

Possible Funding Sources

SOURCE	FUNDING POSSIBILITIES
Green Municipal Funds	Available for municipalities with innovative environmental projects – GMF grants and below-market loans directly support municipal initiatives.
Partnerships	Opportunities for funding through partnerships with local universities and/or non-profit groups particularly for research and public outreach.
Federal government departments	Infrastructure Canada (gas tax funding), Natural Resources Canada Climate Change Impacts and Adaptation Division, and Federal Government EcoAction Fund are some examples of federal funders.
Revolving funds	Using the savings from existing mitigation work to help fund the expansion of adaptation actions. This can be particularly useful where the action is being instituted as part of the adaptation plan but will also have an economic payback via budgetary savings. See the City of Edmonton case study in the case study box below.
Carbon trading	Once you've met your council's commitment to emissions reductions, any surplus emissions reductions you make could be traded and the income from these could be used to support your adaptation actions.

CASE STUDY

Securing Funding – Energy Management Revolving Fund in Edmonton, AB

The City of Edmonton has a revolving fund aimed at financing energy retrofits for City facilities. The benefits of a revolving fund include: it reduces operating costs, projects are not competing for limited capital funds, and due to the internality of the fund there is flexibility to address changing conditions. This or similar revolving funds can be used to fund adaptation actions.

It is important that your adaptation team realistically looks at the costs associated with the actions that it identifies. However, as stated earlier, costs should not inhibit adaptation actions from being included in the plan. Where applicable, actions can be timed around the investigation of future funding opportunities or partnerships to seek funding for a given action.

Create an Implementation Schedule

The creation of an implementation schedule is the backbone for the implementation milestone (Milestone Four). Note that although it is included here as part of the planning process, it could also be used as an implementation tool and be created as the first steps of Milestone Four.

Earlier your adaptation team identified an estimated time to implement and/or complete each action; these timelines should now be finalized and compiled to create an overall implementation schedule. This schedule will track each action and associated tasks/sub-tasks, and will include a calendar of when each action is to be implemented (including the lead department, financing requirements, etc.). A comprehensive implementation schedule will help later to monitor what progress is being made on the adaptation plan. Keep in mind that the purpose of the implementation schedule is not to prioritize or rank adaptation actions but rather provides a tool for planning the implementation of each action. Also note that the implementation schedule will likely cover an extensive period of time as all adaptation actions, from immediate to ongoing, should be included.

13 *Worksheet 13 will assist your community with drafting your adaptation plan, providing guidance on how to identifying timelines, associated costs, responsible persons, other resources (external support, tools, financing), pre-cursors and sub-tasks for each of the actions that have been identified as well as an implementation schedule.*

FINALIZING YOUR ADAPTATION ACTION PLAN

The work your community has done to this point will make up the majority of your adaptation plan. The more thorough your adaptation team has been in identifying goals and objectives, categorizing actions, assigning responsibilities, and identifying funding mechanisms, the easier it will be to compile those items into a formalized adaptation plan.

Drafting the plan may be a good task to assign to the adaptation team leader, as writing by committee can often lead to delays, miscommunication, and aggravation. One person, or at most a small group, should be assigned the job of turning the various components into a larger document for review by the adaptation team. Once a draft of the adaptation plan has been written by the core writing group this should be circulated to the wider adaptation team for review, comments, and editing. By circulating a draft to a wider audience than the drafting group, you are creating a more consensus built document rather than one that is 'owned' by a small group. Elements that should be included in the final adaptation plan include:

- **Acknowledgements** – Thank you to stakeholders, adaptation team, Mayor, Council, etc.
- **Mayors/Council Commitment**
- **Executive Summary**
- **Glossary** – Key terms that may assist the reader.
- **Introduction**
- **Background and Context** – What is climate change? Why was this process undertaken? Why is it important
- **Impacts & Issues** – What impacts are projected for the community? What are the risks?
- **Vision Statement** – A call to action for your community
- **Goals and Objectives** – What are the objectives for achieving the vision? What are our targets for measuring these?
- **Actions** – Actions, costing, financing, responsibilities, timeline, monitoring & review
- **Implementation schedule** – A timeline by action with a defined date and responsible departments.
- **Additional Information** – References, sources of information, etc.

Integration with other Municipal Planning Activities

In addition to having a stand alone adaptation action plan, it is good practice to interweave adaptation planning into existing municipal planning documents such as master/strategic plans (transportation, cycling, etc.), official plans, community visions and/or your community's Integrated Community Sustainability Plan (ICSP). By integrating adaptation into existing policy documents, your community's adaptation plan will not become a stand alone stagnant document but rather will make up part of the way your community operates. This sort of integration will not necessarily be done quickly, but the process should be initiated upon the completion of an adaptation plan.

Worksheet 14 provides a template for a press release which can be used in two ways; firstly to outline your community's adaptation plan and secondly to communicate how far your community has come in increasing its adaptive capacity as well as any next steps.

Ensure You Have the Approval and Support of Council, Municipal Staff and the Community

In Milestone One, you secured the support of council for your adaptation planning efforts. It is important to maintain that support, as such it is suggested to bring your adaptation plan to Council at this stage in the process. Having the support of Council, municipal staff and the community will help in moving plan implementation forward.

Your community's final Adaptation Plan will likely need to pass through Council in order to ensure that each action will be implemented in Milestone Four. Your climate change champion may be a good choice to present the plan to Council as they will be able to speak to the importance of the plan and also provide a stirring call to action.

The completion of the formal adaptation plan and its passing through Council is a success that your adaptation team will want to communicate both internally to staff (using issue briefs), and externally to stakeholders and the community at large (use the press release template in Worksheet 14). It will likely be an occasion to celebrate as it marks your community's first steps in becoming more adaptive to the impacts of climate change. Use this to build momentum for the implementation phase as well as to mark the achievements of your adaptation team to date.

Alternatives... If it is not possible to pass the completed adaptation plan through Council, one alternative is to take the plan to Council in sections or even divide up the larger plan into smaller plans which address a given impact.

Once you have a finalized adaptation plan which has been passed through Council, be sure to reconnect with relevant departments as to their roles and responsibilities. Some departments will have been involved throughout the process, however for those who have not been involved recently this information should be (re)communicated.

As you engage internal and external stakeholders it is important to focus on action and emphasize local benefits. Be sure to identify the importance of adaptation efforts while still emphasizing the necessity of mitigation as you engage stakeholders.

It is also important to address the fact that there are costs associated with delaying action, most importantly the increased risks and possible danger to the community. Take the time to communicate both the objectives of your adaptation plan and the implications of the plan to the key stakeholders that were identified in Milestone One. This communication may also extend more widely to other municipalities, local government associations, and provincial or federal governments. You can use Issue Briefs (See Worksheet 4) to communicate internally. You can also use Worksheet 14 to announce the completion of the adaptation plan to external stakeholders.

Note that in many cases there are steps in Milestone Three that could be done in Milestone Four and vice versa. This happens because both planning and implementing are conceptually linked. Although we have recommended a certain progression of activities, it may make more sense for your community to conduct certain elements of each stage out of sequence. Often, Milestone Three and Milestone Four will be done simultaneously with constant revision and modification. This iteration demonstrates the cyclical nature of adaptation planning and the importance of monitoring and reviewing.

CASE STUDY ***Collaborative Planning – Urban Forest Management Plan in Edmonton, AB***

Due to an urban forest that is threatened by drought and invasive pests, the City of Edmonton created an *Urban Forest Management Plan* (UFMP) that guides the City's future urban forest management over a 10 year horizon. The plan was developed collectively, with regular input from a multi-stakeholder advisory group and consultation with the public. This collaborative approach has been a key strength of the UFMP and demonstrates how adaptation planning can be incorporated into a municipal plan for managing urban forests.

CASE STUDY

Planning Across Council – Ahead of the Storm: Preparing for Climate Change in Toronto, ON

In 2008, the Toronto Environment Office, in collaboration with the City of Toronto's Climate Adaptation Steering group and the Clean Air Partnership, developed *Ahead of the Storm: Preparing Toronto for Climate Change*. As part of the actions contained within the City's Climate Change, Clean Air and Sustainable Energy Action Plan, this adaptation plan includes programs that will reduce the effects of various climate change impacts such as heat waves, flooding from intense rainstorms, high winds, the expanding range of insect pests, and changes in lake levels. A few examples of adaptation actions that are currently in place in Toronto include: Toronto's Heat Alert System and Hot Weather Response Plan; Flood Warning Forecasting; the Deep Lake Water Cooling (Enwave), Peaksaver and Keep Cool Programs (Toronto Hydro); and their Emergency Plan. Within the City's Adaptation Plan they've also included a number of recommended actions for developing and implementing their climate change adaptation strategy including actions specific to establishing a strong ongoing adaptation process and enhancing capacity within the community.

WHERE SHOULD YOU BE NOW?

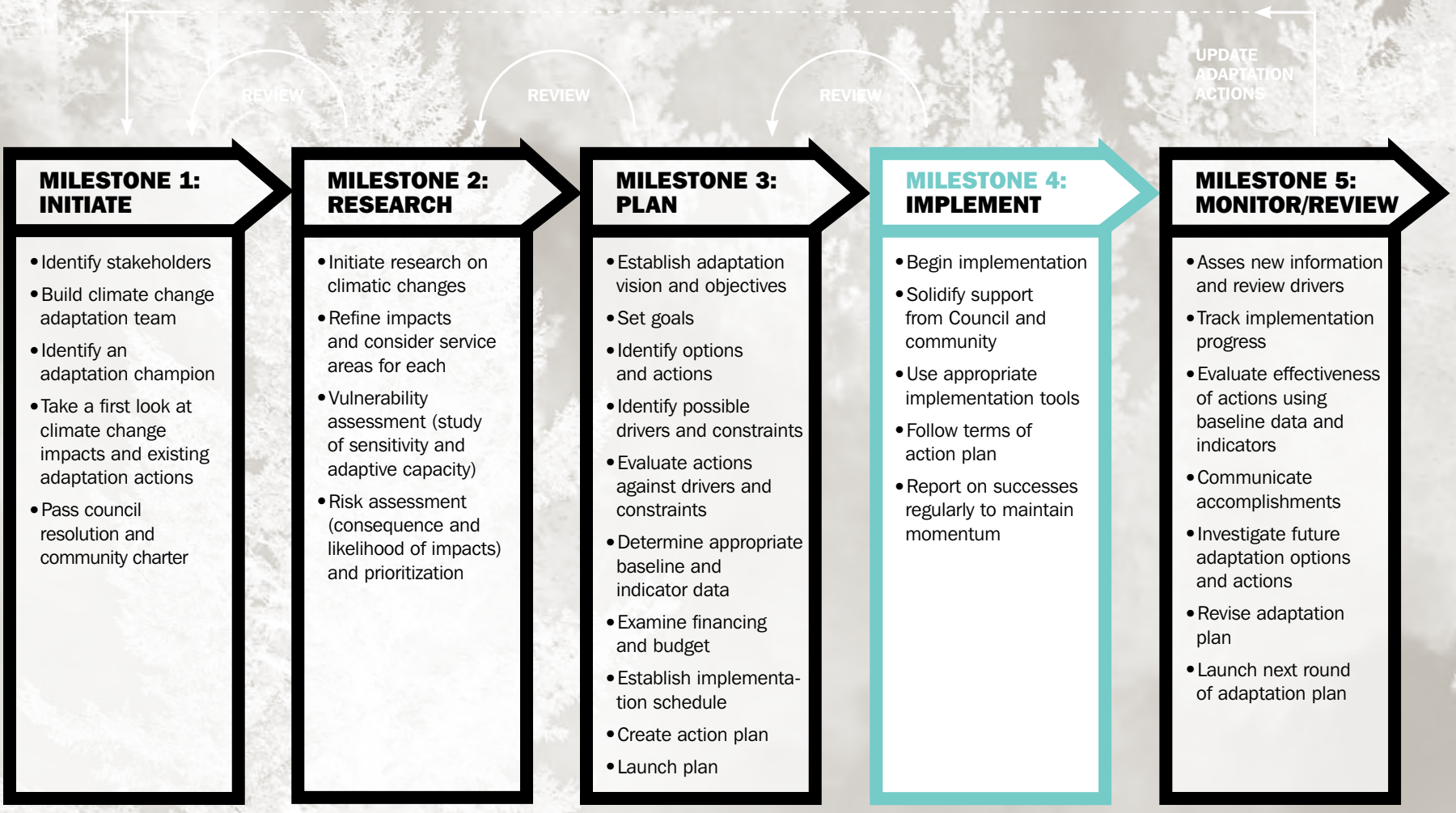
At this point you should have a finalized action plan, which includes an outline of adaptation actions, costing, financing, responsibilities, implementation timeline, and a basis for monitoring and reviewing your implementation success. With your community's adaptation plan finalized, you can start putting your plan into action in Milestone Four, *Implementation*.

SUMMARY OF OUTPUTS

- **Vision and guiding principles**
- **Adaptation options**
- **Specific actions (where applicable)**
- **Financial implications of your plan**
- **Draft and Final Adaptation Plan**

ENDNOTES

69. Bizikova, L., Neale, T., Burton, I. (2008). *Canadian Communities' Guidebook for Adaptation to Climate Change: Including an approach to generate mitigation co-benefits in the context of sustainable development*. First Edition. Environment Canada and University of British Columbia, Vancouver.
70. Partners for Climate Protection (2008). *Five-Milestone Framework for Reducing Greenhouse Gas Emissions*. Available for download at http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_PCP/PCP_Resources/PCPFiveMilestoneFramework-e.pdf


REVIEW
REVIEW
REVIEW
UPDATE ADAPTATION ACTIONS
MILESTONE 1: INITIATE
• Identify stakeholders
• Build climate change adaptation team
• Identify an adaptation champion
• Take a first look at climate change impacts and existing adaptation actions
• Pass council resolution and community charter
MILESTONE 2: RESEARCH
• Initiate research on climatic changes
• Refine impacts and consider service areas for each
• Vulnerability assessment (study of sensitivity and adaptive capacity)
• Risk assessment (consequence and likelihood of impacts) and prioritization
MILESTONE 3: PLAN
• Establish adaptation vision and objectives
• Set goals
• Identify options and actions
• Identify possible drivers and constraints
• Evaluate actions against drivers and constraints
• Determine appropriate baseline and indicator data
• Examine financing and budget
• Establish implementation schedule
• Create action plan
• Launch plan
MILESTONE 4: IMPLEMENT
• Begin implementation
• Solidify support from Council and community
• Use appropriate implementation tools
• Follow terms of action plan
• Report on successes regularly to maintain momentum
MILESTONE 5: MONITOR/REVIEW
• Asses new information and review drivers
• Track implementation progress
• Evaluate effectiveness of actions using baseline data and indicators
• Communicate accomplishments
• Investigate future adaptation options and actions
• Revise adaptation plan
• Launch next round of adaptation plan

MILESTONE 4:

IMPLEMENT

MILESTONE 4: IMPLEMENT

In the fourth milestone, *Implement*, you will be working to ensure that you have the appropriate implementation tools as well as the approval and support of Council, municipal staff and the community to enact your adaptation plan. Though your community has made strides towards becoming more adaptive by planning, it is through the implementation phase and beginning to put the adaptation plan into action that it will improve its adaptive capacity.

PURPOSE	OUTPUTS
Secure the support of Council and the community and implement the actions identified in your adaptation plan.	✔ Support and Approval from Council ✔ Implementation Tools ✔ Community Engagement and Partnerships

CHECK BACK

As you progress through Milestone Four, be sure to keep track of how new conditions within your community might affect the decisions taken in Milestones One, Two and Three. Maintaining the relevance and accuracy of information throughout this adaptation process is important as the information collected will continue to inform decisions in the future. By periodically scanning the sources you've used in Milestone Two, you will be able to make changes as per any new information. You will also want to ensure the actions you've identified in Milestone Three remain appropriate for each impact, especially as local conditions may change. Throughout this Milestone be sure to take note of the measuring and monitoring elements that have been included in your adaptation plan to prepare you for Milestone Five on monitoring and review.

GETTING STARTED

While the scope of activities and steps in Milestone Four may seem less time consuming than the activities from previous milestones, the implementation phase can be one of the longest milestones in this process. The work that the adaptation team has done to this point in ensuring that the adaptation plan is as comprehensive as possible will help to ease any difficulties with implementation. The duration and resources needed for implementation will vary, sometimes considerably, from one community to the next; however, several elements will be consistent including: a comprehensive implementation schedule (from Milestone Three), identification and use of implementation tools, and partnerships for delivery.

While your adaptation team and other municipal staff are responsible for putting your adaptation plan into motion and maintaining momentum, non-governmental organizations and private-sector contractors can contribute to the implementation of specific projects.[71] Approval from both internal stakeholders (Council and municipal staff) and external stakeholders (vendors, residents and community groups) will contribute to the plan's success.

As actions are developed, it may be the case that certain elements are implemented prior to the more formal implementation process outlined in this milestone. This will likely be the case for many communities and is common in most planning processes. It is good practice to take a quick survey of the implementation status of actions before delving further into the implementation milestone; this will assist in documenting what has taken place already and allow you to identify appropriate implementation tools for remaining actions.

The implementation tools identified below will help to secure support from the departmental staff that will, in effect, be charged with carrying out the actions and precursors to actions contained within the plan.

If your team was not able to establish a baseline or identify indicators in Milestone Three, you may find that you are able to now. It will be helpful later in Milestone Five to have some indication of the pre-existing levels of adaptive capacity prior to the implementation of adaptation actions in order to assess the progress and effectiveness of each action. If your team was able to establish a baseline and identify indicators in Milestone Three, ensure that that information is still representative and current before moving on.

Consider This…

Your community may decide to solidify its implementation commitments through political declarations. Alternatively, if the political will is not present, your community may drive implementation through stakeholder feedback from the community or from departmental staff.

ENSURE YOU HAVE APPROPRIATE IMPLEMENTATION TOOLS

Identification of the appropriate tools for implementation will help to drive the implementation process. These tools will be used at various times throughout this stage and represent the way in which your adaptation team will reach out to the responsible staff and wider community as identified in Milestone Three.

Training

Throughout implementation, training of staff, elected officials, and key community stakeholders is a key tool for the execution of adaptation actions. Some examples of training topics that may be required include:

- New standards or codes of practice;
- Benefits of a given adaptation action (i.e. increasing tree cover in the community);
- New technologies (i.e. engineered materials or machinery) that may be used in infrastructure replacement; and
- Rationales behind policy changes and or amendments to departmental strategic plans.

Additional training workshops may also be required on specific technologies that are being adopted by various departments; these may require the hiring of external experts or consultants who may be most familiar with the given technology. Trainings need not be long formal sessions, brown-bag *lunch'n'learns* are an excellent example of a small, informal training session that can help to educate key individuals on a given action or policy initiative.

Workshops and other training exercises will both add to your community's skill set and contribute to the successful implementation of your adaptation plan overall.

Pilots

Piloting is a way to implement adaptation actions through small scale initiatives. By conducting a pilot, you can assess the strengths and weaknesses of specific actions, as well as associated costs and whether it produces both desired and measurable results. This analysis will allow you to determine if your identified adaptation action is the most appropriate action to pursue on a larger scale.

For example, if your community decided to replace aging infrastructure, your adaptation team may decide that before a full scale project is undertaken it may be relevant to conduct a pilot by replacing the infrastructure of a particular site and assessing the benefits of that action. Such a pilot would help to determine the associated costs and find out whether the action produces the desired results. Likewise, replacing impermeable paving materials with permeable ones at the neighbourhood level would be a great way to determine if the measure should be scaled up to cover the entire community. Pilots can help to secure the commitment of smaller groups of residents who can then help to spread the message about the need and benefit of a given action.

Internal Communication

Along with training, communication will play a significant role in the implementation of your actions. In addition to those stakeholders which have been involved throughout the process, there are likely other teams, departments, individuals with whom information on the adaptation plan and specific actions will need to be communicated. Depending on the specific actions in your adaptation plan, a variety of information should be communicated both to Council and municipal staff including:

- Emergency service updates and preparedness plans;
- Changes to Council priorities and objectives;
- Changes to by-laws, zoning requirements, and codes;
- New plans or guides; and
- New land-use regulations.

Much of this information will also need to be relayed to the public and should be included in relevant external communication.

This sort of internal communication can be done in a variety of ways; options include regular updates to Council, inclusion in departmental annual reports, internal memos or informal means of communication within the corporation (i.e. lunch and learn sessions, information posters, etc.). Coupling internal communication activities with more rigorous training exercises can be an effective way to ensure that staff and Council are well appraised of not only the actions that are taking place but also the reasons and motivation behind adaptation actions.

External Communication

In addition to communicating specific changes that will affect municipal staff and residents, it will be important to communicate more generally on the impacts of climate change and the risks associated with those impacts to the wider community. For example, increasing public awareness and education about the public health implications of climate change and the need for emergency preparedness, may be an action you've identified in your adaption plan, and you will need to utilize communication tools to achieve it.

As you carry out the implementation phase of this process be sure to continue to include public input, involvement, and engagement. Volunteers are also a powerful resource and can help enhance public awareness on these issues and can be helpful to target larger groups such as youth, specific community groups, etc.

There is also opportunity for partnerships with other communities throughout implementation. Partnerships provide a chance to share resources, experiences and lessons learned. It is often helpful to know how other similar communities have progressed through implementation and what methods they employed during the process which may also be valuable to your community.

CASE STUDY

Engaging the Community – Encouraging Residents to Prepare for Emergencies in New York, NY

As a way to engage the community with emergency planning, New York City implemented *Get Prepared: Ready New York*. *Ready New York* is an educational campaign which encourages preparedness planning for residents. *Ready New York*'s resources now includes 11 multilingual publications, numerous public service announcements, multimedia advertising campaigns, extensive web content, a speakers' bureau, a reprinting program, corporate partnerships, and continuous community outreach.

For more information on this program visit New York City's Office of Emergency Management website at http://www.nyc.gov/html/oem/html/get_prepared/ready.shtml

Marketing

Given that public involvement and awareness is such an important element of implementation, marketing is a helpful tool through which communication with wider audiences can be carried out. Of course, your community will want to market its accomplishments and successes, but it is similarly important to inform the public about adaptation efforts, more generally, and of where there might be opportunities for public participation. By encouraging residents to participate in adaptation activities at the household level, your municipality is broadening its adaptation efforts from tackling only those issues that are under municipal control to those which are within the wider realm of the community.

There are a variety of marketing tools that are available to you. A few possibilities include:

- Awareness raising campaigns or events;
- Tips for home adaptation (e.g. downspout disconnecting, emergency preparedness kits, or rain barrels);
- Incentives for participation in City led programs (e.g. installing backwater valves, disconnecting downspouts, etc.)
- Guides, brochures, and pamphlets on climate change threats and risks; and
- Public challenges and contests relating to climate change adaptation and preparedness.

Community based social marketing (CBSM) is another tool which can be used to assist with the implementation of particular actions. CBSM is marketing that emphasizes direct, personal contact among community members and the removal of barriers (i.e., "road-blocks" to more sustainable actions and behaviours).

CASE STUDY

Implementing Action – Using Community Based Social Marketing in the Town of The Blue Mountains, ON

As part of their Integrated Community Sustainability Plan (ICSP), and with funding from the Ontario Ministry of the Environment's Community Go Green Fund, The Blue Mountains created *Your Community, Your Planet: A Guide to Reducing Greenhouse Gas Emissions*. The guide emphasizes the importance of individual actions and seeks to animate the community on what they can to do about climate change whether it be joining one of the EcoAction teams or implementing simple actions to reduce energy use. Using community based social marketing; the guide stresses the importance of bringing a global issue to the local culture through real people, real stories and real situations. For more information on The Blue Mountains program visit http://www.thebluemountains.ca/sustainability-plan.cfm

Other Resources

There are also other implementation tools that you may find applicable to your community. For instance other planning guides or documents from communities that have already implemented an adaptation plan may be helpful during implementation. Through such resources your community will have access to best practices, information sharing, and knowledge exchange.

Also recall the local government action mechanisms that are available to your community (See *Background*, p. 14). Consider how these mechanisms can be used to aid the implementation of your adaptation actions. Such mechanisms include land use and urban planning, licensing and regulation, facilitation, advocacy and leadership, community service delivery, community development and civic engagement, and workforce development. Through these action mechanisms, local governments can use direct and indirect influences to support and foster behaviour that furthers adapting to a changing climate.

Whatever means your community uses to implement its adaptation plan, ensure that it remains transparent and includes stakeholders from the community (especially those that can be considered vulnerable populations or groups at risk).

15 *Worksheet 15 will help you to allocate tools to aid in the implementation of identified adaptation actions.*

Follow the Terms of the Adaptation Action Plan

Be sure to check-in to your wider plan as implementation progresses. Your team will want to ensure that implementation is following the terms that have been outlined in the adaptation plan. Though the implementation phase does require a degree of flexibility, your adaptation team will want to ensure that this process remains consistent with the vision, goals and objectives that you have outlined in Milestone Three.

WHERE SHOULD YOU BE NOW?

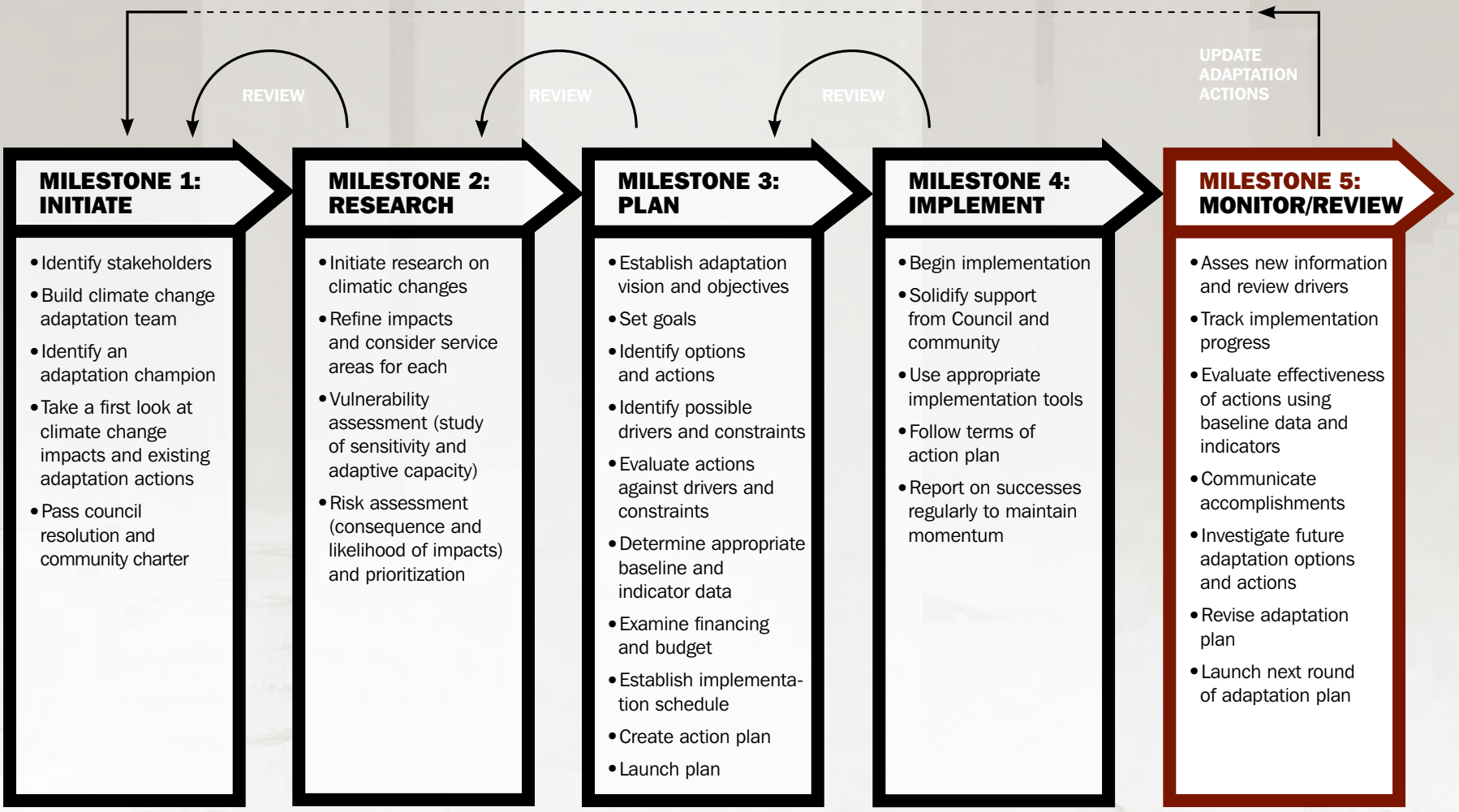
Your community should now be underway with the implementation phase of the adaptation process. Do not get discouraged if implementation is slower or more challenging than you anticipated; the work to get to this point took many months (or years) therefore the results cannot be expected to take place instantly. Also remember that planning does not end with implementation — be sure to revisit your plan on a regular basis to account for new changes and to review the appropriateness of identified measures (more on this in Milestone Five). Building ongoing renewal into your plan is a key element to long-term success.[72]

SUMMARY OF OUTPUTS

- ✔ **Support and approval from Council**
- ✔ **Identified implementation tools**
- ✔ **Strong community engagement and ongoing partnerships**

ENDNOTES

71. Partners for Climate Protection (2008). *Five-Milestone Framework for Reducing Greenhouse Gas Emissions.* Available for download at http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_PCP/PCP_Resources/PCPFiveMilestoneFramework-e.pdf
72. *Ibid*


REVIEW
REVIEW
REVIEW
UPDATE ADAPTATION ACTIONS
MILESTONE 1: INITIATE
• Identify stakeholders
• Build climate change adaptation team
• Identify an adaptation champion
• Take a first look at climate change impacts and existing adaptation actions
• Pass council resolution and community charter
MILESTONE 2: RESEARCH
• Initiate research on climatic changes
• Refine impacts and consider service areas for each
• Vulnerability assessment (study of sensitivity and adaptive capacity)
• Risk assessment (consequence and likelihood of impacts) and prioritization
MILESTONE 3: PLAN
• Establish adaptation vision and objectives
• Set goals
• Identify options and actions
• Identify possible drivers and constraints
• Evaluate actions against drivers and constraints
• Determine appropriate baseline and indicator data
• Examine financing and budget
• Establish implementation schedule
• Create action plan
• Launch plan
MILESTONE 4: IMPLEMENT
• Begin implementation
• Solidify support from Council and community
• Use appropriate implementation tools
• Follow terms of action plan
• Report on successes regularly to maintain momentum
MILESTONE 5: MONITOR/REVIEW
• Asses new information and review drivers
• Track implementation progress
• Evaluate effectiveness of actions using baseline data and indicators
• Communicate accomplishments
• Investigate future adaptation options and actions
• Revise adaptation plan
• Launch next round of adaptation plan

MILESTONE 5:

MONITOR/REVIEW

MILESTONE 5: MONITOR AND REVIEW

The fifth and final milestone, *Monitor and Review*, serves to assess whether the goals and objectives previously set by your community have actually been achieved, and to identify any problems that have been encountered with an aim of developing solutions. An internal review of your community's adaptation plan should be conducted to look at whether planned actions have been implemented, and if so, what has been achieved, what barriers were encountered, and to begin identifying potential solutions.

This milestone should also be an opportunity for communicating progress to the outside world, thereby helping to raise general awareness about climate change adaptation and celebrate your community's accomplishments.

PURPOSE	OUTPUTS
Assess progress towards the goals and objectives that were set out in Milestone Three and to reassess the scientific information upon which vulnerability and risk were evaluated.	✔ Review of scientific information ✔ Progress on implementation ✔ Effectiveness of actions ✔ Updated action plan ✔ Communication of accomplishments

GETTING STARTED

Since Milestone One, the process of monitoring and reviewing progress on climate change adaptation has been built into this guide. This process should be ongoing and happening on multiple levels (political, staff, budgetary) and for multiple audiences (from your adaptation team to your community at large).

Monitoring, as set out in your community's adaptation plan, should enable your team to examine lessons learned throughout implementation in order to identify if the context of your risks and vulnerabilities have changed or if any of the underlying research is now out of date, in which case a review should be triggered (and potentially revision) of the plan.

In addition to ongoing monitoring and review, Milestone Five offers a specific opportunity to focus efforts on tracking your community's progress against its adaptation goals and objectives and to update your adaptation plan based on this information and analysis.

Lastly, though your adaptation team has likely been reporting back to Council and other staff its key findings, informing Council, municipal staff and the community on the progress that has been made to date and any changes that need to be made to the planning process is an important part of this milestone.

TRACKING YOUR PROGRESS

Tracking results is an important part of the adaptation process; it requires following up on the goals and objectives that were set as part of Milestone Three; looking at the indicators of progress that were identified earlier; and interpreting whether or not the actions taken have improved the adaptive capacity of the chosen service areas within your community. Looking at the progress made to-date is important as it:[73]

1) Gives your adaptation team an opportunity to assess whether you are continuing towards your adaptation vision and goals;

2) Enables your community to know more accurately where, to what extent, and against which impacts it is most vulnerable;

3) Allows your adaptation team to know whether the actions in your plan are producing the results that were anticipated (and if not, giving the opportunity to modify and/or replace them with more appropriate ones); and

4) Will likely be an occasion to celebrate your first steps in becoming more adapted to the effects of climate change.

Fundamentally, tracking your community's progress is meant to gauge the implementation status of the adaptation actions your team has developed, and to identify whether these actions are helping to improve your adaptive capacity and achieve the climate adaptation vision established in Milestone Three.

Exhibit 22 offers a set of questions that can be used for this purpose. The questions have been divided into two distinct areas: **tracking progress on implementation** and **tracking effectiveness of actions**. These questions are meant to help your community examine how successful your actions have been in achieving your community goals and the lessons you have learned in the process.

EXHIBIT 22

Tracking Progress and Effectiveness

PROGRESS ON IMPLEMENTATION: Are actions being implemented as per the adaptation schedule in your adaptation plan?	**EFFECTIVENESS OF ACTIONS:** How are your actions increasing or maintaining the adaptive capacity of service areas in your community? Are individual actions producing the intended results?
• How many actions have been undertaken by various departments? • How many departments/staff have been involved in implementing adaptation actions? • How have you engaged stakeholders in the development and implementation of your adaptation action plan? • Are community partnerships in place to enable robust decision making with regard to adaptation planning? • To what extent have you increased the general and technical capacity of your community to prepare for climate change impacts? • How is climate information being considered in decision making processes within your community? • How much support is there among your government, your community, and stakeholders to prepare for climate change impacts? • How have drivers or constraints changed? Are there new opportunities available which might aid the implementation of your community's actions now and in the future?	• Refer to the specific indicators established in Worksheet 12 and reassess your baseline. How have the conditions in your community changed? • How effectively is your community's technical capacity being used to evaluate risk and vulnerability? • How effective have the measures been in achieving your community's vision and goals? • Are there any formal mechanisms in place that "mainstream" or otherwise facilitate climate change adaptation planning? If not, what has prevented this from happening? • How has awareness about climate change and its projected impacts on your community increased?

Reflecting on progress made throughout the process is a cornerstone of Milestone Five; be sure to allocate enough time to do this thoroughly.

ASSESSING NEW INFORMATION

Keep in mind that climate change adaptation is an ongoing process. As natural, economic, social and political conditions change, the research that was conducted as part of Milestone Two may also need to be updated. When assessing new information, important questions to consider include:

- To what extent has there been a change in political leadership since the adoption of the adaptation plan?
- Has there been a shift in public opinion that has led to a shift in priorities?
- How have economic factors changed? Has this driven or constrained implementation (i.e. budgetary cuts, lack of third-party funding, delayed pay-back into revolving funds, etc.)?
- Has there been societal shifts which might influence your communities adaptation efforts (i.e. increased unemployment, increase in violence and/or crime, decrease in interest in environmental issues, etc.)

As your team likely found while completing the research phase of the adaptation planning process, the range of information available varies depending on the location of your community. Recall that one option for dealing with limited information was to look at how sensitive your community was to past and present-day climate and weather events. This method of research is highly applicable in Milestone Five as your team can begin to interpret the data from the period covered by your adaptation plan to identify any significant changes or impacts.

Your team will want to ensure that it considers all of the factors that may affect policy-making and the planning processes over all. These considerations will help to shape updates to your adaptation plan, as discussed in the next section of this Milestone.

Use the following considerations to help review the assumptions that underlie your adaptation plan:[74]

- **What non-climate related changes (societal, economic or political) were important in the creation of a climate adaptation plan? Have any changes to these assumptions occurred that might affect the successful implementation of your community's adaptation actions?** Take note of how these changes will affect your ability to address climate change (i.e. funding, public perception, and/or political support?) and whether these factors are a short-term concern or an ongoing issue. Also consider whether such changes have eliminated constraints thereby creating an opportunity to implement an action.

- **Have new scientific findings improved or changed the understanding of your community's vulnerabilities to climate change?** Maintaining the relevance and accuracy of information throughout this process is important as the information collected will continue to inform decisions in the future. Make a commitment to monitoring the science that you've used to base the climate change impacts for your community on by periodically scanning the data sources you've used in Milestone Two and making changes as per any new and applicable data. One possible way to do this is to plan for a scientific review every few years. In cases where you find new (and sometimes seemingly conflicting) scientific reports, it may be useful to work with the academic community to determine how relevant new findings are to your work and whether they should influence a change in the direction of your adaptation plan. It is important to keep in mind that climate change science will not stay static. Science is constantly evolving and it is likely that your adaptation plan will experience a similar evolution.

- **Based on changes in scientific information, have your community's vulnerabilities or high risk areas changed?** A re-evaluation of scientific information may lead your community to change the focus of its adaptation plan. For instance, though your initial research (in Milestone Two) led you to assign a high risk factor to particular impacts, your current evaluation has found that your original assessment assigned a higher risk than what is currently needed and/or other impacts have become a more pressing concern. In such instances your updated adaptation plan will need to reprioritize certain actions, based on the higher risk factor, to account for the changes in scientific information.

- **Are your vision and goals still relevant to the information and results from the first milestones?** Though the adaptation vision and corresponding goals that were originally set will likely be broad enough to account for new scientific information and conditions, these might need to be narrowed or expanded to account for the most relevant and current data.[75]

- **Have you collected enough information about the success or failure of your adaptation actions?** Tracking the progress that your community has made towards its adaptation goals may reveal that a given adaptation action is not improving the adaptive capacity of your community and may in fact be amplifying your community's vulnerability.[76] Conversely a given measure may be so successful that additional funding is necessary to replicate that measure in another department. The information collected as part of your tracking therefore can be useful for critical review of the plan and later for updates to public reports, budget requests and policy decisions.[77]

- **Are you able to address the lower vulnerability impacts that you identified in Worksheet 7?** The purpose of conducting a vulnerability assessment in Worksheet 7 was to identify which impacts your community is the most vulnerable to and proceed with a risk assessment of those impacts. For the impacts that ranked lower, it may be valuable to re-evaluate whether your vulnerability has changed and whether your community is now equipped to address these impacts. You may also want to consider conducting a risk assessment of those lower vulnerability impacts at this point.

UPDATE YOUR ADAPTATION PLAN

Once you have tracked progress against your community's adaptation plan and reviewed new information, your community is ready to tackle the second part of Milestone Five, updating your adaptation actions and plan. In some cases you may need to update a specific action while in others you may have to adjust the implementation schedule of the entire plan. For example, an economic crisis which results in major industry cuts may have an impact on your ability to carry out your adaptation plan and should be taken into consideration when you review your implementation schedule.

Be sure to incorporate the most urgent and specific information in short-term decision making or budgetary processes. As you progress through your plan, external factors will not remain static. Depending on the length of time in between Milestone Four and Milestone Five, you may find that the factors which influence the effectiveness of your plan have changed. Many of these immediate and unforeseen changes cannot be adequately addressed in your regular policy making and planning cycles. Some of these changes may require immediate attention, and although they may not have been integrated into your original plan, will need to be incorporated into decision making and budgetary processes now. Due to the likelihood of such unforeseen factors, it is important to re-evaluate the relevance of your plan in the short term and determine whether it adequately addresses the most pressing concerns.

Incorporate new climate change information into your regular planning and policy updates.[78] While some new information is urgent and requires immediate attention, other information can be integrated into your regular policy making and planning processes. Building new climate change information into, comprehensive land use plans, official plans, shoreline management plans, and other such planning documents can be a useful policy mechanism to address and integrate climate change information on a ongoing basis.

Try to think about the opportunities that this juncture offers to share your knowledge and lessons learned in order influence climate change adaptation efforts beyond your immediate adaptation team. The plan updating process is an ideal time to communicate with a larger audience on the successes and lessons learned from the initial adaptation planning process – specifically how new research may necessitate expediting or strengthening your adaptation efforts.

16 *Worksheet 16 is a checklist which should be referred to as your team updates your adaptation plan.*

COMMUNICATING ACCOMPLISHMENTS

The completion of your implemented action plan is a success that your adaptation team will want to celebrate and communicate both internally to Council and staff, and externally to stakeholders and the community at large. Use this occasion to build momentum for ongoing implementation as well as to mark the achievements of your adaptation team to date.

Your team may want to use similar implementation tools as those used in Milestone Four to communicate the accomplishments of your adaptation team to the wider community. These communication tools include annual progress reports, press releases, issue briefs, website updates, workshops, awareness campaigns, celebration events and advertisements.

A communication strategy that reaches out beyond your adaptation team to the wider community will help to foster adaptive behaviour outside of municipal operations. Engage those external stakeholders from citizen groups, local NGOs, universities or businesses that you identified in Milestone One as you develop a communications strategy to convey the accomplishments of your community's adaptation efforts. Make an effort to consider a broad range of the community population, in particular those populations which are particularly vulnerable to the effects of climate change. By targeting vulnerable populations and groups that tend to be disengaged from municipal politics, your local authority can further expand its adaptation work beyond its own operations through individual actions and behaviour changes.

Communicating your successes will be a testament to the countless months (and years) that your adaptation team has put into the process of creating, implementing and monitoring your community's adaptation plan. It is important that both elected officials and senior managers take time to acknowledge the commitment of the adaptation team and its stakeholders to secure the community's future against the impacts of climate change. A public celebration of this work (through an "adaptation week" or an awards ceremony for instance) could serve as an open and appreciative gesture towards the dedication of the adaptation team.

17 *Worksheet 17 suggests a variety of options for communicating successes and assists with the development of a communications strategy.*

WHERE SHOULD YOU BE NOW?

Your community has now gone through the full cycle of the adaptation planning milestones, from initiating your adaptation effort through implementation and now monitoring and review. Recall that this is an iterative process; the cycle of adaptation planning should be maintained by following your implementation schedule and adding to it any new action items that have arisen as a result of Milestone Five.

DELIVERABLE

- **Assessment of progress on implementation**
- **Review of effectiveness of actions**
- **Updated action plan**
- **Communication on accomplishments and successes**

ENDNOTES

73. Partners for Climate Protection (2008). *Five-Milestone Framework for Reducing Greenhouse Gas Emissions.* Available for download at http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_PCP/PCP_Resources/PCPFiveMilestoneFramework-e.pdf
74. Snover, A.K., et al. (2007) *Preparing for Climate Change: A Guidebook for Local, Regional and State Governments.* In association with and published by ICLEI – Local Governments for Sustainability: Oakland, CA
75. *Ibid*
76. *Ibid*
77. *Ibid*
78. *Ibid*

FINAL THOUGHTS

Climate change is already being felt in towns and cities across the country. There are many indications that these changes are already underway: temperatures are increasing, snowpack is disappearing, spring is arriving earlier, and seas are rising. Across Canada, warmer temperatures have supported the rapid spread of invasive animal and plant species, melting of arctic and glacial ice, and increased heat stress among vulnerable populations. While at the same time exacerbating Canadians concern about extreme weather events, including ice storms, floods, and forest fires. Municipal services and infrastructure are increasingly being affected by these events.

Hundreds of Canadian municipalities have stepped up to the climate change challenge and are doing their part to control emissions by undertaking successful climate change mitigation activities. However, with the increasing effects of climate change becoming apparent, municipalities are beginning to see the need to assess their vulnerability to the changes that are already underway, and to develop responses that protect their communities. Mitigation is necessary to reduce the rate and magnitude of climate change, while adaptation is essential to reduce the damages from climate change that cannot be avoided.

Changing Climate, Changing Communities: **Guide and Workbook for Municipal Climate Adaptation** is a collection of resources that provide a milestone based framework to assist local governments in the creation of adaptation plans to address the relevant climate change impacts associated with their communities. Although climate change adaptation is a complex process, this guide aims to provide a straightforward methodology to adaptation planning using a five-milestone approach. Each milestone represents a fundamental step in the adaptation planning process, starting with the initiation of adaptation efforts (by building an adaptation team and identifying local stakeholders) and culminating with a monitoring and review process that analyzes the successes and reviews the challenges of the adaptation plan and its implementation.

This guide is aimed at municipal staff interested in working on climate change adaptation strategies. Staff from across all municipal departments can be involved in the process outlined in this resource; as it encourages an integrated approach to planning that requires examination of the environmental, economic, social, and health implications of climate change.

In moving forward with your community's adaptation planning efforts, consider the following key messages to municipalities on adaptation:

Understand what adaptation is.

Adaptation to climate change can include any activity that reduces the negative impacts of climate change and/or takes advantage of new opportunities that may be presented. Climate change, unlike most other public priorities, will directly or indirectly affect a broad range of resources and activities in the public sector (from water resources and land use planning to public health and emergency management). As climate change will affect a broad range of community assets and government services adapting to climate change is a matter of "good government" and risk management in an effort to ensuring the safety, health and welfare of communities now and into the future. In order to reduce your communities' vulnerabilities public decision-makers must ensure a positive lasting influence on their communities' so that future generations do not bear the worst effects of climate change.

Realize that adaptation and mitigation are not mutually exclusive

Mitigation efforts, or efforts to curb greenhouse gas emissions, have become widespread among local governments. However, scientific evidence indicates that even if we could halt greenhouse gas emissions today, the world would still experience a changing climate for decades to come.

Many of the impacts (changing temperature and weather patterns, drought, flooding, erosion, and sea level rise) will be felt directly at the local level. Local governments have the greatest ability to prepare for these changes, and many are now embracing climate adaptation as a co-strategy to their climate mitigation efforts. While neither adaptation nor mitigation actions alone can prevent significant climate change impacts, taken together they form a comprehensive climate change response strategy that will prepare communities for the climate impacts underway while working to avoid even worse future affects.

Know what you are adapting to

The old management adage – *you cannot manage what you don't measure* – is accurate when looking at adaptation planning. Developing your community's understanding of climate change impacts and the major service areas which are likely to feel these impacts most acutely is crucial to know what climatic changes and impacts you will need to adapt to. Conducting both a vulnerability and risk assessment are crucial first steps in becoming more adaptive to a changing climate. There are many sources of information on how climate change will affect Canada and its various sub-regions. These sources can all be used to some degree to develop a better understanding of how climate change will affect your community even when information specific to your location is not available. Knowing the impacts on your municipality will not only help you plan for adaptation but will also help build support among stakeholders for your planning efforts.

Prepare for those impacts

As practitioners of good governance, local governments must develop responses that protect their local citizens, environment and economy. Preparing for the impacts that will face your community will be the fundamental action you must take. It is important to remember that as your community engages in a climate change adaptation planning process, it should consider the balance of immediate and long-term needs, that community interaction must be supplemented with municipal action, and the need for commitment to plan for impacts despite facing uncertainty. Communities must, therefore, commit to driving this initiative by identifying and following-through on the actions they can undertake themselves or directly influence without getting sidetracked and delayed.

Realize there is no 'one size fits all' approach

Although the need for adaptation planning is clear, it is important to recognize that there is no one way to approach planning for climate change. Adaptation planning, by its definition of responding to local impacts, requires a certain degree of 'right-sizing' or localizing, as any plan must be tailored to the community. The methodology presented here is not intended to be a one size fits all approach nor is it intended to supplant the many other resources that are available to Canadian municipalities. Rather it is meant to provide a high-level framework for how local governments can address the array of impacts likely to occur as a result of climate change. The Guide encourages the use of existing sector or impact specific resources to further advance and/or refine municipal adaptation efforts.

Adaptation planning is not a new process and should be integrated with existing efforts

Acknowledge the work that your community is already doing which addresses climate change impacts (but which may not be labelled as "adaptation"). Where there is such work, it is important to incorporate any future adaptation planning with those existing efforts to ensure an integrated and comprehensive plan. In many cases, climate change will exacerbate existing high priority management concerns rather than creating completely new challenges. It is likely that your community will find that efforts to address existing management concerns affected by climate change may simultaneously reduce vulnerability to project climate impacts, particularly in the projected impacts are included in the scope of current decision making.

Anticipatory planning is more effective than reactive planning

Taking proactive steps to be flexible and to anticipate and address expected impacts can save money and protect the well being of communities. This includes activities that are taken before impacts are observed (anticipatory) and after impacts have been felt (reactive). In most circumstances, anticipatory adaptations will incur lower long-term costs and be more effective than reactive adaptations. Successful adaptation does not mean that negative impacts will not occur, only that they will be less severe than would be experienced had no adaptation occurred. Taking practical steps now with the best information available enables you to reduce your future risk and also realize possible near-term benefits.

As stated in the preface to this guide, *adapting to climate change is the new reality*. Many local governments are already at the centre of this reality; dealing with the effects of thawing permafrost, damaged infrastructure and heat waves. Adaptation will require an integrated approach as it is a long-term, continual process which will touch all sectors of society; however, local governments have a unique opportunity to begin preparing for a changing climate as they will be on the front lines of responding to its impacts and therefore, have an interest in preparing for them. While higher levels of government can and must provide funding and support for climate change adaptation strategies on the ground, local and regional governments have an equal or even greater responsibility to plan proactively as well.

ACKNOWLEDGEMENTS

ICLEI – Canada would like to thank the many people who contributed their time so generously to review this guide throughout its production.

ADVISORY GROUP

Rachel Bocock, Alberta Urban Municipalities Association
Mike Brotherston, Municipal Corporation of Delta
Ian Burton, University of Toronto
Devin Causley, Federation of Canadian Municipalities (FCM)
Angela Danyluk, Municipal Corporation of Delta
Gary Davidson, Davidson Group
Al Douglas, Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)
Jenny Fraser, Province of British Columbia
Gordon McBean, University of Western Ontario
Jennifer Penney, Clean Air Partnership
Dave Sauchyn, Prairie Adaptation Research Collaborative (PARC)
Missy Stults, ICLEI USA

MUNICIPAL REVIEW WORKSHOP PARTICIPANTS

Allison Ashcroft, City of Victoria
Brian Beck, City of Vancouver
Curt Benson, Niagara Region
Mark Boysen, District of Saanich
John Charles, Halifax Regional Municipality
Kathryn Cooper Macdonald, Halifax Regional Municipality
Angela Danyluk, Municipal Corporation of Delta
Ciara De Jong, City of Toronto
Cameron Deacoff, Halifax Regional Municipality
Jennifer Decker, City of Fort St. John
Jenna Dunlop, Durham Region
Suzanne Elston, City of Oshawa
Brian Hamilton, City of Hamilton
Birgit Isernhagen, City of Ottawa
Maria Jacobs, Halifax Regional Municipality
Caroline Jackson, City of North Vancouver
Kelly Johnston, City of Kamloops
Pamela Kertland, Natural Resources Canada
David Lane, Halifax Regional Municipality
Meagan Leach, City of Iqaluit
Leilani Lee-Yates, Region of Peel
Trisha Leszczynski, Town of Oakville
Richard MacLellan, Halifax Regional Municipality
Chris MacPherson, City of Fredericton
Shannon Miedema, Halifax Regional Municipality
Wayne Miller, Town of Essex
Debbie Nielsen, Union of Nova Scotia Municipalities (UNSM)
Brenda Osborne, City of Mississauga
Renee Roberge, Halifax Water
Kim Sare, City of Regina
Cindy Toth, Town of Oakville

PUBLISHER

ICLEI – Local Governments for Sustainability, Canada Office

AUTHORS

Ewa Jackson, ICLEI Canada
Leya Barry, ICLEI Canada
Nicole Marzok, ICLEI Canada

DESIGN AND LAYOUT

Hambly & Woolley Inc.

PHOTO CREDITS

p. 2 Megan Meaney, Director ICLEI Canada. Photo courtesy of ICLEI Canada
p. 3 Mayor Lois Jackson. Photo courtesy of the Municipal Corporation of Delta, BC
p. 6 "Couple birding with manhattan skyline background." Dreamstime.com/© Stefan Ekernas |
p. 10 "Wickaninnish Bay." Dreamstime.com/© Fallsview
p. 13
1) "Bench after ice storm." Flickr/bradipo
2) "Flooding in Cedar Rapids." Flickr/U.S. Geological Survey
3) "Epic hail." Flickr/Shiny Things
4) "Red River Valley." Flickr/morningstartphoto
5) "Forest fire." Flickr/canadagood
6) "Toronto flood." Flickr/Diego_3336
7) "Flooding in Cedar Rapids 2." Flickr/U.S. Geological Survey
8) "Hailstorm." Flickr/schuey
9) "Hurricane Gustav." Flickr/DVIDSHUB
p. 16 "Blue Ice." Dreamstime.com© Staphy
p. 17 Photo courtesy of ICLEI
p. 18 Photo courtesy of ICLEI
p. 22 "TO City Hall." Flickr/416style
p. 23 "Homer, AK." Dreamstime.com/© Matt Wise
p. 28 "Flood." Dreamstime.com/© Péter Gudella
p. 29 "Hiker." Dreamstime.com/© Rafał Cichawa
p. 30 "Cold reception." Flickr/jaxxon
p. 34 "Plant fighting drought/desert." Dreamstime.com/© Pascal Eisenschmidt
p. 44 "Flooded road near Richmond, London." IstockPhoto/Mike Graham
p.45 "Windmills." Dreamstime.com/© Fallsview
p. 51 "Just clearing the bridge." Flickr/oldonliner
p. 56 "Wildfire." Flickr/Eggs&Beer
p. 56 "The storm cloud." Flickr/ragardner4
p. 58 "Forest fire."Dreamstime.com/© Bambi L. Dingman
p. 59 "Boy planting sprouts." Dreamstime.com/© Valentina Razumova
p. 60 "Water level measure." Dreamstime.com/© Jasenka
p. 64 "Smog sunrise." Dreamstime.com/© Arne9001
p. 65 "City people." Dreamstime.com/© Joy Fera
p. 69 "Green leaves with sun ray." Dreamstime.com/© Iryna Sosnytska
p. 71 "City bikers in San Francisco." Dreamstime.com/© Can Balcioglu
p. 72 "City at dusk, Seattle." IstockPhoto/Veni
p. 75 "Stanley Park, Vancouver." Dreamstime.com/© Brad Calkins

This Guide was made possible with the generous support of Natural Resources Canada: Climate Change Impacts and Adaptation Division.

·I·C·L·E·I
Local
Governments
for Sustainability

ICLEI Canada
401 Richmond Street West, Studio 417
Toronto, Ontario M5V 3A8

T: 647.728.4308 F: 416.642.0954
E: iclei-canada@iclei.org

www.iclei.org

ICLEI
Local Governments for Sustainability

CHANGING CLIMATE, CHANGING COMMUNITIES:

Workbook for Municipal Climate Adaptation

INTRODUCTION

The seventeen worksheets contained within this workbook are meant to operationalize the methodology presented within the main guide. Their purpose is to provide highly engaging and visual tools that can be used by community's working through each of the five milestones. The tools contained within the worksheets range from basic conceptual mappings to more complex tables on assessing a community's vulnerability and the risks associated with climate change impacts.

The worksheets are an optional component of the guide that are meant to assist community's who would like additional resources at particular stages of the planning process. It may be the case that not all worksheets will be useful to each reader; it will be up to each user to determine which worksheets will be the most helpful. It should be noted that though the main Guide can stand alone and be used without the workbooks, in order to complete the worksheets the guide must be used and will likely require repeated referencing.

Worksheets Included:

In some cases it may be helpful for community's using the worksheets to bring in an external facilitator as there may be instances where an impartial moderator would be helpful; alternatively a staff member could act as an impartial facilitator (for more suggestions on facilitating see the Tips for Facilitators section of the Information Annexes).

Time Commitments

It is difficult to allocate a set time for each of the worksheets as each community has differing capacity circumstances and structures. For the purpose of work planning we have assigned a time commitment scoring to each of the worksheet. The amount of hours expected to be spent on a given worksheet represents the total hours that will be required by participants.

Minimal (8 hours or less)
Nominal (8-16 hours)
Average (24-32 hours)
Significant (40-45 hours)
Substantial (Over 50 hours)

WORKSHEET 1
STAKEHOLDER IDENTIFICATION

PURPOSE	TO IDENTIFY KEY STAKEHOLDERS RELEVANT TO YOUR COMMUNITY'S ADAPTATION WORK
Resources Needs	✔ Adaptation Team time commitment – minimal ✔ Minimum 2-3 staff for brainstorming exercise – minimal time commitment
Output	A refined list of internal and external stakeholders.
How this fits with larger process	This stakeholder identification process establishes a foundation for future communication and input from stakeholders. This list of stakeholders will also inform the building of your community's adaptation team.

INTRODUCTION

Completing a stakeholder identification exercise can assist in identifying the necessary participants to include in a climate adaptation planning process. The stakeholders identified may be individuals or groups you want to have on your adaptation team (see Worksheet 2) or who you might want to engage throughout the process, for example as part of your research effort or marketing strategy.

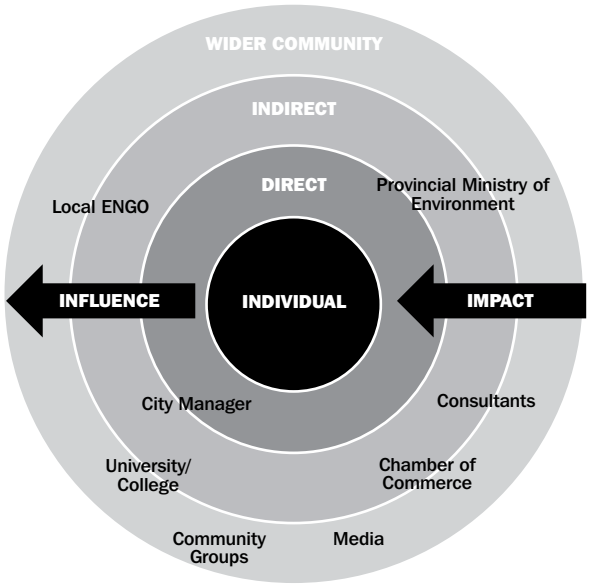
The first step in identifying stakeholders is to look at your community's *spheres of influence*. This exercise can help to identify who your community is accountable to and who it can learn from. Exhibit 1.1 illustrates this idea:

- The circle at the centre of the diagram represents the person (or department) tasked with initiating the adaptation planning effort in the community; this sphere represents the area that you have the most control and responsibility over.
- The next layer includes the departments, organizations, or individuals with which you have a direct relationship or partnership. It is important that the groups in this layer have common goals and/or a shared purpose, but over which you may or may not have direct control.
- The next layer includes those individuals or organizations that have indirect effects on the work you do, perhaps through loose or informal relationships, but where you have even less control than with those in the previous circle.
- The final outermost layer represents the wider community over which you have minimal control but should remain included (or acknowledged) in this initial stage.

It is important to note that as you get closer to the centre sphere your direct influence or control increases and as you move out from the center your ability to impact the external circles decreases. Also consider that stakeholders may move between the different spheres as your adaptation work progresses.

EXHIBIT 1.1

Spheres of Influence



INSTRUCTIONS

Bring a few colleagues together and as a group begin brainstorming potential stakeholders. Place yourself or your department in the centre of the diagram and work your way outwards. Exhibit 1.2 lists possible stakeholders that can be relevant to your adaptation effort.

EXHIBIT 1.2

Possible Stakeholders

POSSIBLE STAKEHOLDERS	
• Other municipal departments – staff and department heads (engineering, parks & recreation, corporate services, legal, public health, emergency response, finance, etc.) • City Manager or CAO • Mayor and Council • City operations contractors • Utilities • Other levels of government (federal, provincial, territorial, regional) • Residents • Agricultural community • First Nations groups • Housing authority • School boards • Local universities, colleges or other knowledge institutions	• Non-Governmental Organizations • Local businesses • Media • Community groups • Local neighbourhood associations • Consultants • Public transit authorities • Large industry representatives • Developers • Social policy groups • Hospitals • Port authority • Coast guard • Airport authority • Chamber of Commerce

To complete the table in Exhibit 1.3 use the spheres of influence idea and consider who you have the most influence over and whose actions would have the greatest impact on your adaptation work. Likewise, based on your existing knowledge of how the effects of climate change will impact your community, consider which stakeholders you would want to engage. Specifically:

- What information do you need with regard to understanding and acting on a climate change impact? Who has (or has access to) this information?
- What are the areas that you have influence over? Is there anyone who can help you use that influence?
- Who are the individual stakeholders that you can influence and where do they fit within the spheres?

Once you have taken some time to consider these questions fill in the table below with the stakeholders you have identified as having a direct relationship with, an indirect relationship, or those which fall into the wider community. Keep in mind their placement in either the direct, indirect, or wider spheres may change throughout the process. Consider those stakeholders that would be most useful to engage, including those that you do not already have a relationship with. At this time, leave the last two columns blank.

EXHIBIT 1.3

Direct Stakeholders	Indirect Stakeholders	Wider Community	On adaptation team (Y / N)	If not for team, how to include in list (be specific)

Once you have filled out the table, take a look at the stakeholders that you have identified. Consider:

- How might each stakeholder contribute to the planning process?
- Is there anyone in your list that you do not already have a relationship with?
- What about those people and organizations in the wider community (the outer circle), do you already engage them? Is it possible to engage them more closely?
- If not, are there particular barriers in place that may prevent the development of a relationship or dialogue with these or other stakeholders?

Take some time to fill in any gaps. In the last column consider those stakeholders whom you have identified but do not intend to have on your team; record how these stakeholders will contribute to your community's adaptation effort and what stage(s) they should be involved in.

Think about how you will engage and communicate with the various stakeholders you have identified. For example, the issue briefs in Worksheet 4 can be used to communicate information and seek input from internal stakeholders. Likewise, consider when you will be contacting the various stakeholders identified – is it immediate (as part of the research phase) or further down the road to help identify adaptation options or for implementation?

In addition to those stakeholders that you have identified, think about how you might encourage possible stakeholders to self identify themselves as interested parties to the process. It is possible to solicit participation through: public announcements (newspaper, radio, and television), invitations to existing climate change networks/groups, municipal website posting, or announcements at other community events.

As you work to engage a wide-range of stakeholders, it is important to also recognize the reality of stakeholder burnout. One possible way to overcome burnout is by limiting the demands you are putting onto identified individuals or groups. For example, you might limit meetings (i.e. once a quarter as opposed to monthly) or another option is to let stakeholders dictate the degree of their involvement – do they only want to be notified of important occasions or do they want to be present for information gathering, debate, and decision-making. Avoiding stakeholder burnout will help to ensure that the individuals/groups you have identified are committed to the process over the long-term.

In Worksheet 2 you will use this list of stakeholders to create your adaptation team. You will want to check back throughout the planning process to ensure that your list of stakeholders stays relevant and up to date.

WORKSHEET 2
BUILDING AND TASKING YOUR ADAPTATION TEAM

PURPOSE	TO BUILD AN ADAPTATION TEAM, ASSIGN A TEAM LEADER AND DEVELOP A TEAM MANDATE
Resources Needs	✔ Interested staff – nominal time commitment ✔ Facilitator (optional)
Output	A team mandate A team leader A team champion
How this fits with larger process	The team constitutes the foundation of expertise which will be drawn upon throughout your community's adaptation effort and will be responsible for maintaining momentum throughout each of the milestones. The team's creation also represents the first step towards initiating your community's internal capacity to adapt to the impacts of climate change.

When forming your adaptation team, try to ensure a diversity of expertise which draws from relevant departments or programs. This process can use the stakeholder identification activity done previously in Worksheet 1 and can include as many or as few individuals as is appropriate for your community. The team can be any mix of stakeholders (internal or external) that you, as a community, deem appropriate. Keep in mind the more people there are on the team, the more comprehensive your dialogue and resulting adaptation plan will be; however, scheduling and managing meetings can become increasingly difficult with many participants.

You should have a clear idea of relevant stakeholders from Worksheet 1; however the specific level of involvement of external stakeholders in the adaptation team will be dictated by the circumstances and dynamics of your community. One item to consider at this stage is having two teams: a core team consisting of mostly internal individuals and a secondary team consisting of external stakeholders that can be consulted at key points along the way. Likewise you can use the list of stakeholders developed in Worksheet 1 and bring in individual stakeholders with relevant expertise into Team meetings at key points.

The number and background of team members will vary. The team makeup that is appropriate for your community depends on the specific impacts likely to occur in your region; the infrastructure and policies that will be affected; and how your community intends to interact with other stakeholders and the public in preparing for climate change. This may change and evolve over time and team members can be added as needed. Exhibit 2.1 lists some potential participants to include on your adaptation team.

EXHIBIT 2.1

Potential Participants

DEPARTMENT	
Agriculture	Legal Services
Communications	Parks and Recreations
Economic Development, Culture and Tourism	Planning and Zoning
Energy	Police
Engineering	Public Health
Emergency Management	Transportation
Environment	Water
Finance and Administration	Waste
Fire Services	Coastal Zone Management
Housing	Port and Harbour Management

GROUPS	
Residents and Community	Non-profit Organizations
Neighbouring Communities	Networks
Business Community	Provincial and Federal Government
Scientific Advisors	Academic Institutions

INSTRUCTIONS

Using the list of potential Team members as a guide, record those individuals from departments or groups that should be included in your team. Be sure to include all the departments and/or organizations that might contribute positively to your community's adaptation work. As you create your team, also consider the organizational structure of your community as this will likely affect the structure of your adaptation team.

QUESTIONS TO CONSIDER WHILE CREATING YOUR ADAPTATION TEAM

- Is your adaptation team being established as a permanent working group?
- How much time does the team have to accomplish this task?
- What resources are available for the team to accomplish its work?
- What authority does the team have?
- To whom is the team accountable?

Be as specific as possible by including individual's names, divisions or sub-sectors in the list as necessary. As you will likely be completing this exercise with others, this list is easily transferable to white or chalk boards for group facilitation. Depending on who participates in this exercise, you may find that the group completing this worksheet may make up the final adaptation team. Contacting additional participants can be done via the issue briefs in Worksheet 4.

DEVELOPING A TEAM MANDATE [1]

Once you have created your community's adaptation team, you can now develop a team mandate. A mandate describes the authority of the adaptation team, its purpose (i.e. decision making, providing information, gathering information etc), and the time commitment required of team members. A clear and strong mandate will not only help the team with its work but will also give legitimacy to the work that is being carried out from an outside perspective. The answers to the questions above can be turned into such a mandate.

Sample team mandate:

The City of [Name] Adaptation Team was created by Council to research, draft and implement our community's Adaptation Plan. The Team is led by [Team Leader Name] the [Team Leader Title] for the City of [Name].

Our purpose is to collect information on climate change impacts and offer expert advice to Council on the most credible, aggressive and economically viable options for adapting to climate change through the creation and implementation of our community's adaptation plan.

Team members must commit to monthly meetings for a minimum of 1.5 hours each in addition to project specific tasks to be determined by the group. The Adaptation Team, on behalf of the community at large, has committed to an ongoing process of monitoring and review for the duration of the project (approximately two years).

ASSIGNING A TEAM LEADER

With your adaptation team and mandate in place, you will need to assign someone as the team leader. This person will have the responsibility of assembling the team and leading its efforts. Given that your adaptation team will cross a variety of departments, it is important that the team leader be centrally located, has a good grasp of the community's concerns, and is able to communicate well with colleagues from other departments or divisions. The team leader should also have authority to work with staff members from all departments; though they will not be the direct manager of all team members they should have some authority to require deliverables from the departments represented on the team.

Now that you have created your adaptation team you may want to revisit your list of stakeholders to ensure that the list is still relevant and there aren't any key stakeholders missing.

SELECTING A CHAMPION

As outreach will play a major role in building and maintaining support for your adaptation effort, it is a good idea to identify an adaptation champion to lead such activities. Selecting an appropriate champion will help solidify the awareness and long-term commitment from your local government to the adaptation process. Your adaptation champion should commit to this process and to the responsibility of being the public spokesperson for the team to the community.

Potential champions include, but are not limited to, former (or current) elected officials, key business leaders, long-range planners, or other respected members of the community. It will generally be the case that your champion and team leader will be two different individuals. If, however, you feel that it is most appropriate for your community to have one individual that is both your adaptation team leader and champion this is another option.

WORKSHEET 3
A FIRST LOOK

PURPOSE	TO DETERMINE THE LEVEL OF UNDERSTANDING OF CLIMATE CHANGE IMPACTS, THE EXISTENCE OF ACTIONS WHICH ALREADY INCLUDE ADAPTATION AND ANY EXISTING PLANS OR POLICIES WHICH A CLIMATE CHANGE ADAPTATION PLAN COULD INFLUENCE
Resources Needs	✔ Adaptation Team – average time commitment ✔ Research intern or volunteer – average time commitment ✔ Facilitator (recommended)
Output	An initial list of climate change impacts, existing adaptation actions and any plans or policies relating to adaptation.
How this fits with larger process	This initial survey of climate change impacts, adaptation actions and relevant plans and policies provides a basis upon which more in depth research in Milestone Two can be developed. It is important to assess your community's existing knowledge and actions relating to climate change in order to appropriately tailor your future adaptation work. This is also an exercise is evaluating internal capacity. It is good to know where there is existing capacity within the community and those areas which require more direct planning.

PART 1: FIRST LOOK AT CLIMATE CHANGE IMPACTS

As part of your first look at adaptation, it is important to consider how climate change will affect the various systems (built, social, economic and natural systems) in your community. [For a full description of each system, refer to page 24 of the main guide]. This worksheet provides a way of examining the various impacts associated with each of the systems and recording the results in preparation for Milestone Two.

Some questions to get your team started include:

- What extreme weather events has your community already experienced? What were the impacts of those events?
- How well prepared is your community if such an event occurs again? Especially if such an event becomes more frequent or severe as a result of climate change?
- Based on your existing knowledge what climatic changes are the most likely to impact your community?
- Are there any opportunities associated with climate change that could arise for your community?

This initial brainstorming session offers an opportunity to lay the groundwork for identifying areas which will require further research in Milestone Two. You may wish use the basic question of *"How could climate change affect my region, and do these impacts pose a risk for my community?"* as a starting point for discussion.

Instructions

For each climatic change that you feel threatens your community (i.e. changes in water levels, precipitation, temperature, etc.) identify the impacts of that change for each of the four systems identified and record the associated impacts you've identified in the table on page 7. Note, that in many instances, there will be impacts that will have implications on a variety of systems. Be sure to identify any and/or all of the systems affected by the impact.

Impacts can range from the highly specific (e.g. increased instances of flooded basements causing mold growth) to the more general (e.g. spread of infectious disease due to increases in temperature). The specificity of impacts will be flushed out more in Milestone Two when you conduct more formal research, however it is important to be consistent with how you record impact statements. For now, record any impact which might be a threat to your community, keeping in mind that your team may need to refine the language once you have conducted more research.

We recommend using a brainstorming approach in identifying impacts as it encourages all participants to raise issues and provides opportunities to spark further discussion based on one idea. Following the usual rules of brainstorming, allow any and all input and suspend judgment during this activity to ensure as many issues as possible are raised. If an impact is even partially related to climate change it should be included here.

As you can see in Exhibit 3.1, there are two possible ways to use this table. The first option is to place an "X" for each of the identified impacts in one or all of the columns which represent the affected system(s). The second option is more intensive and requires you to explain how each system will be affected by the impact. Choosing to do a more, or less, comprehensive look at how climate change impacts affect systems will likely depend on the amount of experience your team has with this subject and staffing capacity. Whichever approach you use, it is important to remain consistent.

EXHIBIT 3.1

Recording Your First Look at Impacts

	IMPACT	BUILT	SOCIAL	ECONOMIC	NATURAL
Option 1	e.g. spread of infectious disease due to increases in temperature		X	X	X
	e.g. increased damage to infrastructure due to changes in freeze/thaw cycles	X	X	X	
Option 2	e.g. increased summer drought due to decreased precipitation	Water infrastructure may be damaged	Water supply may be compromised affecting drinking water	Damage to infrastructure has monetary consequences	Plants and animals may not be able to cope with limited water supply

PART 2: FIRST LOOK AT MUNICIPAL ACTIONS

Before delving into the research stage in Milestone Two, it will be helpful to take stock of existing adaptation actions within your community. You team may want to keep a list of actions that are already underway and even planned actions that might be relevant to the adaptation planning process. This will help your team evaluate where there are existing actions addressing climate change impacts, how other actions might be revised to accommodate for climate change, and where there is a need for more action.

Where actions exist that already address climatic impacts (but perhaps are not labelled as specifically responding to climate change) consider how that impact is likely to change in the future and how that action may require revisions to accommodate future impacts associated with climate change. As an example, consider emergency management and response actions, scheduled infrastructure maintenance, or public health outreach policies. As you look at these existing actions, keep the impacts you've brainstormed previously in mind: Do any of these existing actions address the impacts you've identified? Are there actions that can be amended to account for climate change impacts?

At this point, your team may only have a basic understanding of climate change impacts, however this exercise is not meant to be an in depth analysis. This is just a first look at the understanding you have now and will help your team later in Milestones Two and Three. Using Exhibit 3.2, record any existing actions that might be relevant to your adaptation work.

EXHIBIT 3.2

Recording Existing Actions

EXISTING ACTION	HOW THE ACTION RESPONDS TO WEATHER?	CONSIDERATIONS FOR CLIMATE CHANGE
e.g. cooling centers	Hot days require cooling centers for community residents without air conditioning	May need to establish more cooling centers to accommodate for increase frequency of hot days

PART 3: FIRST LOOK AT PLANS AND POLICIES

Similar to actions, there may be plans and policies within your community that already address adaptation but perhaps aren't labelled as an adaptation plan or policy. Look into the variety of plans that exist across departments (i.e. Transportation Master Plan, Cycling Master Plan, Environmental Master Plan, etc.), as well as any other strategic policy documents (i.e. Official Community Plan, Long-term Sustainability Visions, Strategic Plans, etc.) to take stock of what is in place and how adaptation might tie into it. Use Exhibit 3.3 to record any existing plan that might be relevant to your adaptation work.

EXHIBIT 3.3

Recording Existing Plans or Policies

EXISTING PLAN OR POLICY	IS THERE ANY DIRECT OR INDIRECT REFERENCE TO PLANNING FOR CLIMATE CHANGE?	HOW ADAPTATION MIGHT TIE INTO IT?
e.g. Official Community Plan	Yes	Using planning and land use management to reduce vulnerability to climate change and increase adaptive capacity

WORKSHEET 4
ISSUE BRIEFS

PURPOSE	TO CREATE AND DISTRIBUTE ISSUE BRIEFS FOR KEY STAKEHOLDERS
Resources Needs	✔ Adaptation Team – minimal time commitment
Output	An issue brief tailored for a specific individual or on a specific task.
How this fits with larger process	Issue briefs are a means by which to communicate with relevant stakeholders throughout each of the Milestones.

In the same way that building political support for your adaptation efforts is critical to its success, securing the support of staff from all departments is important to move forward on adaptation planning.

As climate change impacts will affect various stakeholders throughout the community making key stakeholders, staff, and other decision makers aware of the climate change impacts expected within their spheres of influence will help drive the process and help those individuals understand that measures taken early will help to reduce the community's vulnerability in the long term. Likewise it may help staff to realize that some of the work they are already engaged in also falls under adaptation planning - it may just be a matter of labelling it as a climate adaptation action or plan (recall parts II and III of Worksheet 3).

This worksheet introduces the process of communicating via issue briefs. Issue briefs are a way for your adaptation team can communicate with other departments and with other external stakeholders throughout the planning process. These briefs may go by another name in your community – framework documents, memos or interdepartmental communications – however they all accomplish the same goal of communicating an issue from one group to another. Whatever form it takes, an issue brief is an important tool for both internal and external communications.

Consider using issue briefs:

- To communicate interest to stakeholders;
- To check in with stakeholders at the end of each Milestone;
- When your team is developing adaptation actions;
- When you develop your community's adaptation plan;
- When you begin to implement adaptation actions; and
- When you begin your process of monitoring and review.

By communicating with stakeholders consistently throughout this process, you are ensuring a more transparent process (one of the cornerstones of good urban governance). This worksheet provides a sample issue brief that can be used to communicate to staff, Council and the community.

INSTRUCTIONS

You will have taken a first look at climate change impacts in the previous worksheet and will have also done a preliminary investigation of their effects on a variety of systems (built, natural, social, etc.). As such, you now have a basic understanding of what climate change impacts will be relevant to your community and can now communicate that understanding to relevant stakeholders.

As you develop these issue briefs, consider the importance of tailoring the message you are communicating to your audience. It is not recommended to use the same language in every brief as each stakeholder will respond differently to different messaging. For example, consider tailoring the briefs to those with a scientific background with science focused information and those to community groups with relevant information for the community.

Refer back to the list of stakeholders that you developed in Worksheet 1. Use issue briefs to communicate to those stakeholders about the importance of climate change impacts within their spheres of responsibility and how they might engage in this process.

When releasing issue briefs at this stage, be sure to communicate that your adaptation team is only at the beginning stages of a long-term planning process. It is important to stress to any audience, that the next stage in the process will be to carry out detailed research on climate change and its impacts for your community and to invite those that are interested to either get involved or to sign up for updates as they are available.

Sample Issue Brief

To:
From:
Date:
Subject:

Background	• Scientific backing - Global climate change. Use the Background Primer of this Guide to inform this content. • Expected climate changes for your region – use Annex One to complete this section. • Importance of local governments and adaptation planning
Impact	• Complete one issue brief for the key impacts you have identified – it is a good idea to use the most high profile impact; this could be the one that affects the most systems; one that is the most documented; or one that has already been experienced.
Department or Stakeholder	• List the key departments or stakeholders that should receive this issue brief
Considerations (i.e. impacts on social, economic, natural, and built systems)	• List the various systems (relevant to the departments or stakeholders above) that would be affected and how these will be impacted. NOTE: this issue brief is not meant to list the variety of actions that can be taken (those will be identified in Milestone Three) the key message in this issue brief should be to build support for the adaptation effort that the municipality will take on in order to investigate how these impacts can be best dealt with.
Next Steps	• List the next steps that the recipient can take, this could be to join the adaptation team, provide information, etc.

NOTES

WORKSHEET 5
SAMPLE COUNCIL RESOLUTION

PURPOSE	TO SECURE POLITICAL SUPPORT AND COMMITMENT FOR YOUR COMMUNITY'S ADAPTATION EFFORT
Resources Needs	✔ Adaptation Team – minimal time commitment ✔ Communications Expert – minimal time commitment
Output	A council resolution to present to Council at the end of Milestone One.
How this fits with larger process	By exposing local elected officials to key elements of your adaptation work, and including them at significant points, staff can ensure that their efforts will have political support in the long-term. In making a political commitment to the adaptation planning process, you are ensuring that this process will continue despite possible political changes in the community.

Adjacent is a sample council resolution your community can use as a template, or you may wish to develop one internally, in either instance, be sure to include key data that supports local action on climate change. The template relies on information contained within the *From Impacts to Adaptation: Canada in a Changing Climate 2007* report which can be found on the Natural Resource Canada website at http://adaptation.nrcan.gc.ca.

As your team develops a resolution for your community you may also want to consider:

- The provincial or territorial position on climate change and adaptation planning;
- How existing plans address climate change impacts and adaptation planning; and,
- How to involve internal and/or external stakeholders.

Consider This…
In addition to a Council resolution, your Adaptation Team may also want to consider creating a community charter to secure buy-in from the wider community and from key external stakeholders.

Sample

City/Town/Region of _____, Province

Commitment to Creation of a Climate Adaptation Plan

WHEREAS, scientific consensus has developed that carbon dioxide (CO2) and other greenhouse gases released into the atmosphere have a profound effect on the Earth's climate; and

WHEREAS, the 2007 Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) states that it is very likely that most of the observed increases in globally averaged temperatures since the mid-20th century are due to human-induced greenhouse gas emissions; and

WHEREAS, *From Impacts to Adaptation: Canada in a Changing Climate 2007* found that the impacts of climate change pose serious risk to physical, biological and social systems; and

WHEREAS, according to *From Impacts to Adaptation: Canada in a Changing Climate 2007*, climate change is one of the most pressing environmental challenges we are facing today; and

WHEREAS, *From Impacts to Adaptation: Canada in a Changing Climate 2007*, determined that adaptation is a necessary complement to the reduction of greenhouse gas emissions in addressing climate change; and

WHEREAS, *From Impacts to Adaptation: Canada in a Changing Climate 2007*, also determined that climate change will affect important human systems in Canada, especially those related to human health, settlements and welfare; and

WHEREAS, local government actions taken to prepare for climate change impacts provide multiple local benefits by building a more resilient economy, and by helping to reduce the physical impacts and costs to people, property and resources associated with a changing climate.

NOW THEREFORE, BE IT RESOLVED, that the City/Town/Region of _____, PROVINCE, will undertake the five milestones presented in *Changing Climate, Changing Cities* to prepare for the impacts of climate change, and specifically:

1) Initiate an Adaptation Effort;
2) Research Climate Change Impacts;
3) Create an Adaptation Plan;
4) Implement the Plan; and
5) Monitor and Review the Plan.

BE IT FURTHER RESOLVED, that the City/Town/Region of _____, PROVINCE, will mandate an adaptation team to be responsible for researching scientific climate change projections, communicating climate change impacts, providing advice on preparing for and adapting to these impacts, and guiding the City/Town/Region of _____, PROVINCE, through adaptation milestones presented in *Changing Climate, Changing Cities*.

NOTES

WORKSHEET 6(a)
RECORDING CLIMATIC CHANGES

PURPOSE	TO RECORD RELEVANT CLIMATIC CHANGES
Resources Needs	✔ Adaptation Team – significant time commitment ✔ Research Volunteer or Consultant – average time commitment ✔ Facilitator not required
Output	A record of climatic changes that are expected to affect your community.
How this fits with larger process	The list of climatic changes will inform the identification of specific impacts for your community in Worksheet 6(b). The combined information constitutes the bulk of your research and will be used to assess vulnerability and risk in Worksheets 7 and 8.

GETTING STARTED

Exhibit 6a.1 provides a list of possible scientific sources which can be used to find data on expected climatic changes in your region. In addition, included in the information annexes are annotated resources, such as regionally-focused climate change reports, fact sheets, impacts listed by region, and websites which will help your team with research on both projected changes in regional climate and with identifying climate change impacts in Worksheet 6(b). Refer to these resources as needed.

EXHIBIT 6a.1

Scientific Sources

ORGANIZATION	WEBSITE
• Intergovernmental Panel on Climate Change (IPCC)	http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1
• Natural Resources Canada	http://www.nrcan.ca
• Environment Canada	http://www.ec.gc.ca
• Ouranos	http://www.ouranos.ca
• Canadian Climate Change Scenario Network	http://www.cccsn.ca
• Environmental Systems Research Institute Canada	http://www.esricanada.com/english/955.asp
• Pacific Climate Impacts Consortium	http://pacificclimate.org/
• Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)	http://www.climateontario.ca

Note: When attempting to identify forecasted changes in climate, consider using your Adaptation Team members, a volunteer, consultant, other local government staff, or a summer student.

INSTRUCTIONS

The first step in this process is to identify the climatic variables, such as average temperature or precipitation, that are projected to change in your region (or the amount of change that occurs by a specified future date, relative to the average for a range of years in the past). The "expected change" is often expressed as a range of increase or decrease. Often, using a range helps to document any uncertainty in the projection or seasonal variability (where one season is expected to see an increase and another season will see a decrease). Where possible, define the climatic change clearly so as to avoid statements which indicate both an increase and a decrease. For example, define "average summer precipitation" and "average winter precipitation" instead of "average yearly precipitation" in cases where the seasonal variability results in both increases and decreases.

Exhibit 6a.2 provides a table to record the climatic changes that are expected to change in your region. Be sure to record all climatic changes that will affect your community when you re-create this table.

Note: It is important to source information appropriately; in the final column include all of the relevant bibliographic information for each resource.

EXHIBIT 6a.2

Sample Climatic Change Table

CHANGING CLIMATIC CONDITION	GEOGRAPHIC AREA	RANGE OF EXPECTED CHANGE BY A SPECIFIC DATE (repeat for near, mid, and long-term)	COMPARING RATE OF CHANGE TO PAST AND CURRENT CONDITIONS	EXTENT OF SEASONAL VARIABILITY	DEGREE OF CONFIDENCE OF DATA SOURCE	SOURCE(S)
Increased Temperature	Prairies	1.5°C increase from 1895-2000 average by 2020 5°C increase from 1895-2000 average by 2050 5.5°C increase from 1895-2000 average by 2080	Projected warming to 2020 is similar to regional warming observed during the 20th century. By the 2020s, average temperature could be higher than most of those experienced during the 20th century.	Slightly more warming in winter and spring	High as information came from a government body	Sauchyn, D. and Kulshreshtha, S. (2008): Prairies; in From Impacts to Adaptation: Canada in a Change Climate 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush

NOTES

WORKSHEET 6(b)
REFINING IMPACTS AND IDENTIFYING SERVICE AREAS

PURPOSE	TO REFINE IMPACT STATEMENTS AND IDENTIFY THE SERVICES AREAS RELEVANT TO EACH IMPACT
Resources Needs	✔ Department Heads (those not already on Adaptation Team) – nominal time commitment ✔ Adaptation Team – significant time commitment ✔ Key stakeholders (those not already on Adaptation Team) – nominal time commitment
Output	A comprehensive list of climate change impacts and their relevance to specific service areas within your community.
How this fits with larger process	The refined list of impacts and the identified service areas will be used to conduct a vulnerability assessment (Worksheet 7) and will also help with the risk assessment (Worksheet 8).

PART 1 – REFINING IMPACTS

Based on the climatic changes identified in Worksheet 6(a), identify what impact those changes will have on your community. Your team can refine the impacts that were identified in the brainstorming activity in Worksheet 3 by using the research from Worksheet 6a. Earlier, the scale of the impact statements you identified was less relevant; however it is now important to decide on the scale that you will use. Whether your team decides to have high level or very specific impact statements it is important to try and maintain consistency among those statements.

If your team is finding it difficult to determine appropriate impact statements, consider the following questions:

	Sample
1) What is the climatic change you are looking at?	1) Decreased Precipitation
2) What is the outcome of that change?	2) Summer Drought
3) What are the impacts associated with that outcome?	3) Increased demand on water supply

Once you've answered these questions, you should have arrived at an impact (i.e. increased demand on water supply due to summer drought). A description of an impact includes an identification of the 'someone' or 'something' that will be impacted, the specific way it will be impacted, and the reason the impact may occur. For example, "summer drought" is not a strong climate change impact; but "increased demand on water supply due to summer drought" would be. Notice how the latter description answers all of the "what", "why" and "how" questions, and that the impact is a result of changes to climate conditions, namely precipitation. Be as specific as you can, including whatever level of detail you research can provide.

Once your team has refined its impacts, apply a *common sense test* to check whether the impact statement will be understood by everyone who reads it.

PART 2 – RECORDING IMPACTS STATEMENT

For each impact, consider the relevant service areas and how the function of each might be affected by the impact. **A service area** refers to the areas in which a government or community delivers, manages, plans, or makes policy. See the table below for a list of some possible service areas.

EXHIBIT 6b.1

Examples of Service Areas

Agricultural Services	Forestry And Forest Service's
Biodiversity	Housing Services
Coastal Zone Management	Insurance
Community Development	Legal Services
Corporate Services	Natural Resources
Culture And Tourism	Parks And Recreation
Economic Development	Planning And Zoning
Emergency Management	Port And Harbour Management
Emergency Response	Police
Energy Management	Public Health
Engineering	Stormwater Management
Environment	Transportation
Fire Services	Water
Finance	Waste Management
Flood Control	

This list should be tailored to your community; depending on its make up, one service area may be made up of multiple items listed above. Identify the service areas that are relevant for your community and include these across the top of the table below. Multiple service areas may be affected by one impact, so be sure to identify all that will be impacted. Create a table for each of the climatic changes and list the relevant impacts down the left hand side and your community's service areas across the top.

As you consider how climate change impacts will affect your community and how it functions, it is important to differentiate between the key service areas that will be affected and those areas which are important to keep in mind but which aren't the primary area to be affected. In the table below, identify which service areas will be affected either directly (with an "X") or indirectly (with an "O").

CLIMATIC CHANGE Decreased Precipitation in Summer	Agricultural Services	Biodiversity	Coastal Zone Management	Corporate Services	Culture and Tourism	Engineering	Environment	Fire Services	Housing	Parks and Recreation	Planning and Zoning	Port and Harbour Management	Public Health	Water	Waste Management
Increased demand on water supply due to summer drought	X	O	O	X	O	X	X	X	O	X	O	O	X	X	O
Increased irrigation needs due to decreased water supply	X	O		X			X				X		X	X	

CLIMATIC CHANGE Increased Temperatures in Summer	Agricultural Services	Biodiversity	Corporate Services	Economic Development	Culture and Tourism	Energy Services	Emergency Management	Fire Services	Environment	Forestry and Forestry Services	Housing	Parks and Recreation	Parks and Recreation	Public Health	Water	Waste Management
Increased demand on energy due to increased cooling needs in summer			X	O	O	X	X				X		O	X	O	
May experience longer growing seasons which increases potential to double crop	X	X	X	O	O				X	X		X			O	

After you have completed your research and these tables (for each climatic change identified) take a moment to review them, make sure that the list of impacts is as comprehensive as possible. If you come up with any additional impacts, add these to the tables. After completing this, you will have a comprehensive list of climate change impacts and their relevance to specific service areas within your geographic location. This process of identifying service areas will be useful when completing your vulnerability assessments as you will need to assess the vulnerability of specific service areas to a given impact.

Increased Frequency of Extreme Events	Agricultural Services	Coastal Zone Management	Corporate Services	Engineering	Emergency Management	Environment	Engineering	Fire Services	Parks and Recreation	Police	Port and Harbour Management	Public Health	Water	Waste Management
Contamination of streams and/or lakes due to sewer overflow	X	X	X	O		X	X		X		O	X	X	X
increased frequency of illness or death among vulnerable populations due to extreme heat			X		X			O		X		X		

WORKSHEET 7
VULNERABILITY ASSESSMENT

PURPOSE	TO ASSESS THE VULNERABILITY OF A SERVICE AREA TO A CLIMATE CHANGE IMPACT
Resources Needs	✔ Department Heads (those not already on Adaptation Team) – nominal time commitment ✔ Key stakeholders (those not already on Adaptation Team) – nominal time commitment ✔ Adaptation Team – substantial time commitment
Output	List of impacts sorted according to the vulnerability identified.
Linkage to wider methodology	The vulnerability assessment acts as a filter for the upcoming risk assessment exercise. By determining the vulnerability of each impact, you can conduct a risk assessment for only those impacts to which your community has a high vulnerability. The values assigned for adaptive capacity can also be used as a basic baseline measurement for assessing the effectiveness of adaptation actions in Milestone Five.

Vulnerability refers to the susceptibility of a given service area to harm arising from climate change impacts. It is a function of a service area's sensitivity to climate and its capacity to adapt to climate change.

This worksheet will go through the process of assessing the sensitivity of the service areas you have identified; it will also help you to determine their adaptive capacity and based on those factors their vulnerability to the effects of climate change. It will be a large task to carry out the vulnerability assessment for all of the impacts identified in worksheet 6(b), however, this step is a precursor for Worksheet 8, risk assessment wherein only the impacts defined as highly vulnerable will be assessed in terms of risk.

INSTRUCTIONS

Referring to the list of impacts in worksheet 6(b), extract all the service areas which will be directly affected by that impact (those identified with an "X"). Your team should conduct a vulnerability assessment of each service area to the impacts that have been identified.

EXHIBIT 7.1

Example Impact and Directly Affected Service Areas

IMPACT	SERVICE AREAS	
Increased demand on water supply due to summer drought	Agricultural Services Corporate Services Engineering	Environment Parks and Recreation Public Health Water
Contamination of streams and/or lakes due to sewer overflow	Agricultural Services Coastal Zone Management Corporate Services Environment	Engineering Parks and Recreation Public Health Water Waste Management
Increased demand on energy due to increased cooling needs in summer	Corporate Services Energy Services Emergency Management	Housing Public Health

Part 1: Sensitivity Assessment

To conduct a sensitivity assessment, your Adaptation Team should look at each identified impact and assess, to the extent possible, if changing climate conditions will significantly affect the functionality of a given service area. For example, if your electricity grid is already at maximum capacity and increased summer temperatures are likely to drive homeowners to increase air conditioning - thereby increasing their demand on the grid - then the service area of *energy services* is sensitive to changes in temperature. Generally, if the functionality of a service area is likely to be affected as a result of projected climate change, it should be considered sensitive to climate change.

In order to assess the service areas sensitivity to an impact:

- Determine which climatic changes affect the impact in question;
- Identify how the service area is affected by these changes.
- Assess whether the service area is subject to any existing stress and whether the impact will exacerbate that stress.
- Assign a value (out of 5) representing the sensitivity of the service area to the climate change impact. See Exhibit 7.3 for a 1 – 5 Sensitivity Scale. Exhibit 7.2 assesses the sensitivity of three sample impacts and service areas: water, environment, and energy services.

Timeline: In order to appropriately assess the sensitivity of a particular service area to an impact, you should determine a timeline (i.e. determining the sensitivity of a service area over the next 25 years). The timeline criterion can be adjusted according to the needs of your community as it may be relevant to consider how this assessment fits into broader municipal plans e.g. 100 year sustainability plan, 30 year official plan, etc.

NOTE: The sensitivity assessment can also be used to evaluate the sensitivity of your community to events that have occurred in the past. Consider a previous extreme weather event (ice storm, heavy rain event, etc.) and apply the same questions. This provides an opportunity to integrate your community's past sensitivities into the planning process.

EXHIBIT 7.2

Sensitivity Assessment

SENSITIVITY ASSESSMENT			
Impact	Increased demand on water supply due to summer drought	Contamination of streams and/or lakes due to sewer overflow	Increased demand on energy due to increased cooling needs in summer
Service Area	**Water Supply**	**Environment**	**Energy Services**
Which climatic changes affect the functioning of this service area?	1. Temperature (warmer temperatures expected across all seasons under all climate change scenarios, especially during summer months) 2. Precipitation (less rain in summer and snow in winter)	1. Precipitation (more rain in summer and snow in winter)	1. Temperature (warmer temperatures expected across all seasons under all climate change scenarios, especially during summer months)
How would the service area be affected by these changes today?	1. Warm winter and spring temperatures lead to lower snowpack and earlier snowmelt, increasing summer drought 2. Warmer summer temperatures increase evaporation rates and demand on water 3. Lower winter precipitation lowers winter snowpack, reducing water supply	1. Increased rainfall in summer and quantities of melting snow in spring causes sewers to overflow into streams and/or lakes, contaminating marine ecosystems with domestic waste 2. Large flow variations between wet and dry weather can cause contamination issues	1. Increased number of hot days in summer months leading to increased demand for cooling centers 2. Increased temperatures leading to increased household use of air-conditioning
Is the service area subject to any existing stress?	Water shortages have occurred in the past during particularly hot summers	Decreasing marine ecosystem habitat due to urban development	Electricity grid is already at maximum capacity
If the impact occurs, will it affect the functionality of the service area?	Yes – Increased summer drought will increase the frequency of water shortages during the summer months Yes – Functionality will become unmanageable (S5)	If the already limited water area is contaminated by domestic waste, plant and animal species will be subject to increased pressure which may affect their longevity (S3) Yes - Functionality will get worse (S4)	Increased summer temperatures are likely to drive homeowners to increase air cooling – thereby increasing pressure on energy supplies (S4) Yes – Functionality will get worse (S4))

EXHIBIT 7.3

Sensitivity Scale

If the impact occurs, will it affect the functionality of the service area?				
No – Functionality will stay the same (S1)	Unlikely – Functionality will likely stay the same (S2)	Yes – Functionality is likely to get worse (S3)	Yes – Functionality will get worse (S4)	Yes – Functionality will become unmanageable (S5)

Note: It is unlikely that the functionality of a service area will stay the same; however it may not change dramatically depending on the timeline used.

Part 2: Adaptive Capacity

The next step in determining vulnerability is to identify the adaptive capacity of a given service area. In addition to sensitivity, assessing vulnerability requires consideration of the main stressors, both climatic and non-climatic, on a region, as well as the socioeconomic influences on adaptive capacity.[2] Adaptive capacity refers to the ability of built, natural, or human systems to accommodate to changes in climate (including climate variability and climate extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. Inherent in the analysis of adaptive capacity is the assumption that systems can accommodate to changes in climate with minimal damage and cost. Those systems that are unable to are those with a low adaptive capacity.

To measure adaptive capacity, consider the projected impacts for your community and assess how those impacts will affect the systems in your service areas using the key determinants listed below. Also consider the extent to which current plans, policies and regulations account for the indentified set of climate variables and their future changes. By increasing adaptive capacity, a systems vulnerability to current and future climate change impacts is reduced.

Use the information from your sensitivity assessment to frame the linkages between the climatic change, the effect on the service area and whether that service area can adapt. Based on that information, your team can assess the ability of the service area to accommodate these changes with little or no cost or disruption. Consider the key determinants listed above and use the 1 – 5 Adaptive Capacity Scale in Exhibit 7.5 to assign a value to represent the adaptive capacity of the service area and be sure to explain the reason for that assigned value.

Exhibit 7.4 assesses the adaptive capacity of three sample impacts and service areas: water, environment, and energy.

EXHIBIT 7.4

Adaptive Capacity

Adaptive Capacity			
Impact	Increased demand on water supply due to summer drought	Contamination of streams and/or lakes due to sewer overflow	Increased demand on energy due to increased cooling needs in summer
Service Area	Water Supply	Environment	Energy Services
Can the service area adjust to the projected impact with minimal cost and disruption?	No – Will require substantial costs ($$$$$) and staff intervention (AC1)	No – Will require significant costs ($$$$) and staff intervention (AC2)	No – Will require significant costs ($$$$) and staff intervention (AC4)
Explain Response	Unable to "adapt" snowpack to warmer temperatures; limited options for expanding water supply and summer demand is already greater than supply.	Unable to adapt with minimum cost and disruption due to the costs and scale of operation required to clean up streams and/or lakes.	Able to adapt with minimal disruption and cost as many solutions are educational and knowledge based.

EXHIBIT 7.5

Adaptive Capacity Scale

Can the service area adjust to the projected impact with minimal cost and disruption?				
No – Will require substantial costs ($$$$$) and staff intervention (AC1)	No – Will require significant costs ($$$$) and staff intervention (AC2)	Maybe – Will require some costs ($$$) and staff interventions (AC3)	Yes – But will require some slight costs ($$) and staff intervention (AC4)	Yes – No to little costs ($) and staff intervention are necessary (AC5)

Once you have completed implementation as per Milestone Four, you will want to reassess your adaptive capacity in relation to each impact to determine the success of your adaptation actions.

Part 3: Vulnerability

Using the sensitivity and adaptive capacity ratings allocated for each impact and service area, vulnerability can then be assigned to each service area. Use the matrix (Exhibit 7.6) to determine the vulnerability of each service area to the impact identified and record the impacts according to their vulnerability rating in Exhibit 7.7 (Note: sensitivity ratings are across the top and the adaptive capacity ratings are down the left hand side).

EXHIBIT 7.6

Sensitivity and Adaptive Capacity Matrix

	S1	S2	S3	S4	S5
AC1	V2	V2	V4	V5	V5
AC2	V2	V2	V3	V4	V5
AC3	V2	V2	V3	V4	V4
AC4	V1	V2	V2	V3	V3
AC5	V1	V1	V2	V3	V3

V1 = Low Vulnerability
V2 = Medium-Low Vulnerability
V3 = Medium Vulnerability
V4 = Medium-High Vulnerability
V5 = High Vulnerability

- Those impacts with high sensitivity (S4 and S5) and low adaptive capacity (AC1 and AC2) are highly vulnerable (V5 and V4);
- Those with low sensitivity (S1 and S2) and high adaptive capacity (AC5 and AC4) have low vulnerability; and
- Those that have that have both high sensitivity (S4 and S5) and high adaptive capacity (AC5 and AC4) – or low sensitivity (S1 or S2) and low adaptive capacity (AC1 and AC2) have medium vulnerability (V3).

EXHIBIT 7.7

Vulnerability Ratings

High Vulnerability (S5 – AC1) **= V5**		Medium-High Vulnerability (S4 – AC2) **= V4**		Medium Vulnerability (S3 – AC2 or S3-AC3) **= V3**		Medium-Low Vulnerability (S2 – AC3 or S2-AC 2) **= V2**		Low Vulnerability (S1 – AC5) **= V1**	
Impact	Service Area	Impact	Service Area	Impact	Service Area	Impact	Service Area	Impact	Service Area
Increased demand on water supply due to summer drought	Water Supply	Contamination of streams and/or lakes due to sewer overflow	Environment	Increased demand on energy due to increased cooling needs in summer	Energy				

In worksheet 8, Risk Assessment, you will be evaluating the risk of all the impacts that are in the left-hand columns in the table above as these represent the most pressing concerns for your community. Once you have reached Milestone 5, *Monitor and Review*, your team will re-evaluate where your community's vulnerabilities lie and will have the opportunity to address the remaining vulnerabilities (those in the right-hand columns).

WORKSHEET 8
RISK ASSESSMENT

PURPOSE	TO ASSIGN RISK TO CLIMATE CHANGE IMPACTS WHICH CAN THEN BE PRIORITIZED ACCORDING TO THE LEVEL OF RISK THEY POSE TO THE COMMUNITY
Resources Needs	✔ Adaptation Team – significant time commitment ✔ Key staff or stakeholders (as needed) – nominal time commitment ✔ Facilitator recommended, though not necessarily external
Output	List of prioritized impacts based on assessment of risk.[3]
Linkage to wider methodology	Prioritized risks will help the adaptation team to move forward on developing adaptation options and actions. The risk assessment is also an excellent communication tool to "sell" certain adaptation options to Council and the wider community.

As identified in the main guide and glossary, risk is a function of the consequence of an impact and the likelihood of its occurrence or more simply,

risk = likelihood x consequence

Depending on the size of your adaptation team, it may be helpful to bring in stakeholders and/or department heads for input on the risk assessment process if their functions are not already represented on your adaptation team (e.g. someone from the conservation authority, the local transit system, environmental protection authority, etc). Alternatively, your team may want to delegate the responsibility of conducting a risk assessment to relevant working groups within departments if the capacity or expertise required to conduct a thorough assessment is not contained within the adaptation team itself.

INSTRUCTIONS

Likelihood

To determine likelihood you will have to consider whether the impact is recurring or a single event (for example: increased demand on water supply is a recurrent impact, whereas as damage to engineered infrastructure from an extreme weather event is a single event).

For each impact, assign a likelihood rating from 1 to 5 using the scale in Exhibit 8.1; you can record this rating in Exhibit 8.3.

EXHIBIT 8.1

Likelihood Rating

LIKELIHOOD RATING	RECURRENT IMPACT	SINGLE EVENT
Almost Certain 5	Could occur several times per year	More likely than not- probability greater than 50%
Likely 4	May arise about once per year	As likely as not – 50/50 chance
Possible 3	May arise once in 10 years	Less likely than not but still appreciable – probability less than 50% but still quite high
Unlikely 2	May arise once in 10 years to 25 years	Unlikely but not negligible – probability low but noticeably greater than zero
Rare 1	Unlikely during the next 25 years	Negligible – probability very small, close to zero

Consequence

Consequence refers to the known or estimated consequences (to public safety, local economy & growth, community & lifestyle, environment & sustainability, and public administration) of a particular impact and likelihood is the probability of the projected impact occurring.

For each impact, use Exhibit 8.2 to ascertain its consequence. Record the numbers assigned for each criterion (public safety, local economy, community, etc.) in Exhibit 8.3; you will then add these together to ascertain the total consequence rating for a particular impact.

EXHIBIT 8.2

Consequence Criteria

CONSEQUENCE RATING	CRITERIA				
	Public Health & Safety	**Local economy & growth**	**Community & lifestyle**	**Environment & sustainability**	**Public administration**
Catastrophic	Large numbers of serious injuries or loss of lives	Regional decline leading to wide-spread 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 environ-mental amenity and progressive irrecoverable environmental damage	Public administration would fall into decay and cease to be effective
	5	**5**	**5**	**5**	**5**
Major	Isolated instances of serious injuries 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	Public administration would struggle to remain effective and would be seen to be in danger of failing completely
	4	**4**	**4**	**4**	**4**
Moderate	Small number of injuries	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	Public administration would be under severe pressure on several fronts
	3	**3**	**3**	**3**	**3**
Minor	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	Isolated instances of public adminis-tration being under severe pressure
	2	**2**	**2**	**2**	**2**
Negligible	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	There would be minor instances of public administration being under more than usual stress but it could be managed
	1	**1**	**1**	**1**	**1**

INTERPRETATION

Place each of the high vulnerability impacts from Worksheet 7 along the top of the Exhibit below. Having used the consequence scale (Exhibit 8.2), record the consequence rating for each area. To determine the overall consequence rating, add all of the values for each consequence criteria and record the total. Once you have calculated the total consequence rating, use the likelihood rating based on Exhibit 8.1. Multiplying the total consequence rating and the likelihood rating, ascertain the risk level for each impact.

EXHIBIT 8.3

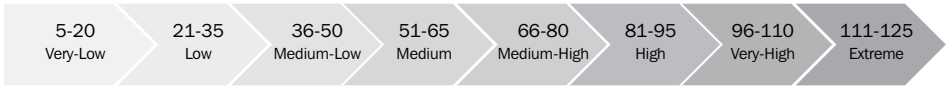
Risk Score for Impacts

		Increased demand on water supply due to summer drought	Contamination of streams and/or lakes due to sewer overflow	
CONSEQUENCE RATING	PUBLIC SAFETY /5	3	3	
	LOCAL ECONOMY AND GROWTH /5	2	2	
	COMMUNITY AND LIFESTYLE /5	3	4	
	ENVIRONMENT AND SUSTAINBILITY /5	3	4	
	PUBLIC ADMINIS-TRATION /5	3	3	
	CONSEQUENCE TOTAL /25 (A)	**14**	**17**	
LIKELIHOOD RATING	/5 (B)	4	3	
RISK SCORE	= **A X B /125**	**56**	**51**	

Once you have the total risk score for each impact, use the risk spectrum (Exhibit 8.4) to organize each impact in the table according to the risk score. Place the extreme risks in the first rows and subsequent risks in the following rows.

EXHIBIT 8.4

Risk Spectrum



Be aware that although you will have a numerical risk ranking for each impact, a numerical ranking may overstate the accuracy of the perception of risk more than a qualitative statement would.

The interpretation of the risk levels, broadly speaking, is as follows:

- **Extreme** risks demand urgent attention at the most senior level and cannot be simply accepted as a part of routine operations without executive sanction.
- **High** risks are the most severe that can be accepted as part of routine operations without executive sanction but they will be the responsibility of the most senior operational management and reported upon at the executive level.
- **Medium** risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for actions, maintained under review and reported upon at senior management levels.
- **Low** risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe.

Consider This…
It is important to consider the full spectrum of risks identified as you may find that by tackling some of those items that are labeled low risk you prevent them from becoming high risks in the future.

Once you have completed the table and organized the rows according to their risk scores, your team may want to consider re-securing the support from your stakeholders as you can now inform them about the most pressing risks and discuss how to move forward (revisiting the issue briefs from Worksheet 4 may be helpful with this exercise).

In theory it is possible to apply a risk score for opportunities but the language of consequence and risk does not necessarily fit this sort of discussion. However, it is important to prioritize the likelihood of opportunities to make sure that your community takes advantage of the benefits associated with those opportunities. You can record the likelihood of opportunities separately or use the table (in Exhibit 8.5) and fill in the likelihood of each positive impact (or opportunity).

Consider This…
Having completed a thorough vulnerability and risk assessment, your team may now want to consider mapping out the risks spatially for your community (e.g. GIS Mapping).

EXHIBIT 8.5

Recording Opportunities

IMPACT	LIKELIHOOD
Longer growing seasons, increasing potential to double crop.	Likely

WORKSHEET 9
SETTING GOALS AND OBJECTIVES

PURPOSE	TO ESTABLISH AND VISION AND DEVELOP GOALS AND OBJECTIVES
Resources Needs	✔ Adaptation Team – average time commitment ✔ Key staff or stakeholders (as needed) – minimal time commitment
Output	Community adaptation vision, goals and objectives.
Linkage to wider methodology	The goals and objectives will help your team develop specific actions in Worksheet 10. They can also be used in Milestone Five to determine the success of the adaptation plan (i.e. whether goals and objectives have been met).

ESTABLISHING A CLIMATE ADAPTATION VISION

Establishing a vision is a way for your community to integrate your adaptation goals into the wider vision of your community. Though not a necessary requirement for adaptation planning, it can be a useful exercise and may help your community to set specific adaptation goals and objectives later on.

A vision is a statement that expresses where your community wants to be in the future. For local governments embarking on an adaptation planning process, a vision can help to establish what an adaptive community looks like. By articulating where you would like to see your community in the future, your team and your community will have something to refer back to throughout your adaptation effort.

A vision statement also acts as a call to action and can be a catalyst to inspire change. Ideally, it should incorporate the values that are important to your community while also communicating the purpose and intended outcome of your climate adaptation plan.

There are a few key questions to consider while establishing your vision:

- What are you trying to accomplish with your climate change adaptation plan?
- What does a well adapted community look like to you?
- What sort of climate change impacts will affect your region?
- Who is your target audience: council, stakeholders, and/or citizens?
- Will this be a key public document?

Of course, if your team is struggling with developing a vision, do not let yourselves get stymied at this stage. It is enough to adopt the following simple vision:

Our Community, the _____ of _____ will become more adaptive to a changing climate.

SETTING GOALS AND OBJECTIVES

Goals

Once you have completed your vision, your team can now develop adaptation goals. Goals should be phrased in reference to the climatic changes that are threatening your community. They will act as high level intentions which your community will strive towards. Goals are general statements about the expectations of a program or plan, such as:

- *Increasing public awareness of increased temperatures and their projected impacts on our community.*
- *Increasing technical capacity to prepare for the impacts of increased precipitation in winter.*

If you do not want to list climatic changes in your goals, you may want to use more guiding goals, such as:

- *Increasing adaptive capacity of built, natural and human systems in our community.*

Be careful using guiding goals, as it may be difficult to distinguish between these more broad goal statements and your community's adaptation vision.

Objectives

Having identified community goals, your team can begin to set specific objectives. Objectives refer to the ways in which your community intends to overcome the impacts that have been identified (in Worksheet 6b) and represent the path towards achieving your wider vision. Some objectives might be specific, while others might be broad and thus more challenging to measure.

Remember that adaptation objectives will vary from one community to another based on a variety of factors, including: types and magnitude of projected climatic changes and impacts; level of support for adaptation efforts; and service areas on which your community has direct influence.

When trying to draft objectives, you may want to consider rephrasing each impact description with the intention of improving the affected service area in a way that eliminates or lessens the severity of the impact.

Some examples of such objectives include:

- *Expand and diversify water supply;*
- *Increased drought preparedness;*
- *Reduce shoreline erosion;*
- *Reduce the impact of extreme heat events;*
- *Reduce flooding and erosion impacts on infrastructure ;*
- *Improving energy conservation;*
- *Lower the ecological footprint of existing buildings;*
- *Engage energy providers to enhance local renewable energy generation opportunities;*
- *Support the local agricultural economy; and*
- *Protect local habitats and migration routes.*

Targets

To the extent possible, identify what your objective is striving to accomplish using targets. Targets can be set as a defined timeframe (e.g. develop a downtown food co-op by 2015 or designate reliable shelters for cold/warm extreme weather events by 2012) and/or relevant numerical standards to measure progress (e.g. improving energy conservation by 25% or increase local food production by 20%). Keep in mind that numerical standards will likely only be possible in cases where baseline data is available (i.e. energy use prior to an adaptation action). In some instances, baseline inventories from Milestone One of the *Partners for Climate Protection* program can be used to supply this information.

See Worksheet 12 for more information and guidance on using indicators and baselines.

NOTES

WORKSHEET 10
IDENTIFYING ADAPTATION OPTIONS

PURPOSE	TO IDENTIFY ADAPTATION OPTIONS AND RELEVANT SERVICE AREAS
Resources Needs	✔ Adaptation Team – average time commitment ✔ Key staff or stakeholders (as needed) – nominal time commitment
Output	A list of adaptation options and the associated service areas.
Linkage to wider methodology	The options that are identified here will be refined through an assessment of drivers and constraints in Worksheet 11; this process will help establish a final list of actions which can be planned out in Worksheet 13.

This worksheet will help your team create a list of adaptation options. It is important to list any actions that might improve your community's adaptive capacity here; consider this exercise as a 'wish list' of possible actions. This list will then be refined through an assessment of drivers and constraints in Worksheet 11. Although some options may seem impractical, it is still important to include them as you may discover drivers which might help overcome any initial barriers.

Adaptation Options may be any combination of the following:

- **Modifying policies, plans, practices and procedures:** Existing by-laws, codes, regulations, policies, development plans, and operating practices may have to be modified in order to adapt for climate change impacts.
- **Building new or upgrading existing infrastructure:** Examples of this include expanding stormwater collection systems, expanding wastewater treatment capacity, increasing bridge heights or strengthening levees.
- **Improving community awareness and public education:** To generate support for adaptation efforts your municipality will likely need to use outreach and education actions. These can also be useful to effect voluntary change at the individual level, such as water or energy conservation.
- **Varying and/or diversifying your options:** By developing "safeguards" against climate change impacts you can increase the preparedness of your community. Examples can include: diversifying your community's economic base to move away from sources that will be negatively affected by climate change (i.e. coastal recreation); developing new groundwater sources to expand water supply; or diversifying your energy supply to include renewable energy to both help mitigate climate change impacts and reduce demand from the electric grid during heat waves.

As you develop your options, keep in mind that these actions should not only address the climate change impacts which your community is facing, but should do so in a sustainable manner. Specifically, they should not impede any wider sustainability efforts.

Pre-cursors to Action

Actions have tangible results which should lead to improvements in adaptive capacity; however it is also important to identify pre-cursors to action which are the steps that need to be taken to enable the implementation of an action. Consider a research study for example, it may be necessary to conduct research in cases where there is a lack of information however the research itself does not make your community more adaptive. The research informs the adaptation action which will then ultimately increase your community's adaptive capacity and reduce vulnerability to an impact.

Precursors to actions may include a wide range of strategies and will likely involve a combination of the following:

- **Establishing partnerships with other communities and government levels:** Climate change impacts do not fall neatly within jurisdictional boundaries. Adapting to climate change will require collaboration (with other local governments, federal and provincial departments, non-profit organizations, and the private sector). Such partnerships may be a way to secure funding, identify best practices or other resources which will help to create, implement and sustain adaptation actions.
- **Carrying out or commissioning of research studies:** In cases where there is a lack of information to develop appropriate actions, one option would be to commission (or carry out) research on the particular climatic change or impact. Examples of research include: studies on sea-level rise and its projected impacts on a specific part of the coastline; research on the implications of heat-waves on vulnerable populations; or a review on the effects of climate change on a variety of development options.

Any pre-cursors to action can also be included in your list of adaptation options or can be linked with specific actions where appropriate.

INSTRUCTIONS

Using the prioritized list of impacts (based on risk scores) from Worksheet 8, your team can now identify options to address each impact. There are a variety of approaches that can be taken to develop this list:

1) By service area, listing all the relevant impacts and options for each service area;
2) By climatic changes, such as sea level rise, increased temperature, precipitation or extreme events; or
3) By impact (see example below), listing each impact then identifying options and relevant service areas.

Choosing an approach will depend on the time, financial resources, and number of staff available in your community. We recommend option 3, however this process can be tailored to your community as you see fit. Use the table below to record your team's list of impacts, options and relevant service areas.

EXHIBIT 10.1

Adaptation Options

IMPACT	OPTION	RELEVANT SERVICE AREAS
Increased demand on water supply due to summer drought	Diversify water supply sources	Water Emergency Response Public Health Communication
	Implement conservation measures	Water Public Health Communications
	Increase drought preparedness	Emergency Response Water Public Health

If your community has had difficulty in the past with buy-in from senior staff not already involved in the planning process, it may be valuable to communicate with them once your team has developed a list of options for addressing the highest risk impacts and likewise again as you refine the list of options in Worksheet 11 through identifying any drivers and constraints.

NOTES

WORKSHEET 11
DRIVERS AND CONSTRAINTS

PURPOSE	TO REFINE YOUR LIST OF ADAPTATION OPTIONS AND DEVELOP A FINALIZED LIST OF FEASIBLE ADAPTATION ACTIONS
Resources Needs	✔ Adaptation Team – significant time commitment ✔ Key staff or stakeholders (as needed) – nominal time commitment ✔ Experts in relevant departments or fields of study (as needed) ✔ Facilitator recommended, though not necessarily external (see Facilitation Tips in Information Annexes)
Output	Finalized list of adaptation actions.
Linkage to wider methodology	You will use the final list of adaptation actions to draft your plan.

This worksheet will help to identify possible drivers and constraints for the implementation of adaptation actions. The purpose of this worksheet is to refine your team's initial list of adaptation options to create a finalized list of tangible adaptation actions. To include a drivers and constraints section in the final adaptation plan is up to the discretion of the team, however, considering these factors while developing your actions will be helpful in setting timelines, allocating costs, and assigning staff responsibilities.

Having identified adaptation options, in Worksheet 9, you will need to consider what factors may influence their implementation (These factors may be scientific, social, operational, environmental or financial).

In many cases, the *drivers* of an action will be the co-benefits and opportunities which would result from the implementation of that action. For example, the availability of a grant from the federal government to replace aging road infrastructure (using permeable materials) might spur action on this front.

Constraints, on the other hand, are the issues (or perceived issues) that may prevent actions from being implemented. Consider the following questions as you examine possible constraints and ways to overcome them:

- Do you have enough scientific information?
- How much support (financial, personnel, infrastructure) do you have? Where might you find what you don't currently have?
- Is the option possible within your community's policy context – does your authority have the power to change the policies that are influenced by climate change?
- Who has the authority in your local government to enact adaptation actions? Are they already involved in the planning process?
- Do you have sufficient support from council to carry out an option?
- How would a change in political leadership alter the implementation of an option?
- Who will you need to convince that action needs to happen now?
- How much time do you need to develop and implement each option?
- What resources do you have already? What else might you need? Are these internally or externally available?
- How will the environment be impacted? Is this impact positive or negative?
- Will the option have implications for mitigation activities?

These questions are designed to take you through a structured process to identify resources and mechanisms for identifying and overcoming constraints. You can refer to the list of possible constraints and possible ways to overcome them from Annex Three to inform the content of the chart below.

EXHIBIT 11.1

Factors that may influence implementation

DRIVERS	CONSTRAINTS
• The release of new/relevant studies or guidelines • Funding opportunities • Availability of staff • Political leadership / support • Appropriate messaging • Available external resources • Consequences of inaction (increased risk levels) • Benefits of action (increasing adaptive capacity) • Co-benefits (immediate and long term) • A weather event (i.e. flooding, heat wave) • Partnerships • Provincial or territorial legislation	• Lack of available information • Cost • Staff capacity • Number of service areas involved • Silo thinking • Lack of messaging • Need for external resources • Lack of agreement on severity and timing of climate change impacts. • Political will • Competing or short timelines • Effects on mitigation activities • Provincial or territorial legislation

INSTRUCTIONS

Using the adaptation options listed for each impact in Worksheet 10; develop a concept map (see Exhibit 11.2 below). Using the information on drivers and constraints in the Information Annexes, identify the possible constraints and drivers for each option on the map. You'll notice that depending on the circumstances constraints can act as drivers and vice-versa (i.e. political will for an action might drive that action, while limited political will may act as a constraint). The particular conditions within your community will dictate whether something is a driver or a constraint.

After you have completed a concept map for each option, look at all of the constraints and drivers that you have identified. Take note of the top five drivers and the top five constraints that appear most frequently. Fill out the chart in Exhibit 11.3 for each of the five most common constraints and Exhibit 11.4 for each of the five most common drivers.

EXHIBIT 11.2

Sample Concept Map

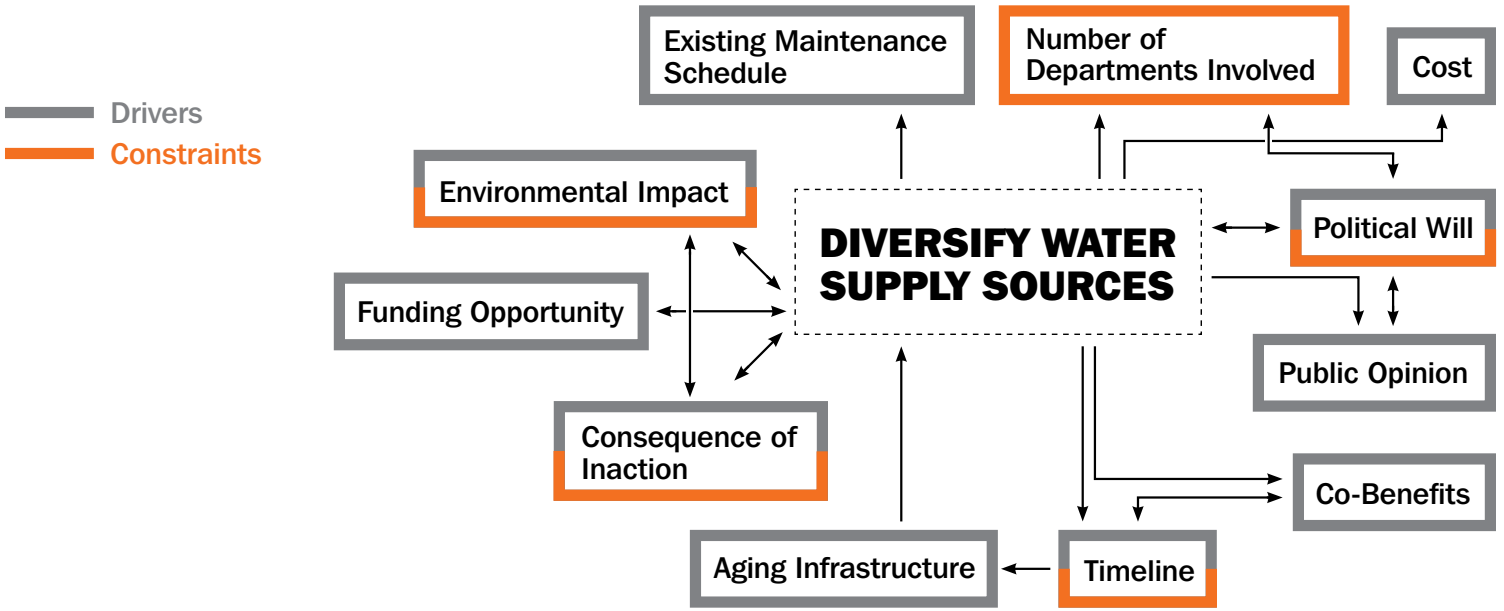


EXHIBIT 11.3

Constraints

CONSTRAINTS	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3	CONSTRAINT 4	CONSTRAINT 5
1. What is the nature of the constraint?					
2. What resources are needed to overcome that constraint? Be as specific as possible (e.g. time, money, knowledge).					
3. Do you know of any resource that already exists that could help you overcome this constraint (i.e. drivers)? If so what is it and how would it meet your need?					
4. Who has knowledge (or other resources) that would be valuable in regard to overcoming this constraint? Consider the nature of the constraint (e.g. scientific, social, operational)					
5. What is the best way to access (someone with that) knowledge? (e.g. verbally, in a guide, electronically)					
6. Other comments					

EXHIBIT 11.4

Drivers

DRIVERS	DRIVER 1	DRIVER 2	DRIVER 3	DRIVER 4	DRIVER 5
1. What is the nature of the driver?					
2. How might this driver help to overcome other constraints? Be as specific as possible					
3. Are there any significant timelines associated with this driver?					
4. Other comments					

Table adapted from CCP Australia Adaptation Initiative – Local Government Climate Change Adaptation Toolkit (2008)

Once you have outlined the drivers and constraints for each adaptation option, go back and refine your list of options based on this information. You may find that some of the identified drivers will help to overcome constraints. Be sure to take this into consideration as you refine your list of adaptation options. Using this information create a final list of adaptation actions. This list will be the basis of the remaining planning process.

WORKSHEET 12
INDICATORS AND BASELINE DATA

PURPOSE	TO DEFINE A SET OF INDICATORS IN ORDER TO ESTABLISH A BASELINE
Resources Needs	✔ Adaptation Team – significant time commitment ✔ Key staff or stakeholders (as needed) – minimal time commitment ✔ Research help (i.e. summer student, academic placement, etc.)
Output	This worksheet provides the foundation upon which a future assessment of the adaptive capacity of your community will be based. With an established set of indicators, your team will create a baseline. Both the specific indicators relevant to particular actions and the baseline will be used when drafting your adaptation plan and will be referred back to in Milestone Five to measure the progress and effectiveness of each adaptation action.
Linkage to wider methodology	This set of indicators will be used again in Milestone Five to evaluate the progress being made on implementation and the level of effectiveness of each adaptation action against the baseline set now.

While developing your adaptation plan, you should establish a set of indicators that can be used to create a baseline against which the effectiveness of your adaptation actions can be measured. These indicators can also help assess how your community's vulnerabilities are changing based on implemented actions and whether these actions increase or decrease your adaptive capacity or sensitivity to climate change impacts. Keep in mind, if your team is not able to establish a comprehensive baseline prior to the creation of an adaptation plan, you may have a less accurate portrayal of the progress and effectiveness of your adaptation actions.

Establishing Baseline Data

Adaptation baseline data provides a record of a community's current condition as it relates to vulnerability and risk. In order to create a baseline, your team will need to identify a set of indicators which can be used to assess and record your community's current conditions.

Indicators should be precise, clear and easy to understand. As there may already be some indictors which are used in your community that indirectly relate to adaptation, prior to developing more indicators your team should assess your community's familiarity with indicators broadly and their current use in policies and actions that contribute to adaptation so as to avoid duplication or indicator overload.[4]

Some of the challenges of developing adaptation indicators include:

- Often indicators are outcome based, however due to the nature of adaptation this approach may not have the degree of flexibility that is required;
- It can be difficult to distinguish between an increase in adaptive capacity due to adaptation actions or an increase in adaptive capacity due to the natural course of sectoral development; and
- It is possible that if not assessed comprehensively, actions may not be seen as effective if indicators have not been properly allocated or defined.

The comprehensiveness of the indicators that your team develops will determine the degree to which the effectiveness of the actions that have been implemented can be measured in Milestone Five. For more detail on the kind of information that will be used to determine progress on implementation and the effectiveness of adaptation actions refer to the section on tracking progress in Milestone Five in the main guide.

The process of establishing baseline data can range from being exhaustive (touching on sensitivities, adaptive capacity, exposure, etc.) to cursory (selecting only one or two sample indicators). Keep in mind that the more information that is gathered at this stage, the better equipped your community will be to communicate the successes of your adaptation actions later in Milestone Five. Collecting baseline data is also a good opportunity to utilize the help of students, volunteers and/or interns.

Instructions

Using the list of indicators below (Exhibit 12.1) as a guide, create a list of indicators for each of your adaptation actions using any combination of qualitative or quantitative indicators.

EXHIBIT 12.1

Possible Indicators by Service Area

SERVICE AREAS	INDICATORS
Planning and Zoning	• Total land area in flood risk zone • Utilized river bed area(km)/total land area(km) • Proportion of low lying coastal areas (in km) (altitudes below 1m) • Proportion of drought vulnerable area (i.e. km_2 agricultural land area/total land area (km_2)) • Average number of permeable and non-permeable surface area (m_2) in permitted developments • Ecologically sensitive area (i.e. area (km_2) of habitat of endangered species, or tidal wetland areas (km_2))
Communications	• Existence and regular use of ongoing forums for sharing information on climate change impacts • Existence of surveys to track requests for adaptation (i.e. heat-risk) related publications • Existence and regular use of ongoing forums for sharing information on climate change impacts • Number of people attending public meetings on adaptation • Tracking "hits" on community-sponsored or community-run webpage's
Public Health	• Number of patients with respiratory disease/total population • Number of patients with vector-borne disease/total population • Proportion of elderly population living alone (in %) • Proportion of people living in poverty (in %) • Proportion of population over 65 (in %) • Population density (i.e. total population/total land area km_2) • Availability of medical facilities (i.e. population/# of hospital beds; hospital workers/total population; public health center employees/total population; number of general hospitals)
Transportation	• Proportion of transportation and supply facilities
Environment	• Average temperature at assigned community hotspots
Engineering	• Proportion of industrial park area/total land area km_2
Housing	• Proportion of housing units older than 30 years/total housing units • Proportion of housing and development permitted in flood risk or vulnerable areas
Economic development, culture and tourism	• Gross Regional Domestic Product (GRDP) • Economic growth (i.e. GRDP growth rate over five years) • Fiscal independence (i.e. local tax + non tax revenue/general account budget)
Parks and Recreation	• Park area (km_2) per capita • Average increase / decrease of green space and trees (i.e. square feet, meters or kilometres)
Water	• River improvement (i.e. river improvement length (km)/improvement needed (km)) • % of population with access to clean drinking water • Capacity of sewage treatment systems compared to quantity of total sewage • Use of groundwater/available groundwater

As your adaptation team continues to develop specific actions, it is likely that those actions will have more specific indicators than are listed here. Be sure to generate an appropriate list of indicators that reflects the actions that your team has developed.

The indicators that are identified in this worksheet can also be used to determine whether your community has achieved its adaptation objectives. Particularly for those objectives with specific targets, indicators can be used to assess the degree to which those targets have been achieved by creating a baseline to compare against.

In cases where action specific indicators are unavailable the level of your community's vulnerability prior to the implementation of an action, and the level of vulnerability after an action has been implemented can be used to determine progress on implementation and the effectiveness of your adaptation actions. The table in Exhibit 12.2 provides additional determinants of adaptive capacity which can be used to supplement a vulnerability assessment when establishing a baseline.

EXHIBIT 12.2

Determinants of Adaptive Capacity

SERVICE AREAS	INDICATORS
Social Capital	• Climate related public-private partnerships • Citizen's capacity on climate change (i.e. citizen's actions, education and/or campaigns for emergency management, proportion of people with health education) • Sense of community (i.e. number of volunteers or volunteer commitment specific to emergency management or climate change)
Institutional Capacity	• Political leadership (i.e. political leaders concerned with climate change and emergency management) • Prevention systems (i.e. delivery systems for disaster relief, warning systems) • Staff for adaptation actions (i.e. public officials per capita, convalescence care) • Level of climate change policy or emergency management policy

WORKSHEET 13
DRAFTING AN ACTION PLAN

PURPOSE	TO ASSIST IN IDENTIFYING TIMELINES FOR ACTIONS, ASSOCIATED COSTS, RESPONSIBLE DEPARTMENTS AND OTHER RESOURCES NEEDED TO DRAFT AN ACTION PLAN
Resources Needs	✔ Key staff or stakeholders (as needed) – nominal time commitment ✔ Adaptation Team – significant time commitment ✔ Facilitator as necessary (depending on the contentiousness of drafting the plan)
Output	Draft Adaptation Action Plan.
Linkage to wider methodology	It is at this stage where all the time spent researching, analysing and developing appropriate actions will come together in a formal adaptation plan. This plan will become the backbone of your team's adaptation work and will serve as both a landmark for your community and a point of reference as you monitor your progress through to Milestone Five and beyond.

The actions that have been identified after having completed Worksheet 11 will make-up the bulk of your community's adaptation plan. In order to move from a list of actions to a more formalized action plan you will need to identify timelines for action, costs, lead departments as well as other relevant departments, other resources (external support, tools, financing etc.) and any necessary pre-cursors to action. By combining these with your action list, you will have a basis for your draft action plan.

Table 13.1 suggests a way to organize proposed actions. For each action it is important to identify:

- A lead department – this will be the department charged with implementing the action;
- Other relevant department(s) – any other departments that should be involved with planning and/or implementation;
- Timeline –start and end dates; short, medium or long-term timelines; immediate or ongoing actions etc;
- Costs – are the costs variable/fixed, significant;
- Funding – can this be funded by an existing budget, through third-party funding, future budgets;
- Indicators –what is the baseline information you need to measure the action against; (Refer to Indicators from Worksheet 12)
- Pre-cursors to action – what steps need to be taken to enable the implementation of an action (i.e. research studies, establishing partnerships etc); (Use the pre-cursors to actions from Worksheet 10 as a starting point); and
- Other – what other factors are important to consider for this action (potential barriers, etc.)

At this point, it is important to make sure that the actions that are being indentified not only address the climate change impacts that your community is facing, but that in doing so they do not impede any wider mitigation or sustainability efforts already under way.

EXHIBIT 13.1

Sample Action Table by Impact

Impact:	[insert impact]
Action 1	[insert action]
Lead department	[Identify the primary department that will implement the action]
Relevant departments	[List any other departments that may be involved in the implementation process]
Timeline	[Establish a timeline e.g. short, medium or long term]
Costs	[Identify costs e.g. $$$$ /year*]
Funding	[Specify funding source e.g. existing operating budget]
Indicator	[e.g. number of culverts replaced]
Baseline data required	[e.g. number and age of culverts]
Pre-cursors	[List any steps which need to take place prior to implementing the action]
Other	[Anything else that needs to be included]
Action 2	[insert action]
Lead department	
Relevant departments	
Timeline	
Costs	
Funding	
Indicator	
Baseline data required	
Pre-cursors	
Other	
Action 3	[insert action]
Lead department	
Relevant departments	
Timeline	
Costs	
Funding	
Indicator	
Baseline data required	
Pre-cursors	
Other	

Once your team has a draft action plan, you may want to consider communicating with senior departments heads, directors and other staff within the community on the status of the overall plan and involve the lead departments with the development of the final action plan and implementation timeline.

Implementation Timeline

The creation of an implementation timeline is the backbone for the implementation milestone (Milestone Four). Note that although it is included here as part of the planning process, it could also be used as an implementation tool and be created in the first steps of Milestone Four.

Earlier your adaptation team identified an estimated time to implement and/or complete each action; these timelines should now be finalized and compiled to create an overall implementation schedule. This schedule will track each action and associated tasks/sub-tasks, and will include a calendar of when each action is to be implemented (including the lead department, financing requirements, etc.). A comprehensive implementation schedule will help later to monitor what progress is being made on the adaptation plan. Keep in mind that the purpose of the implementation schedule is not to prioritize or rank adaptation actions but rather provides a tool for planning the implementation of each action. Also note that the implementation schedule will likely cover an extensive period of time as all adaptation actions, from immediate to ongoing, should be included.

In an implementation schedule, be sure to create and assign designated times to monitor and review the actions. This step will ensure your actions are based on the most relevant and up-to-date information available and are not having unintended consequences or are based on inaccurate risk assessments. If contextual changes exist, consider whether they are significant and whether they require action. Should implementation fall behind schedule, identify opportunities to either bring your community back on schedule or revise the adaptation action plan.

As you create an implementation schedule for each action allow enough time to fully implement it. Be practical - keep in mind that other responsibilities will continue and be sure to account for existing processes and responsibilities, future administrative, technical and political changes, council and staff turnover, and other issues you might face as you implement your plan. Also, include time in your implementation schedule for stakeholder review and input.[5]

Also keep in mind that as you implement each action it will be important to monitor lessons learned. These lessons will help both to celebrate successes (particular actions that worked and showed immediate benefits to the community) and also actions that proved to be more challenging and/or perhaps mal-adaptive.

Note: Individual departmental workplans for the responsible departments will have to be modified to include new actions specific; the implementation timeline need not include such a degree of specificity.

FINAL REVIEW

It may be helpful to consider what should be included in the final version of the plan. The following is a list of elements that we recommend to be included:

- *Acknowledgements* – thank you to stakeholders, adaptation team, council, etc.
- *Mayors/Council Commitment*
- *Executive Summary*
- *Glossary* – key terms that may assist the reader.
- *Introduction*
- *Background and Context* – What is climate change? Why was this process undertaken? Why is it important
- *Impacts & Issues* – What impacts are projected for the community? What are the risks?
- *Vision Statement* – A call to action for your community
- *Goals and Objectives* – What are the objectives for achieving the vision? What are our targets for measuring these?
- *Actions* – actions, costing, financing, responsibilities, timeline, monitoring & review
- *Implementation schedule* – a timeline by action with a defined date and responsible departments.
- *Additional Information* – references, sources of information, etc.

WORKSHEET 14
PRESS RELEASE TEMPLATE

PURPOSE	TO COMMUNICATE THE INITIATION OF AN ADAPTATION EFFORT AND/ OR THE COMPLETION OF YOUR COMMUNITY'S ADAPTATION PLAN
Resources Needs	✔ Adaptation Team – minimal time commitment ✔ Communications or media staff from within the community
Output	A press release outlining your community's plan for increasing its adaptive capacity and/or how far your community has come in increasing its adaptive capacity (as well as any next steps).
Linkage to wider methodology	It is important to maintain a dialogue with the wider community. A press release is one way in which to get information on your community's ongoing adaptation work to local media and by extension to the general public. This press release can be used at the beginning of your community's adaptation effort, accompanying the passing of a council resolution, to inform the wider community of the commitment to this process, and/or upon the completion of the adaptation plan.

Below is a press release template which can be used to:

1) Communicate a commitment to an ongoing adaptation effort (Milestone One) or
2) Communicate the completion of your community's adaptation plan (Milestone Three).

Be sure to fill in the specifics of your community's adaptation effort in the space provided. Of course, your community may have internal mechanisms for creating press releases, these can be used in place of this worksheet.

[Community Logo]

FOR IMMEDIATE RELEASE

Contact: [Insert name]
Phone Number: [Insert Phone Number]
Email: [Insert email address]
Date: [Insert date]

Initiating a Climate Change Adaptation effort in [YOUR COMMUNITY]

Canadian communities are becoming increasingly vulnerable to a range of climate change impacts including rising temperatures, more frequent and intense storms and sea level rise. Recognizing that current greenhouse gas (GHG) concentrations in the atmosphere are already having an impact on the Earth's climate, climate change adaptation is necessary to moderate harm. While neither adaptation nor mitigation actions alone can prevent significant climate change impacts, taken together they form a comprehensive climate change response strategy that will prepare communities for the impacts of climate change that are underway while working to avoid harmful future affects.

Acknowledging these risks, **[YOUR COMMUNITY]** has begun to take steps to prepare for the existing and future affects associated with a changing climate by [**initiating an adaptation planning effort OR creating an adaptation plan**]. As municipalities are the level of government closest to residents, they are on the front lines of responding to the impacts of climate change. Our position as a local authority allows for the development of a locally tailored adaptation plan that can have measurable results in improving our local adaptive capacity.

[INCLUDE THE SPECIFICS OF YOUR COMMUNITY'S ADAPTATION EFFORT HERE]

If announcing a commitment to adaptation planning include information on: your community's adaptation team (i.e. name, team members); the political support enabling this process to move forward; the purpose of the adaptation plan (i.e. to address a specific impact or risk); the intended outcome of the plan (i.e. reducing the vulnerability of your community and increasing its adaptive capacity); and next steps.

If announcing the completion of your adaptation plan include information on: the title of the plan; the support (e.g. financial, political etc) which made the plan possible; any partnerships that were developed throughout the process; the intended purpose of

the plan (i.e. reducing the vulnerability of your community and increasing its adaptive capacity); some indication of the implementation schedule of the plan; how the plan is mean to decrease the vulnerability of your residents; and next steps.

By taking practical steps early, we are reducing future climate change related risks in **[YOUR COMMUNITY].**

NOTES

WORKSHEET 15
ALLOCATING IMPLEMENTATION TOOLS

PURPOSE	TO ALLOCATE THE APPROPRIATE IMPLEMENTATION TOOLS FOR PARTICULAR ADAPTATION ACTIONS
Resources Needs	✔ Department Heads (those not already on Adaptation Team) – minimal time commitment ✔ Adaptation Team – average time commitment ✔ Key stakeholders (those not already on Adaptation Team) – nominal time commitment
Output	One or more implementation tools for each adaptation action.
Linkage to wider methodology	Implementation tools are the basis through which your community will move from planning to doing. Choosing appropriate implementation tools will help to ensure that you are reaching the widest audience and making the greatest impact.

This worksheet looks at the implementation tools that have been suggested in the main guide and will help your team identify which tools are the most applicable for each defined action. The primary tools identified are pilots, internal communication, external communication, marketing and training.

EXAMPLE

Due to your community's vulnerability and concern about storm water runoff, your adaptation team has decided that the most desirable action is to encourage residents to replace non-permeable driveways with permeable ones. There are a variety of implementation tools which could be used to implement this action.

Consider the following four options: pilot projects, marketing, external communications, training, and internal communications. The column on the left represents the specific implementation tool while the columns on the right list considerations for each.

EXHIBIT 15.1

Sample Implementation Tools for Increasing Permeable Driveways

IMPLEMENTATION TOOL	PROS	CONS
Pilot Project e.g. neighbourhood specific incentive based initiative to encourage individuals in that neighbourhood to replace driveways	• Incentives make it more likely to guarantee uptake • Can determine the potential success of an action if it were to be expanded to a broader scale	• Costly • Reach a small number of people • May not be replicable in other communities
Marketing e.g. advertising and social marketing campaigns for replacing driveways	• Potentially reaches a wider audience • Can be tailored to specific audiences (i.e. existing knowledge, early adopters, etc.)	• Can be costly • Difficult to determine what the best social marketing mechanisms are • Difficult to guarantee uptake
External Communication e.g. press release and small pamphlets on benefits of replacing driveways	• Minimal costs • Reaches a wide audience (i.e. entire community)	• Very difficult to guarantee update
Internal Communication e.g. issue briefs directed at staff and Council	• Minimal costs • Can be used as a pre-cursor to garner support from staff and council to implement action on a broader scale	• Only reaches a small internal audience
Training e.g. training workshops for staff or elected officials	• Provides specific training relevant to actions • Creates a dialogue which can improve the actions in the long run	• May be difficult to solicit participants • Could be costly

As your team evaluates the value and applicability of each implementation tool for specific actions, consider:

- What staff will need to be involved if this tool were to be used?
- How many resources can be allocated to the implementation of this action?
- What audience is the tool geared towards?
- What audience does the action need to reach?
- Is the tool already being used in another form? If so, can it be used "as is" or with slight modification?
- Is the tool intended for short or long term use? Does this reflect the timeline of the action?
- Consider your local government's action mechanisms and how these can be utilized to drive the implementation of adaptation actions.

EXERCISE

In order to identify which implementation tool would be the most applicable for a specific action, your team can recreate the table above. Consider all of the possible implementation tools and using the questions outlined above list the tools that could potentially be used to implement that action. Use a similar exercise of examining the 'pros and cons' of each tool in order to determine which tool is most fitting for that particular action.

The purpose of this worksheet is to help your team decide which tool is most suited for a particular action. Note that it may not be the case that only one implementation tool is relevant to a particular action (in the example above a pilot project would have to be accompanied by external communication and/or marketing to be effective).

NOTES

WORKSHEET 16
UPDATING THE PLAN

PURPOSE	TO UPDATE YOUR COMMUNITY'S ADAPTATION PLAN BASED ON NEW LOCAL CONDITIONS, OPPORTUNITIES AND/OR NEW INFORMATION
Resources Needs	✔ Adaptation Team – average time commitment
Output	An updated Adaptation Plan.
Linkage to wider methodology	At this point in Milestone Five you team has the formal opportunity to update your adaptation plan, although it is likely that many of the actions that were included in the final plan have been revised as part of their implementation, it is important to assess new information, review assumptions and update your action plan at this time.

This worksheet provides your team with a checklist of items to consider when drafting the update to the adaptation plan.

CHECKLIST

- ✔ Create an issue brief outlining accomplishments to date and next steps.
- ✔ Renew the commitment of your adaptation team.
- ✔ Create a list of actions that were not implemented in the first round. Identify the reasons that implementation did not move forward? Did a shift in vulnerabilities cause a re-ordering of actions? Were there insurmountable constraints that hindered implementation? Have conditions changed enough to enable implementation now?
- ✔ Refer back to the vulnerability assessment - the impacts of medium-low vulnerability can now be addressed as you update the plan.
- ✔ Conduct a risk assessment for medium-low vulnerabilities.
- ✔ Identify adaptation options and actions to address the new impacts.
- ✔ Communicate successes.
- ✔ For each action consider the relevant indicators, drivers, and constraints. There may be elements that weren't considered the first time around.
- ✔ Update, or establish, a baseline. Use the indicators that have been identified to do this.
- ✔ Re-evaluate your community's vision, targets and goals. Assess whether they are still relevant or if they need to be updated to reflect the actions that have been taken or will be taken.
- ✔ Assess funding opportunities – Are there any new opportunities? Are previous funding sources still available?
- ✔ Update the implementation schedule to reflect new adaptation actions.
- ✔ Revise your current adaptation plan to account for the new items that have been added and any previous items that have been readdressed.

NOTES

WORKSHEET 17
COMMUNICATING ACCOMPLISHMENTS

PURPOSE	TO DEVELOP A COMMUNICATION STRATEGY AND COMMUNICATE WITH THE WIDER COMMUNITY ON THE ADAPTATION EFFORTS OF YOUR TEAM
Resources Needs	✔ Adaptation Team ✔ Communications staff from within the corporation
Output	A comprehensive communications strategy.
Linkage to wider methodology	This is the final stage of the five-milestones. Communicating accomplishments is an important step to acknowledge the work of your Adaptation Team and the stakeholders involved.

The way in which you celebrate and communicate the accomplishments of your adaptation effort will be dictated by the kind of plan your community has created (i.e. a departmental plan, a municipal operations plan etc). There are a variety of communication methods that can be employed including a community event, a press release, issue briefs, reporting, etc. Exhibit 17.1 presents a look at several communications options and rates the pros and cons of each.

Be sure to identify future plans and next steps with regard to adaptation within your community in any of the methods you employ.

DEVELOPING A COMMUNICATIONS STRATEGY

Defining a communication strategy is something that is best done in a group as you can pool your collective skills and expertise. Gather your adaptation team, and any key stakeholders with specialized expertise in this field, to develop your communication strategy.

It is best to keep things simple. Consider the following questions:

1) What elements of the adaptation plan need to be made known?
2) What was the objective of the plan?
3) What groups or individuals would be interested in this information?
4) What are the needs of these groups? What elements of the adaptation plan would they be most interested in?
5) What communication tools do you want to use to target these groups? (Consider the communication methods listed below and the implementation tools listed in Worksheet 14)
6) What is your timeframe?
7) What financial and human resources do you have available to you? [6]

Once you have identified the key elements of the adaptation plan that need to be communicated, who it should be communicated to, the timeline in which to accomplish this communication, and what financial and human resources are available to you, you can create a message for each of the identified audiences.

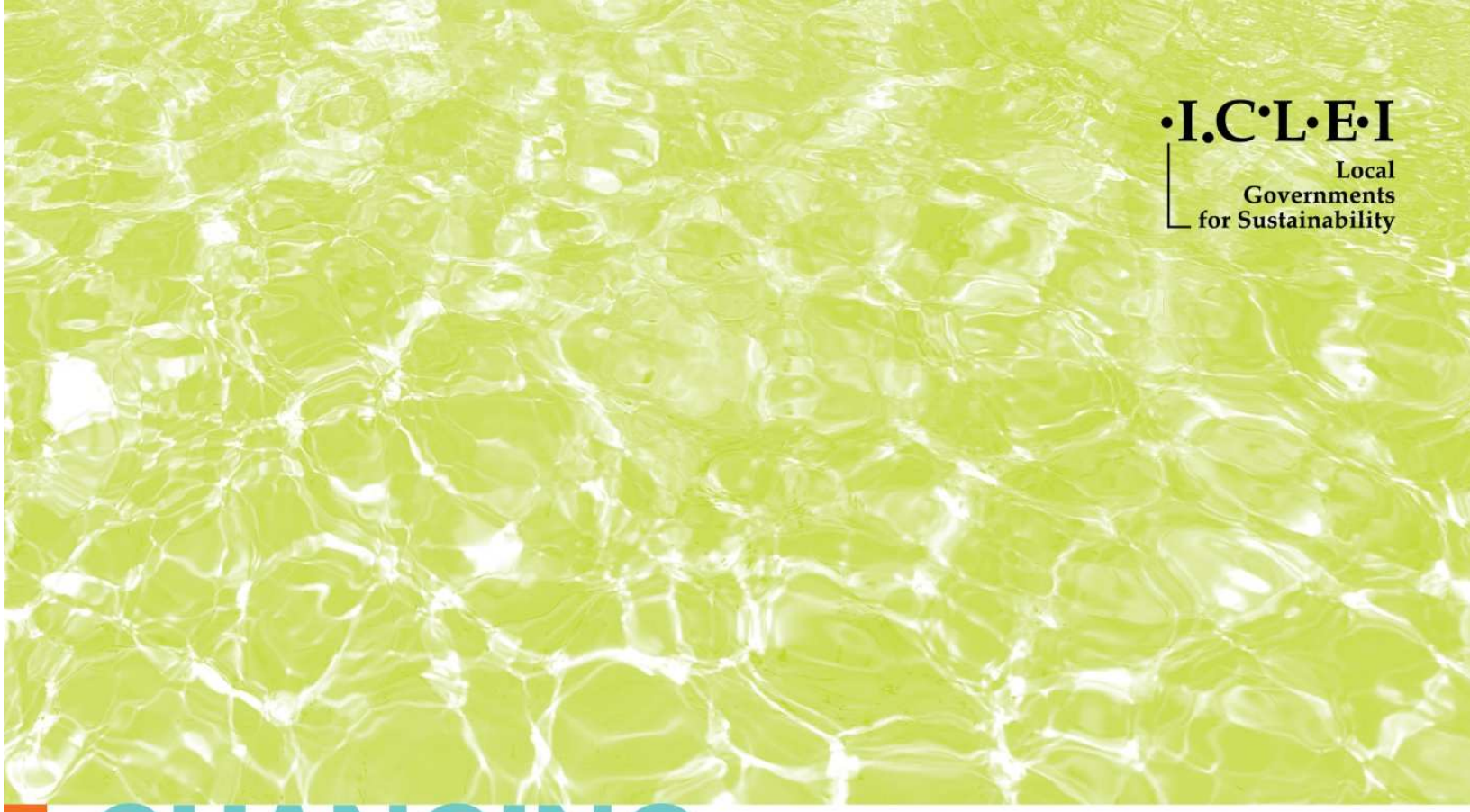
EXHIBIT 17.1

Methods for Communicating Accomplishments

COMMUNICATION METHOD	PROS	CONS
Community Event e.g. an "Adaptation Week", launch even, or awards ceremony	• More likely to get participation • Provides an opportunity for community involvement • High profile	• Costly • May only reach a small number of people
Press Release e.g. a public announcement on the accomplishments of the adaptation plan	• Minimal costs • Reaches a wide audience (i.e. entire community)	• Difficult to ensure that it is read • Low profile – not celebratory
Issue Brief e.g. interdepartmental memo on the accomplishments of the adaptation plan	• Minimal costs • Reaches all arms of the corporate structure • Could create internal awareness of adaptation issues and spur interdepartmental involvement	• Only reaches a small internal audience • May not appropriately represent the scale of the adaptation effort
Reporting e.g. annual progress report on adaptation plan and implementation efforts or community website update or feature	• Documents progress in a formal way • Minimal costs	• Only reaches a small, mostly internal audience • Is not accessible to wider audience

ENDNOTES

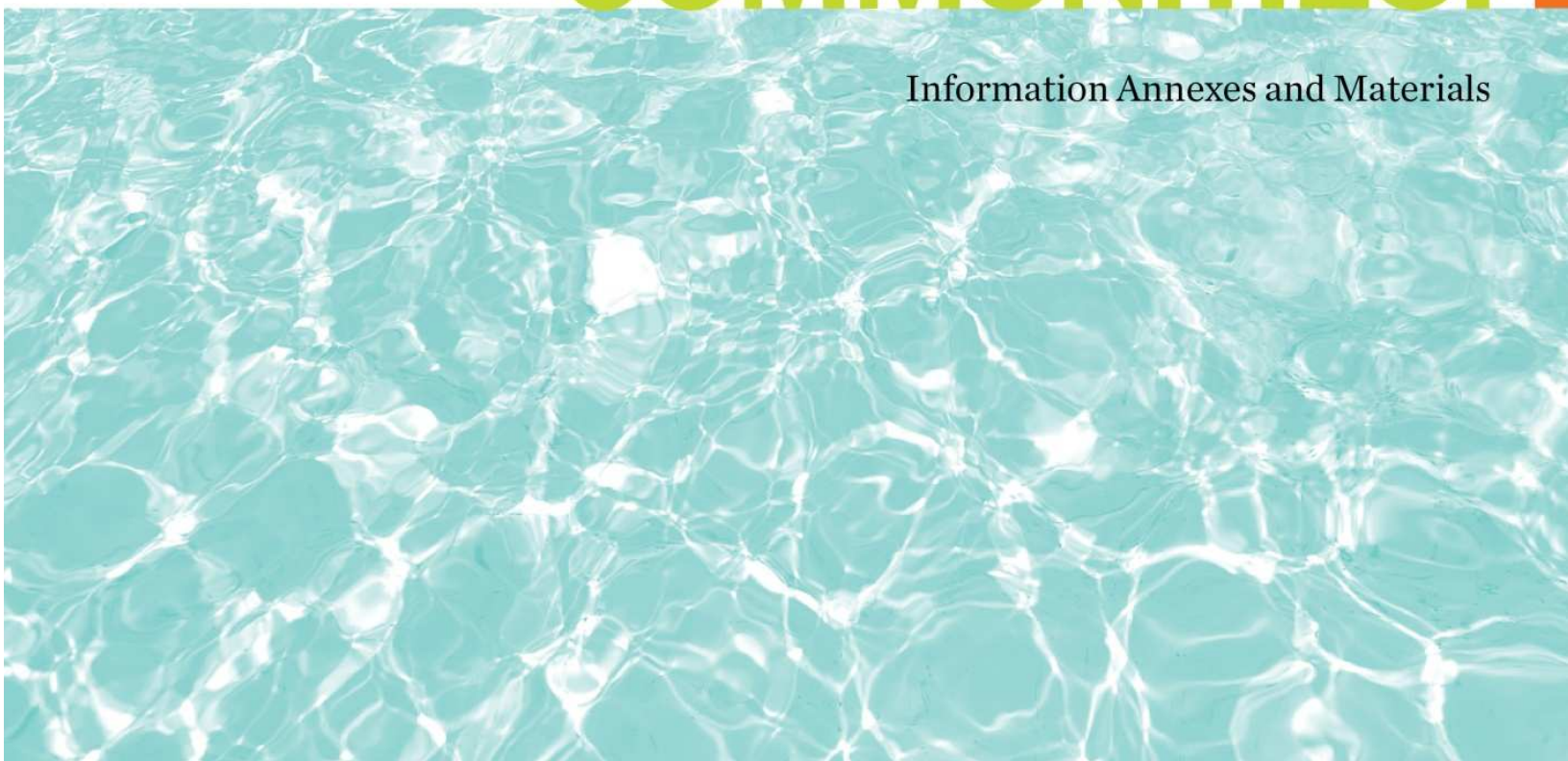
1. Note that the order of selecting a team leader and identifying a mandate can be changed as per your preference.
2. Warren, F.J. and Egginton, P.A. (2008): Background Information; In *From Impacts to Adaptation: Canada in a Changing Climate 2007*, (ed.) D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56
3. These risk assessment scenario charts have been adapted from *Climate Change Impacts & Risk Management: A Guide for Business and Government* © Commonwealth of Australia 2006 and *A Risk Management Approach to Adaptation Decision-making* from Ontario Centre for Climate Impacts and Adaptation Resources
4. Harley, M. et al. (2008) *Climate Change Vulnerabilities and Adaptation Indicators*. Accessed June 24, 2010 from http://air-climate.eionet.europa.eu/docs/ETCACC_TP_2008_9_CCvuln_adapt_indicators.pdf
5. Partners for Climate Protection (2008) Five-Milestone Framework for Reducing Greenhouse Gas Emissions. Accessible at: http://www.sustainablecommunities.fcm.ca/files/Capacity_Building_-_PCP/PCP_Resources/PCPFiveMilestoneFramework-e.pdf
6. International Development Research Center (IDRC), (2010). Developing a Communications Strategy. Accessed June 14, 2010 from http://www.idrc.ca/uploads/user-S/11606746331Sheet01_CommStrategy.pdf



ICLEI
Local Governments for Sustainability

CHANGING CLIMATE, CHANGING COMMUNITIES:

Information Annexes and Materials



INFORMATION ANNEX ONE – RESOURCE CHECKLISTS

Annex One Table of Contents

ADAPTATION IN ACTION

TITLE:	**Cities Preparing for Climate Change**
AUTHOR(S):	Jennifer Penney and Ireen Wieditz
TYPE OF DOCUMENT:	A study of six urban regions
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	This study provides lessons from six urban regions which have begun their adaptation planning process, including: London, New York, Boston, Halifax, Vancouver and Seattle. The report also outlines a systematic process for municipalities to adapt to a changing climate and provides examples of municipal adaptation policies and specific adaptation measures and actions from the cities that were studied.
KEY FINDINGS:	The most successful cities and urban regions studied for this research undertook adaptation processes that included four main elements: 1) Measures to increase public awareness of likely climate change impacts and to engage stakeholders in identifying problems and solutions; 2) A systematic review of climate trends and projections for the specific urban region and an analysis of where and how major impacts are likely to occur; 3) Identification of a range of options for reducing vulnerability to climate change, including an assessment of existing programs that create a foundation for an adaptation strategy; and 4) Developing a strategy and putting it into action.
MOST RELEVANT FOR:	Geared towards North American urban regions.
HOW TO ACCESS:	http://www.cleanairpartnership.org/pdf/cities_climate_change.pdf

TITLE:	Climate Change Adaptation Actions for Local Government
AUTHOR(S):	SMEC Australia to the Australian Greenhouse Office, Department of the Environment and Water Resources
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Australia
ABSTRACT:	The primary objective of this report is to identify climate change adaptation actions that are applicable to Australia's climatic conditions and climate impact risks as currently predicted and what can be implemented by local governments. In developing these actions, the following six local functions are considered: • infrastructure and property services; • provision of recreation facilities; • health services; • planning and development approvals; • natural resource management; and • water and sewage services. Each of the functions is explained in detail with case study examples and a cost-benefit analysis.
KEY FINDINGS:	Local government's response to climate change requires a dual approach: • Management and reduction of greenhouse gas emissions (mitigation) • Making adjustments to existing activities and practices so that vulnerability to potential impacts associated with climate change can be reduced or opportunities realized (adaptation). These two activities are complementary rather than exclusive and should be considered simultaneously.
MOST RELEVANT FOR:	Local governments and various stakeholders associated with municipal functions.
HOW TO ACCESS:	http://www.climatechange.gov.au/community/~/media/publications/local-govt/localadaption_localgovernment.ashx

TITLE:	**Climate Change and Environmental Planning: Working to Build Community Resilience and Adaptive Capacity in Washington State, USA**
AUTHOR(S):	Casilda Saavedra and William W. Budd
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Washington State, United States
ABSTRACT:	This work focuses on the efforts being made by King County, Washington to respond to the challenges of global climate change, concentrating on both mitigation and adaptation. This case study examines the underlying issues and challenges faced by this jurisdiction in adopting its climate change plan; the development and adoption of the plan; issues associated with monitoring and sustaining these efforts; and the broader challenges of building more resilient and adaptive communities. It focuses both on procedural issues, as well as the types of mitigation and adaptive responses. One aspect of the paper examines King County's efforts to link climate change efforts/policy/plans to other critical community concerns (e.g., issues of equity and race), and to the economic opportunities that have become critical motivators to successfully moving forward as the county attempts to establish itself as a global leader in meeting the challenges of global climate change.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local and regional governments in the United States and Canada
HOW TO ACCESS:	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V9H-4TXDX9W-1&_user=10&_coverDate=07/31/2009&_rdoc=1&_fmt=high&_orig=search&_sort=d&_docanchor=&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=7445baf669203d67de85dda1afd024c8

TITLE:	**Extreme Temperature Protocol in Middlesex-London**
AUTHOR(S):	Iqbal Kalsi (presenter)
TYPE OF DOCUMENT:	Power-point presentation
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	This presentation explains that a combined effort of public health, city & county managers, social services workers and emergency medical officers was needed to develop a systematic plan to provide assistance to the most vulnerable populations during extreme temperatures. The presentation uses Middlesex-London as a Case Study in showing the need for a protocol in the face of extreme temperatures. Planning principles, the need for a protocol, protocol goals and activities, and the various steps involved in implementing the protocol are outlined. These steps include: criteria for initiating extreme temperature alerts, monitoring, notification, consultation, decision, activation, communications, media notification, public education, and termination of alerts. Agency roles and responsibilities are also outlined, as are the successes, the challenges and the future of the protocol.
KEY FINDINGS:	Steps for implementation of Protocol and related issues for the consideration of local governments. For details, see above abstract or the document itself.
MOST RELEVANT FOR:	Smaller, local governments, but protocol can be adapted to suit needs of different types of areas/governments in Ontario and elsewhere.
HOW TO ACCESS:	http://www.cullbridge.com/Webinars/PDFs/ARC-3-09/KalsiI_ARC_2009_03_17.pdf

TITLE:	**Final Report on FCM Municipal Infrastructure Risk Project: Adapting to Climate Change**
AUTHOR(S):	The Federation of Canadian Municipalities
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2002
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	The overall goal of this project was to raise awareness with six pilot municipal Governments of six probable climate change impacts that would increase the vulnerability of their communities. One of the key objectives was to facilitate interaction between municipal staff and researchers working on science-based regional climate change projects. The principal investigators selected the six pilot communities, six associated climatic impacts, and six research partners listed below: 1. Sea level rise (Charlottetown, PEI, Environment Canada, Atlantic Region and GSC-Atlantic Region) 2. Drought and water availability (Swift Current, SK, GSC-Ottawa, and University of Regina) 3. Groundwater (United Counties of Stormont, Dundas and Glengarry, neighbouring United Counties of Prescott-Russell, ON, and the University of Ottawa) 4. Flood response and landslides (La Baie, QC and GSC-Ste-Foy) 5. Permafrost change (Norman Wells, NT and GSC-Ottawa) 6. Forest fires (Hinton, AB and Canadian Forest Service-Edmonton)
KEY FINDINGS:	The pilot communities that were most successful or have the greatest potential for success were those with the following conditions in place: • Relationship of trust between the municipal staff/elected official and the project leader and/or the research partner; • A mechanism in place to ensure constant and regular communication between the municipal staff and the research partner; • The research partner having committed funding and carrying out research that can directly assist the municipality; • The climate change impact being a high priority in the community and other programs or research being in place to support addressing this priority; • The local conditions of the community (economic conditions, political situation, etc…) taken into account when planning project activities such as presentations; • Regular communication taking place between the project leader and

	municipal staff; • Commitment from Municipal Council to the municipal government's participation in the project with a clear understanding of the resources that need to be committed; • Tangible benefits to the municipality being in place (i.e. potential funding for database development and from the Sustainable Communities Initiative); • Need for principle investigators to gain first-hand knowledge of the community through travel and face-to-face meetings; • Local research partner maintaining regular communication with the municipal staff contact.
MOST RELEVANT FOR:	Local, Provincial or Federal governments
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/projdb/pdf/16_e.pdf

TITLE:	**Municipal Case Studies: Climate Change and the Planning Process, Calgary**
AUTHOR(S):	CitySpaces Consulting Ltd.
TYPE OF DOCUMENT:	Case Study Brochure
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Prairies
ABSTRACT:	This brochure is a case study of Calgary, AB. It was produced to help community planners learn more about scientific practices and terminology, along with ways they might approach assessing local risks and developing locally appropriate responses. In recent years, the area's temperatures have been rising and precipitation patterns have been changing. River flows have declined, as the City's sole water supply comes from the Elbow and the Bow Rivers with their headwaters in the Rockies. It shares the water resource with high-demand industrial and agricultural users and industry within the watershed. The essential questions posed in this research study were: • Will the Bow River be able to meet future demand as temperature and population increase? • When will the future demand exceed approved license limits? The modeling undertaken through this study is the first to quantify the future impacts of climate change on water supply in relation to demand for Calgary.
KEY FINDINGS:	These results suggest that the city will need to achieve a 50% reduction in per capita use by 2064 in order to provide a sustainable water supply. Even then, cyclical climate patterns indicate particularly low river flow and higher temperature periods in the 2060s that could lead to water demand exceeding supply allotments. This research study focuses on determining when climate change will affect the quantity of water available to be withdrawn from the watershed, in addition to impact on water demand, thereby adding new scientific information for consideration by the City's policy analysts and decision-makers. While the study did not specifically explore potential adaptations, it was a positive collaboration between City officials and the scientific community. A City-sponsored educational program for elementary and high school teachers helps to communicate the findings of the study.
MOST RELEVANT	Local Governments with similar climates to Calgary who are facing warmer weather and changing precipitation patterns which are affecting the city's sole

FOR:	water supply.
HOW TO ACCESS:	http://www.cip-icu.ca/web/la/en/fi/825d91489e8a4a12b8a7c637dc25a04d/get_file.asp

TITLE:	**Municipal Case Studies: Climate Change and the Planning Process, Delta**
AUTHOR(S):	CitySpaces Consulting Ltd.
TYPE OF DOCUMENT:	Case Study Brochure
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Coastal communities in Canada
ABSTRACT:	This brochure is a case study of Delta, BC. It was produced to help community planners learn more about scientific practices and terminology, along with ways they might approach assessing local risks and developing locally appropriate responses. Delta occupies part of the alluvial deposit created by the Fraser River as it flows into Georgia Strait, on its way to the open Pacific. This study focuses on one tidal flat — Roberts Bank — located along Georgia Strait. Within the next 100 years, sea-level rise and intensified storminess are likely to significantly affect Roberts Bank and the adjacent upland areas. The study's main aim was to undertake locally-relevant, scientific research on sea-level rise to help increase certainty for local decision-makers and stakeholders about likely outcomes. The specific objective of the scientific team was to investigate the potential impacts of rising sea level and extreme water levels on Roberts Bank. Using data gathered from extensive monitoring and the use of aerial laser scanning of the inter-tidal sea bed, the researchers modeled future conditions.
KEY FINDINGS:	The results showed that Roberts Bank is likely to experience a significant "coastal squeeze": • All parts of the tidal flats will spend more time under water. • Higher waves will reach the marshes and dykes. • Increased erosion will attack marshes, dykes and causeways. There is an increased risk of dyke breach and flooding.
MOST RELEVANT FOR:	Local Governments with similar climates to Delta who may be affected by rising sea levels and increased storm frequency and severity which impact habitats, property and infrastructure.
HOW TO ACCESS:	http://www.cip-icu.ca/web/la/en/fi/4c182dbfef17451990493ccf748456db/get_file.asp

TITLE:	**Municipal Case Studies: Climate Change and the Planning Process, Graham Island**
AUTHOR(S):	CitySpaces Consulting Ltd.
TYPE OF DOCUMENT:	Case Study Brochure
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Coastal communities in Canada
ABSTRACT:	This brochure is a case study of Graham Island, BC. It was produced to help community planners learn more about scientific practices and terminology, along with ways they might approach assessing local risks and developing locally appropriate responses. Graham Island is the most northern of the Queen Charlotte Islands, also known as Haida Gwaii. The study area — the northeast area of Graham Island — is highly sensitive to future sea-level rise. Two communities on northeast Graham Island — Masset and Old Masset Haida Nation Reserve — are low-lying and vulnerable to flooding.The main highway that connects the northern communities to Queen Charlotte City, the ferries, and the Sandspit Airport, is continuously threatened in this area by erosion and flooding. This study took a local perspective and used an integrated approach to assess human and biophysical vulnerability to climate change. This involved a local focus group to guide the research, in depth interviews with key community members (e.g., emergency and municipal planners, Haida elders, business owners and local residents), a community workshop, and several community research forums. The study examined community resilience and adaptive capacity, as well as environmental sensitivity to climate change, and combined these findings to assess ways to build on existing and potential adaptive capacities at the community and household scale.
KEY FINDINGS:	This participatory, community-based approach showed that: • local knowledge is important in assessing adaptive capacity to climate change and developing effective, longer-term adaptation strategies; • remote communities are inherently, geographically vulnerable, but typically have skills and experiences (e.g., hunting, fishing, food gathering, food stockpiling, coping with storms and power outages) that make them resilient in the face of natural hazards and community changes; and • these communities are more prepared to respond to short-term hazardous events, such as extreme storms or earthquakes, rather than to gradual climate change impacts, such as sea-level rise and accelerating erosion.
MOST RELEVANT FOR:	Local Governments who may be affected by rising sea levels and increased storm frequency.

HOW TO ACCESS:	http://www.cip-icu.ca/web/la/en/fi/5c6a9fb9f3ee45e3ad6c63c5411cd577/get_file.asp

TITLE:	**Municipal Case Studies: Climate Change and the Planning Process, New Brunswick**
AUTHOR(S):	CitySpaces Consulting Ltd.
TYPE OF DOCUMENT:	Case Study Brochure
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Coastal communities in Canada
ABSTRACT:	This brochure is a case study of New Brunswick. It was produced to help community planners learn more about scientific practices and terminology, along with ways they might approach assessing local risks and developing locally appropriate responses. New Brunswick has approximately 5,500 km of coastline, stretching between the Gulf of St. Lawrence and the Bay of Fundy. Coastal features, such as beaches, dunes, barrier islands and salt marshes, act as natural buffers, helping to reduce the impact of storm surges, flooding and erosion. Development in these areas can disrupt the natural eco-system balance, causing water-quality problems or greater risk of damage. The goals of the project were to forecast likely climate changes, anticipate their physical impacts in relation to sustainable management and community resilience, and identify potential adaptation strategies. Using very precise surveying methods, some members of the research team constructed flood-risk maps to identify the extent of flooding. Members of the community were approached to obtain an understanding of priorities and local capacity to adapt to accelerated changes.
KEY FINDINGS:	Overall, researchers found: • a lack of information on possible adaptation techniques and practices; • insufficient and unequal resources to address the coastal issues; • a lack of local governance and effective tools to manage coastal development; and • a regulatory process that is complex, ineffective and applied inequitably. They created a decision-making framework, which includes a process for choosing appropriate adaptation strategies for specific locations, was formed through discussions with communities, examination of key referenced works and analysis of accounts of personal experience.

MOST RELEVANT FOR:	This research is relevant to all low-lying communities along Canada's coastlines, especially for rural municipalities, seasonal settlements and communities that are highly dependent on coastal tourism.
HOW TO ACCESS:	http://www.cip-icu.ca/web/la/en/fi/26df4501b6a64be7968301fb7d811d97/get_file.asp

TITLE:	**Municipal Case Studies: Climate Change and the Planning Process, Salluit**
AUTHOR(S):	CitySpaces Consulting Ltd. For Canadian Institute of Planners
TYPE OF DOCUMENT:	Case Study Brochure
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	This brochure is a case study of Salluit. It was produced to help community planners learn more about scientific practices and terminology, along with ways they might approach assessing local risks and developing locally appropriate responses. Salluit is located in Nunavik, Québec's most northern region. This community of approximately 1,100 people sits in a narrow, steeply-sloped valley with homes, infrastructure and community buildings built on permafrost. The population is projected to increase, driving a need for more housing, infrastructure, community amenities and more land area to accommodate growth. Salluit experienced a 2.6°C temperature increase between 1990 and 2003, and has witnessed the problems that such increases can inflict – damaged buildings, roads and embankments, and the relocation of 20 new homes from unstable land. This study examined permafrost conditions and future patterns of warming and stability, and provided knowledge about permafrost instability to local government in Salluit to support future land-use decisions
KEY FINDINGS:	Using data from multiple sources, the study modeled future permafrost conditions under warming temperatures. The results revealed that land near the village is unstable and not safe for construction. Specifically: • much of the land surrounding the village could experience settlement between 40 and 100 cm in the next 20 years; • landslides are likely to occur in this area on slopes as low as 1°; • the possibility of landslides could be increased by local conditions, such as erosion of a river's edge or melting of a snow bank; and land east of the village is on soil that is lower in ice content but is, nevertheless, likely to experience settlement in the order of 10 cm. This study produced a map showing areas deemed safe and unsafe for development, and has led to the production of a revised zoning map for Salluit. The study is a good example of how locally relevant scientific research and the effective transfer of that knowledge can help a community adapt its future planning and development to the impacts of climate warming

MOST RELEVANT FOR:	This research is relevant to other northern communities in Canada and around the world.
HOW TO ACCESS:	http://www.cip-icu.ca/web/la/en/fi/22df5916accf429e9f600ee2e5802369/get_file.asp

TITLE:	**Urban Form and Climate Change: Balancing Adaptation and Mitigation in the U.S. and Australia**
AUTHOR(S):	Elizabeth M. Hamin and Nicole Gurran
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	United States and Australia
ABSTRACT:	The science of climate change is now well established. Predicted weather-related events like sea level rise, increased storm events, and extreme heat waves imply an urgent need for new approaches to settlement design to enable human and non-human species to adapt to these increased risks. A wide variety of policy responses are emerging at local and regional levels – from sustainable urban form, to alternative energy production and new approaches to biodiversity conservation. However, little attempt has been made to ensure that strategies to *adapt* to the inevitable impacts of enhanced climate change (such as additional open space to enable water inundation) support ongoing policies intended to *mitigate* local contributions to climate change (such as attempts to increase urban densities to reduce car dependency). In some cases mitigation and adaptation are complementary but in other cases these policy goals may conflict. This research examines leading case examples of land-use plans and policies designed to address climate change. Focusing predominantly on cases from the United States and Australia, it identifies whether the policies address adaptation, mitigation or both and whether the practices put mitigation and adaptation in potential conflict with each other.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local, Provincial and Federal Government
HOW TO ACCESS:	Available to purchase from http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V9H-4TY8W15-1&_user=10&_coverDate=07/31/2009&_rdoc=1&_fmt=high&_orig=search&_sort=d&_docanchor=&view=c&_searchStrId=1405204526&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=7395dfe28518a303b69299491d336a77

Economics and Legal Liability

TITLE:	**Assessing the Costs of Adaptation to Climate Change: A review of the UNFCCC and other recent estimates**
AUTHOR(S):	Martin Parry, Nigel Arnell, Pam Berry, David Dodman, Samual Fankjauser, Chris Hope, Sari Kovats, Robert Nicholls, David Satterthwaite, Richard Tiffin and Tim Wheeler
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	International
ABSTRACT:	This document re-assesses several recent studies which have reported on adaptation costs due to climate change. It illustrates the uncertainties in these estimates and identifies three main reasons for under-estimates; 1) some sectors have not been included in an assessment of cost (e.g. ecosystems, energy, manufacturing, retailing and tourism); 2) some of those sectors which have been included have only been partially covered; and 3) the additional costs of adaptation have sometimes been calculated at 'climate mark-ups' against low levels of assumed investment. In some parts of the world, low levels of investment have led to an adaptation deficit. This will need to be made good by full funding development, without which the funding for adaptation will be insufficient. Residual damages also need to be evaluated and reported on because not all damages can be avoided due to technical and economic constraints.
KEY FINDINGS:	There is an urgent need for more detailed assessments of the costs of adaptation, including context-specific case studies of the costs of adaptation in specific locations and sectors as global scale extrapolation can be misleading. If global costs of adaptation are to be calculated, there is a need to establish what actions truly constitute adaptation to climate change, to identify the limits of adaptation and thus the residual damages, to find ways of valuing the full suite of adaptation measures that can be applied globally and to integrate these costs across sectors.
MOST RELEVANT FOR:	All levels of government (local, provincial and federal).
HOW TO ACCESS:	http://www.iied.org/pubs/pdfs/11501IIED.pdf

TITLE:	**Legal Liability as a Driver of and Barrier to Climate Change Adaptation in Infrastructure Projects**
AUTHOR(S):	Torys LLP
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Northern Canada
ABSTRACT:	This paper has been written to assist and support the analysis, conclusions and recommendations of the Climate Change Adaptation Policy Program of the National Round Table on the Environment and Economy. Accordingly, it seeks to contribute to the growing dialogue about the importance of climate change adaptation to Canada, and particularly northern Canada, by focusing on the potential for legal liability of key stakeholders, whether governments, companies or individuals, in connection with climate change-related risks in the development and operation of infrastructure.
KEY FINDINGS:	More broadly based action by the Federal Government, the provincial and territorial governments, regulators and other stakeholders concerned with infrastructure in Canada's north are required to promote adaptation to the impacts of climate change.
MOST RELEVANT FOR:	Local and Provincial governments in Canada – specifically those in Northern Canada
HOW TO ACCESS:	Contact the Alliance for Resilient Cities (ARC) for a copy of this publication cap@cleanairpartnership.org

TITLE:	Limitations of Integrated Assessment Models of Climate Change
AUTHOR(S):	Ackerman, Frank, DeCanio, Stephen J., Howarth, Richard B., Sheeran, Kristen
TYPE OF DOCUMENT:	Academic Journal
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	This journal describes how integrated assessment models (IAMs) are used to analyze the expected costs and benefits of climate policies. This reading seeks to trace the contestable assumptions and limitations of IAMs. IAMs have the capacity to assign monetary values to the benefits of climate mitigation based on incomplete information and speculative judgment concerning the value and worth of human activities and ecosystems. IAMs also exaggerate mitigation costs, which is another example of certain concerns and limitations of this framework. There are alternative approaches, which could be used to assists climate policy in terms of buying insurance against catastrophic, low-probability events.
KEY FINDINGS:	Policy makers and scientists should take caution when using economists to specify optimal policy options using current generation of IAMs. There lacks the integration of uncertainty into the equation and that could mislead the data. With that in mind, economists do provide an alternative perspective and have useful insights for climate policy. Economists should work alongside those who have an understanding of climate unpredictability.
MOST RELEVANT FOR:	National, provincial, and local governments looking into alternative ways to integrate climate policy.
HOW TO ACCESS:	http://www.e3network.org/resources/DeCanio,%20Ackerman,%20Howarth,%20and%20Sheeran%20LimitsOfIAMsOfClimateChange.pdf

TITLE:	**Limiting Liability in the Greenhouse: Insurance Risk-Management Strategies in the Context of Global Climate Change**
AUTHOR(S):	Christina Ross, Evan Mills, and Sean Hecht
TYPE OF DOCUMENT:	Academic Research Paper
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	The primary goal of this article is to identify practical risk-management strategies that will allow insurers and other businesses to preemptively mitigate their exposure to climate-change liability. This article explores 3 major dimensions of the issue: source of climate change related legal liability to third parties and their nexus with insurance and law; new liabilities associated with potential technological responses to climate change; and potential roles for insurers, reinsurers and other industry actors in proactively managing climate change-related liability insurance risks for themselves and their customers. This paper is organized into the following parts: • Part II of this article provides background on how liability from climate change related events can affect the insurance sector. • Part III discusses specific impacts of climate change and how legal liability stemming from those impacts may affect various lines of insurance. • Part IV evaluates the effects on liability insurance responses to climate change impacts. • Part V discusses and recommends actions this industry can take to proactively reduce liability insurance risk relating to climate change, providing real-world examples of ways insurers help their customers avoid liabilities and other types of insured losses.
KEY FINDINGS:	U.S based insures' knowledge of climate-change impacts has been largely focused on property and casualty insurance lines. The focus is almost singularly on damage to fixed structures. Much less consideration has been given to other lines such as auto marine, business interruption, and crop loss. Even less consideration has been given to health and life exposure. Much of this article pertains to U.S examples, but issues can be generalized. Liability claims related to climate change have emerged in Australia, Germany, New Zealand, the United Kingdom and perhaps everywhere.
MOST RELEVANT FOR:	Regional, provincial and local governments.
HOW TO	http://ssrn.com/abstract=987942

ACCESS:	

TITLE:	**Stern Report: Stern Review On The Economics Of Climate Change**
AUTHOR(S):	Nicholas Stern
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2003
GEOGRAPHIC SCOPE:	International
ABSTRACT:	This resource shows that there is now clear scientific evidence that emissions from economic activity, particularly the burning of fossil fuels for energy, are causing changes to the Earth´s climate. A sound understanding of the economics of climate change is needed in order to underpin an effective global response to this challenge. The Stern Review is an independent, rigorous and comprehensive analysis of the economic aspects of this crucial issue. It has been conducted by Sir Nicholas Stern, Head of the UK Government Economic Service, and a former Chief Economist of the World Bank. The Economics of Climate Change will be invaluable for all students of the economics and policy implications of climate change, and economists, scientists and policy makers involved in all aspects of climate change. Contents: 1. Climate change: our approach; 2. Impacts of climate change on growth and development; 3. The economics of stabilization; 4. Policy responses for mitigation; 5. Policy responses for adaptation; 6. International collective action.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	**Local, Provincial or Federal Government**
HOW TO ACCESS:	Available for purchase from http://www.cambridge.org/catalogue/catalogue.asp?isbn=9780521700801

TITLE:	The Economics of Ecosystems and Biodiversity: *Climate Issues Update*
AUTHOR(S):	Pavan Sukhdev, Joshua bishop, Patrick ten brink, Haripriya Gundimeda, Katia Karousakis, Pushpam Kumar, Carsten Neßhöver, Aude Neuville, David Skinner, Alexandra Vakrou, Jean-Louis Weber, Stephen White, and Heidi Wittmer
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	This report assesses the economic magnitude of the human welfare impacts of losing natural areas, especially forests. It described, in economic terms, the fundamental links between eliminating poverty and conserving biodiversity and ecosystems. It highlights ethical issues underlying the choice of discount rates to evaluate the benefits of wild nature for human welfare. The report also prepares the ground for phase 2 of TEEB with some preliminary analysis of the policy implications of available economic evidence. Lastly, the report spelt out the main ambition for phase 2 of TEEB, which is to help 'mainstream' the economics of ecosystems and biodiversity.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.unep.ch/etb/ebulletin/pdf/TEEB-ClimateIssuesUpdate-Sep2009.pdf

TITLE:	**The US Economic Impacts of Climate Change and the Costs of Inaction**
AUTHOR(S):	University of Maryland, Center for Integrative Environmental Research (CIER)
TYPE OF DOCUMENT:	Policy Assessment
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	This report presents a review of economic studies for the United States and relates them to predicted impacts of climate change. The summary findings are organized by region and identify the key sectors likely affected by climate change, the main impacts to be expected, as well as estimates of costs. The report builds on the 2000 Global Change Research Program National Assessment, using additional regional and local studies, as well as new calculations derived from federal, state and industry data sources.
KEY FINDINGS:	From this review and quantification, five key lessons emerge: 1. Economic impacts of climate change will occur throughout the country. 2. Economic impacts will be unevenly distributed across regions and within the economy and society. 3. Negative climate impacts will outweigh benefits for most sectors that provide essential goods and services to society. 4. Climate change impacts will place immense strains on public sector budgets. 5. Secondary effects of climate impacts can include higher prices, reduced income and job losses. The data and information in this report strongly support a call for action to avoid the most severe impacts of climate change, as well as to prepare for and adapt to those impacts that are unavoidable.
MOST RELEVANT FOR:	This report is most relevant for anyone working on large-scale policy development in North America.
HOW TO ACCESS:	http://www.cier.umd.edu/documents/US%20Economic%20Impacts%20of%20Climate%20Change%20and%20the%20Costs%20of%20Inaction.pdf

Frameworks / Guides

TITLE:	**Adapting to Climate Change: A Risk-based Guide for Local Governments in Alberta**
AUTHOR(S):	Robert A. Black, James P. Bruce, I.D. Mark Egener
TYPE OF DOCUMENT:	Risk Management Guide
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Alberta
ABSTRACT:	The provinces' and territories municipal legislation, environmental laws and emergency management arrangements among other legislation or policy, all require in one way or another, that municipalities take action to prevent, mitigate and correspond to threats to human health and safety, public property and the environment. This guide assists regional and local government planners, health officials, emergency managers, infrastructure managers and others understand the risks of potential climate impacts and various means of managing them. This guide describes a risk-based approach that communities can use to adapt to climate change through long-term planning and short term responses. It also provides climate trends and projections specific to Alberta to allow local governments to tailor their strategy to their local climatic context.
KEY FINDINGS:	Despite mounting evidence that gives credibility to climate change and increasing variability, some communities have not fully accepted the need to start examining their situations now. The guide suggests that some preliminary analyses could be undertaken at little cost and would provide a convincing case for action on adaptation.
MOST RELEVANT FOR:	Local and Regional governments in Alberta
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/projdb/pdf/176b_e.pdf

TITLE:	**Adapting to Climate Change: A Risk-based Guide for Local Governments in British Columbia**
AUTHOR(S):	Robert A. Black, James P. Bruce, I.D. Mark Egener
TYPE OF DOCUMENT:	Risk Management Guide
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	British Columbia
ABSTRACT:	The provinces' and territories municipal legislation, environmental laws and emergency management arrangements among other legislation or policy, all require in one way or another that municipalities take action to prevent, mitigate correspond to threats to human health and safety, public property and the environment. This guide assists regional and local government planners, health officials, emergency managers, infrastructure managers and others understand the risks of potential climate impacts and the priorities and means of managing them. The guide describes a risk-based approach that communities can use to adapt to climate change through long-term planning and short term responses. It also provides climate trends and projections specific to British Columbia to allow local governments to tailor their strategy to their local climatic context.
KEY FINDINGS:	Despite mounting evidence that gives credibility to climate change and increasing variability some communities have not fully accepted the need to start examining their situations now. The guide suggests that some preliminary analyses could be undertaken at little cost and would provide a convincing case for action on adaptation.
MOST RELEVANT FOR:	Local and Regional governments in British Columbia
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/projdb/index_e.php

TITLE:	**Adapting to Climate Change: A Risk-based Guide for Local Governments in Ontario**
AUTHOR(S):	Robert A. Black, James P. Bruce, I.D. Mark Egener
TYPE OF DOCUMENT:	Risk Management Guide
PUBLICATION DATE:	2006
GEOGRAPHIC SCOPE:	Ontario
ABSTRACT:	The provinces' and territories municipal legislation, environmental laws and emergency management arrangements among other legislation or policy, all require in one way or another that municipalities take action to prevent, mitigate correspond to threats to human health and safety, public property and the environment. This guide assists regional and local government planners, health officials, emergency managers, infrastructure managers and others understand the risks of potential climate impacts and the priorities and means of managing them. The guide describes a risk-based approach that communities can use to adapt to climate change through long-term planning and short term responses. It also provides climate trends and projections specific to Ontario to allow local governments to tailor their strategy to their local climatic context.
KEY FINDINGS:	Despite mounting evidence that gives credibility to climate change and increasing variability some communities have not fully accepted the need to start examining their situations now. The guide suggests that some preliminary analyses could be undertaken at little cost and would provide a convincing case for action on adaptation.
MOST RELEVANT FOR:	Local and Regional governments in Ontario
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/projdb/pdf/176a_e.pdf

TITLE:	**Adapting to climate change: Towards a European framework for action**
AUTHOR(S):	Commission of the European Communities
TYPE OF DOCUMENT:	Adaptation Framework for European Communities
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	European Union
ABSTRACT:	This White Paper sets out a framework to reduce the European Union's (EU) vulnerability to the impacts of climate change. It builds on the wide-ranging consultation launched in 2007 by the Green Paper on Adapting to Climate Change in Europe and further research efforts that identified action to be taken in the short-term. The framework is designed to evolve as further evidence becomes available. It will complement action by Member States and support wider international efforts to adapt to climate change, particularly in developing countries. The EU is also working with other partner countries in the UNFCCC towards a post-2012 climate agreement which will address adaptation as well as mitigation.
KEY FINDINGS:	The EU's framework adopts a phased approach. The intention is that phase 1 (2009-2012) will lay the ground work for preparing a comprehensive EU adaptation strategy to be implemented during phase 2, commencing in 2013. Phase 1 will focus on four pillars of action: 1) building a solid knowledge base on the impact and consequences of climate change for the EU, 2) integrating adaptation into EU key policy areas; 3) employing a combination of policy instruments (market-based instruments, guidelines, public-private partnerships) to ensure effective delivery of adaptation and 4) stepping up international cooperation on adaptation. For phase 1 to be a success, the EU, national, regional and local authorities must cooperate closely. The proposals set out in this paper covers actions to be taken in the first phase and are without prejudice to the future structure of the EU budget and to the current and future multi-annual financial framework.
MOST RELEVANT FOR:	Local and regional governments in the European Union
HOW TO ACCESS:	http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0147:FIN:EN:PDF

TITLE:	Climate Change Adaptation: A Framework for Local Action
AUTHOR(S):	Rosie Rowe and Anita Thomas
TYPE OF DOCUMENT:	Online resource
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Australia
ABSTRACT:	This Framework is intended to guide local action to address the health and social impacts of climate change and rural adjustment. The Framework takes a strategic approach to the impacts of climate change, with a focus on health promotion. The Framework aims to: • Identify local priority issues of climate change and rural adjustment; • Guide local planning and action by agencies and by the Souther Grampains and Glenelg Primary Care Partnership (PCP) as a collective; and • Encourage the development of inter-sectoral partnerships and integrated planning
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.sggpcp.com/news/Policy_signpost_3.pdf

TITLE:	Climate Change Impacts, Risks and the Benefits of Mitigation
AUTHOR(S):	Commonwealth Scientific and Industrial Research Organization (CSIRO)
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2006
GEOGRAPHIC SCOPE:	Australia
ABSTRACT:	This report outlines a framework for comparing policy-related risks and benefits of climate change and describes the major uncertainties and methods used in climate risk analysis. The psychological framing of risk suggests that the decision space comparing climate with policy risks is asymmetrical. This is because losses are perceived differently to gains. Where there are losses to a particular area that have a high degree of risk averseness or precaution attached to it, then a higher burden of proof is required to engage in risk-taking, or change, behaviour.
KEY FINDINGS:	When contrasted with the costs of acting, the risks of not acting on climate change clearly outweigh those associated with acting. This report presents risk assessment techniques that allow the comparison of climate and policy risks by considering risks to both monetary and non-monetary impacts and mitigation greenhouse gas emission scenarios. The monetary analyses take the form of an expected value analysis that takes into account risk-weighted estimates of climate sensitivity and cost curves, expressed as the percentage damage to GDP as a function of global warming. Non-monetary risk analyses are carried out for damage functions developed to assess extinction risk to species, damage to coral reefs, decline in north Atlantic thermohaline circulation and melting of the Greenland ice sheet. We still have little idea about how the economy might be affected if large-scale biophysical systems were to substantially alter – it is these uncertainties that lead natural and environmental scientists to attach much higher damages to climate change than economists. Therefore, even though economic damages may be relatively low at warming of <3°C, the shape of an economic damage curve is likely to be highly non-linear, especially at higher levels of warming.
MOST RELEVANT FOR:	Academics, scientists, policy makers, and general public.
HOW TO ACCESS:	http://www.csiro.au/files/files/pb9u.pdf

TITLE:	Excessive Heat Events Guidebook
AUTHOR(S):	United States Environmental Protection Agency
TYPE OF DOCUMENT:	Guidebook designed to assess Excessive Heat Events and develop notification and response plans
PUBLICATION DATE:	June 2006
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	This guidebook provides critical information that local public health officials and others need in order to begin assessing their Excessive Heat Events (EHE) vulnerability and developing and implementing EHE notification and response programs. The two basic goals of the guidebook are: first, to provide local health and public safety officials with the information they need to develop EHE criteria and evaluate the potential health impacts of EHEs, and second, to offer a menu of EHE notification and response actions to be considered. • Chapter 2 provides information on EHE-attributable health impacts and sources of risk that affect the vulnerability of individuals and communities to EHEs. • Chapter 3 gives the menu of notification and response options that local officials can use as a starting point when considering whether to develop or enhance an EHE program. • Chapter 4 provides recommendations that should be considered when developing an EHE notification and response program. In addition, this guidebook includes a series of appendices with information that officials may want to incorporate in other materials or make available independent of the guidebook. This information includes: a partial list of resources for additional information on EHE-attributable health risks and impacts and details on EHE programs, and a summary of specific actions people and communities can take in response to forecast EHE conditions to reduce the risk of experiencing heat-attributable health problems.
KEY FINDINGS:	EHEs can increase the number of deaths (mortality) and nonfatal outcomes (morbidity) in vulnerable populations. Climate research suggests that future health risks of EHEs could increase with an increase in EHE frequency and severity. To develop appropriate EHE responses, local officials need to understand the risks that these events pose to their populations and their response options. The intent of this guidebook is to address both needs.
MOST RELEVANT FOR:	Local governments and public health officials, especially in large metropolitan areas.
HOW TO	http://www.epa.gov/heatisland/about/pdf/EHEguide_final.pdf

ACCESS:	
TITLE:	Heat Health Action Plans
AUTHOR(S):	Franziska Matthies, Graham Bickler, Neus Cardeñosa Marín, Simon Hales (eds)
TYPE OF DOCUMENT:	Guidebook
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	International
ABSTRACT:	This guidebook results from the EuroHEAT project on improving public health responses to extreme weather/heat-waves, co-funded by the European Commission. It explains the importance of the development of heat–health action plans, their characteristics and core elements, with examples from several European countries that have begun their implementation and evaluation. A defined heat-health action plan involves a portfolio of actions at different levels, including meteorological early warning systems, timely public and medical advice, improvements to housing and urban planning, and ensuring that health care and social systems are ready to act. These actions can be integrated into a defined heat–health action plan. Chapter 1 introduces climate change, heat waves and public health responses. Chapter 2 outlines the short-term relationship between heat and health, explains which population groups are most at risk and describes the interaction between heat and air pollution. The general principles and characteristics of national and regional heat–health action plans are described in Chapter 3 and all core elements are dealt with in detail.
KEY FINDINGS:	Core Elements of Heat-Health Action Plans: 1. Agreement on a lead body (to coordinate a multipurpose collaborative mechanism between bodies and institutions and to direct the response if an emergency occurs); 2. Accurate and timely alert systems (heat–health warning systems trigger warnings, determine the threshold for action and communicate the risks); 3. A heat-related health information plan (about what is communicated, to whom and when); 4. A reduction in indoor heat exposure (medium- and short-term strategies) (advice on how to keep indoor temperatures low during heat episodes);

	5. Particular care for vulnerable population groups; 6. Preparedness of the health and social care system (staff training and planning, appropriate health care and the physical environment); 7. Long-term urban planning (to address building design and energy and transport policies that will ultimately reduce heat exposure); and 8. Real-time surveillance and evaluation.
MOST RELEVANT FOR:	The publication is aimed at ministries of health and regional and local health authorities that support these ministries.
HOW TO ACCESS:	http://www.euro.who.int/Document/E91347.pdf

TITLE:	Heatwave Plan for England: Protecting Health and Reducing Harm Extreme Heat and Heatwaves
AUTHOR(S):	National Health Services
TYPE OF DOCUMENT:	Public document
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	United Kingdom
ABSTRACT:	The plan explains the responsibilities at national and local level for alerting people once a heatwave has been forecast, and for advising them on how to respond and what to do during a heatwave. Some core elements of the plan are: • Advice and information to the public and to health and social care professionals, particularly those working with atrisk groups, both before a heatwave is forecast and when one is imminent; • The Strategic Health Authority (SHA) role in a heatwave is to ensure that local services have the capacity and capability to deliver their functions as laid out in this plan; • Hospitals and care, residential and nursing homes to provide cool areas and monitor indoor temperatures to reduce the risk of heat-related illness and death in the most vulnerable populations; and • Longterm multiagency planning to adapt to and reduce the impact of climate change, including 'greening the built environment', increasing shading around and insulation of buildings, increasing energy efficiency and reducing carbon emissions.
KEY FINDINGS:	There are three affirmative action's stated in this plan: summer preparedness and long term planning; alert and readiness; and heatwave action/Emergency.
MOST RELEVANT FOR:	National, provincial and local government and all associated stakeholders, including members of the public.
HOW TO ACCESS:	http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_099583.pdf

TITLE:	**ICLEI Oceania: Local Government Climate Change Adaption Toolkit**
AUTHOR(S):	ICLEI Oceania
TYPE OF DOCUMENT:	Toolkit
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Australia
ABSTRACT:	The adaptive management process in this toolkit merges the Australian Government's risk management framework with the capacity building frameworks that ICLEI Oceania has developed over the years of supporting the Cities for Climate Protection (CCP) councils. It is designed to complement the risk management process outlined in the Australian Government's *Climate Change Impacts & Risk Management* (CCIRM) guide. The toolkit outlines an adaptive manag1ement process and provides a set of tools and exercises meant to assist councils as they work through the process. The step-by-step adaptive management process in the toolkit is similar to the step-by-step processes in risk management, the CCP Milestone Framework and council-based processes for emergency preparedness. The toolkit is organized according to the adaptive management process with each section covering a different phase in the process. It outlines how and when to use each of the included tools as a complement to the adaptive management process. The following is an overview of the toolkits step-by-step process. Step 1: Establish the context Step 2: Identify the risks Step 3: Analyze the risks and opportunities Step 4: Evaluate the risks and opportunities Step 5: Develop options Step 6: Develop action/treatment plan Step 7: Implement the adaptation action plan Step 8: Review Progress Step 9: Revise the adaptation action plan

	Repeat
KEY FINDINGS:	The tools range from simple and self-directed templates to more complex exercises. They are as follows: 1. Council Questionnaire *(self-directed)* 2. Planning Workshop Template *(facilitator required)* 3. Tools Worksheet *(facilitator encouraged as part of planning workshop)* 4. Stakeholder Identification Worksheet *(facilitator encouraged as part of planning workshop)* 5. Adaptive Management Scoping Worksheet *(facilitator encouraged as part of planning workshop)* 6. Social Contract Template *(facilitator encouraged as part of planning workshop)* 7. Issue Brief and Direct Impacts *(self-directed)* 8. Conceptual Modeling Exercise and Example *(facilitator encouraged)* 9. Support Letter *(self-directed)* 10. Barriers Document *(self-directed)* 11. Risk Assessment Scenario Worksheet *(self-directed)* 12. Action Planning Workshop Template *(facilitator required)* 13. Assumptions Worksheet *(facilitator highly encouraged)* 14. Action Plan Template *(self-directed)*
MOST RELEVANT FOR:	Australian Local Governments
HOW TO ACCESS:	http://www.iclei.org/fileadmin/user_upload/documents/ANZ/CCP/CCP-AU/Projects/AI/AdaptationToolkit/Toolkit_CCPAdaptation_Final.pdf

TITLE:	Mapping for Preparedness A Guide to Improved Emergency Management Through Location-Based Solutions
AUTHOR(S):	Bjorn Rutten
TYPE OF DOCUMENT:	Guidebook
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	The Conference Board of Canada, with the contribution of GeoConnections, has conducted a project on the topic of building spatial data infrastructures (i.e., the frameworks, standards, and guiding principles that support geospatial information systems). The research includes a literature review, 43 interviews with key individuals (including information users, information providers, and other subject-matter experts), and a one-day workshop focused on clearly identifying both the challenges and the approaches that can be taken to overcome these challenges. The report explains: • the role of location-based information in emergency management; • helps Canadian organizations understand the value proposition of sharing location-based data for the purpose of emergency management; • presents approaches that have been taken in other jurisdictions geared toward information exchange with their infrastructure communities highlighting • successful national and international initiatives and their lessons learned; • identifies and analyzes the barriers to public-private information sharing, particularly as they apply to infrastructure information; and • identifies six strategies critical to the success of creating more awareness of and private sector engagement in the use of geospatial information in emergency management.
KEY FINDINGS:	The standards, principles, and frameworks of the Canadian Geospatial Data

	Infrastructure (CGDI) play a central role in enabling local and regional systems to share selected data sets with regional, national, and international partners, based on clearly defined requirements and roles. This report identifies six Critical Success Factors: • Communicate the value of the Canadian Geospatial Data Infrastructure and its common standards and principles • Clearly define your requirements based on needs • Focus on the location of the infrastructure • Keep the notion of criticality off the table • Accommodate for infrastructure diversity • Take a regional approach
MOST RELEVANT FOR:	Local and regional governments and other organizations in Canada.
HOW TO ACCESS:	http://www.conferenceboard.ca/documents.aspx?did=3014

TITLE:	Principles for an Intergovernmental Agreement for Coastal Planning and Climate Change in Australia
AUTHOR(S):	Barbara Norman
TYPE OF DOCUMENT:	Online Journal
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Coastal communities in Australia
ABSTRACT:	The paper focuses on coastal urbanization and the planning for climate change. The Australian coastal zone is home to over 85% of the Australian population with coastal townships expanding rapidly. The International Panel on Climate Change predicts that the Australian coast will experience increasing storm surge and rising sea levels. A set of principles proposed to underpin an intergovernmental agreement on coastal planning and climate change. The Agreement would include actions such as regional planning, policy integration, financial incentives and innovative regulatory mechanisms that use both mitigation and adaptation in complimentary and reinforcing ways. Selected case studies including peri-urban and sea change locations are used to examine the dynamic for current urban planning and institutional arrangements to incorporate such mitigation and adaptation measures for climate change.
KEY FINDINGS:	Principles for an intergovernmental agreement on coastal planning and climate change in Australia: 1. That a coastal climate change buffer zone be declared to underpin a precautionary approach to coastal development in proximity to the coastal foreshore; 2. That coastal dependent uses be the primary land use activity on coastal public lands; 3. That an ongoing evidence-based assessment of cumulative risk and impact of climate change impacts on the coastal environment be undertaken to advise government and industry policy responses; 4. That the importance of community engagement in place-based solutions be recognized as critical to achieving sustainable outcomes; 5. That 'sustainable regional plans' for managing urban growth and infrastructure be recognized as a key policy instrument in implementing integrated coastal management; 6. That the intrinsic value of natural and cultural heritage and indigenous interests in coastal planning be recognized in developing responses to climate change; and 7. That capacity building for local communities including tools for climate change adaptation is supported over the long term.
MOST	Coastal local governments

RELEVANT FOR:	
HOW TO ACCESS:	http://www.sustainability.mav.asn.au/content/upload/files/publications/Principles-for-an-Intergovernmental-agreement-climate-change-and-coastal-planning8873.pdf

TITLE:	Water and Watershed Planning: A Guide for British Columbia Communities
AUTHOR(S):	Fraser Basin Council, Sheila Creighton and Steve Litke
TYPE OF DOCUMENT:	Guidebook
PUBLICATION DATE:	Publication pending – scheduled for completion in spring 2011
GEOGRAPHIC SCOPE:	British Columbia
ABSTRACT:	The BC Ministry of Environment and the BC Regional Adaptation Collaborative have engaged the Fraser Basin Council to develop a Guide that will provide greater clarity and understanding to support water and watershed planning initiatives, and outline ways of integrating climate change adaptation within these planning processes. The Guide, being developed for local governments, First Nations, and other community stakeholders, will seek to: • Identify and describe water and watershed planning tools (e.g. Water Use Plans, Water Management Plans, Allocation Plans and other tools), • Clarify processes and interactions between regulatory and non-regulatory tools and identify gaps in these available tools; • Identify how each planning tool fits within, and is affected by, the wider planning framework; • Share experiences and lessons learned from communities that have used different regulatory and non-regulatory tools; • Help communities identify appropriate tools for identifying climate-related vulnerabilities and adaptation options; • Help communities determine the appropriate tools for managing water and adapting to climate change; and, • Build understanding about the values and benefits of water and watershed planning as well as climate change adaptation.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local governments, First Nations, stewardship groups and others interested in water and watershed planning.
HOW TO ACCESS:	Contact: Sheila Creighton, Program Coordinator: phone 604-488-5373, fax 604-488-5351, email screighton@fraserbasin.bc.ca or Steve Litke, Program Manager: phone: 604-488-5358, fax 604 488-5351, email slitke@fraserbasin.bc.ca

GENERAL ADAPTATION INFORMATION

TITLE:	**Cities and Communities: The Changing Climate and Increasing Vulnerability of Infrastructure**
AUTHOR(S):	Heath Auld and Don MacIver
TYPE OF DOCUMENT:	General resources
PUBLICATION DATE:	2005
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	Climate change will affect infrastructure through gradual changes in weather patterns and increasing vulnerability to extreme events. The first step in reducing risks to infrastructure is to seek to identify gaps in current capacity for addressing climate variability and extremes. Emphasizing how to design against infrastructure damage this resources looks at: • Climate Change and Engineering Codes and Standards • Premature Weathering of Infrastructure • Adaptation Options and Actions Supporting Infrastructure • Structural Codes and Standards, Climate Design Values and Engineering Practices • Prioritizing Adaptation Actions for Critical Infrastructure and Vulnerable Regions • Improving Community Disaster Management • Education and Outreach of Engineering and Planning Communities and Public
KEY FINDINGS:	"No regrets" adaptation actions are available in the here and now to reduce vulnerability to infrastructure. These "no regrets" actions include measures that reduce uncertainties in climatic design values and update calculations, enforce engineering codes and standards, safeguard the quality and length of climate data records and networks, regularly maintain existing infrastructure, and consistent forensic analysis of infrastructure failures and community disaster management planning.
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=FF501AF7-ACC4-4322-8EB8-69CDF8F12B82

TITLE:	Climate Change 101: Adaptation
AUTHOR(S):	Pew Center
TYPE OF DOCUMENT:	General Adaptation Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	United States
ABSTRACT:	Adaptation planning at the local, state, and national levels can limit the damage caused by climate change, as well as the long-term costs of responding to climate-related impacts that are expected to grow in number and intensity in the decades to come. Climate Change 101: Adaptation discusses the most current scientific evidence for climate change and explains its causes and potential impacts in depth. It also explains how planning can limit the damage caused by unavoidable climate change, as well as the long-term costs of responding to climate-related impacts
KEY FINDINGS:	There is a lack of resources dedicated to adaptation planning even though proactive approaches to reducing risks can result in significant cost savings in the decades ahead, while also protecting critical systems and human life. The United States Federal Government must take action on adaptation. Potential adaptation strategies across the U.S. include: • Intellectual leadership, research and development • Policy and Regulation • Coordination • Sharing of Best Practices • Models and Planning Tools • Education and Awareness • Funding • Federal Lands This brief was prepared as part of a series called *Climate Change 101: Understanding and Responding to Global Climate Change*, published by the Pew Center on Global Climate Change and the Pew Center on the States. Additional reports are available from the Pew Center of Global Climate Change (www.pewclimate.org)
MOST RELEVANT FOR:	Local, State and Federal governments in the United States.
HOW TO ACCESS:	http://www.pewclimate.org/docUploads/Climate101-Adaptation-Jan09.pdf

TITLE:	Climate Change Adaptation Knowledge Needs Survey Report
AUTHOR(S):	North South Climate Change Network
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	Efforts to consolidate regional awareness of climate issues and to create a dialogue among member groups of the North South Climate Change Network (NSCCN) have led to various actions; one of which is the distribution of the Needs Assessment Survey. The goal of NSCCN is to foster dialogue among member groups concerned about climate change, resulting in improved strategies and reduced vulnerability to climate change. This Report on the Needs Assessment Survey will serve to inform the Network and will provide participants with potential contacts and resources.
KEY FINDINGS:	The survey was distributed to 60 organizations (30 from north and 30 from south). The 24 completed surveys will inform the Network and provide a basis on the following factors: • level of knowledge of climate change; • responses to climate change vulnerability; • activities to reduce greenhouse gas emissions; • knowledge of climate change mitigation and adaptation; • adaptation planning; • planning barriers; and • general climate change concerns. There is great interest in reducing community vulnerability by planning for climate change and improving adaptation strategies. There is also a majority agreement of the need to prepare for any potential threats and opportunities posed by climate variability. Each province and region will experience its own set of impacts and changes which need to be planned for.
MOST RELEVANT FOR:	Communities and stakeholders interested in understanding public opinion on climate change impacts at a local level.
HOW TO ACCESS:	http://www.cleanairpartnership.org/files/NSCCN%20Needs%20Assessment%20Final%20Report%20October%202009_0.pdf

TITLE:	Climate Change, Natural Hazards and Cities
AUTHOR(S):	Gordon McBean and Dan Henstra
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2003
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	Canadians face a wide range of temperatures and climatic conditions and have adapted well to these variables. By anticipating the urban impacts of climate change and incorporating them into city planning, communities can bolster adaptive capacity in spite of the changes to the environment which will be experienced in the coming years. Active efforts to reduce vulnerability will protect the lives of Canadians and reduce losses from natural disasters. This paper discusses the implications of climate change for natural hazards that threaten Canada's cities, explores the expected impacts of this changing hazard variable and identifies strategies for adaptation that can be employed in response.
KEY FINDINGS:	Natural hazards pose a significant threat to cities in Canada. These can be measured in physical disruption of infrastructure, human health effects and economic losses from damage and lost productivity. Climate change is expected to change the nature of hazards that surround Canadian cities, demanding adaptation in order to prevent catastrophic loss. As the climate changes, local governments will have to tailor a program of adaptation that will reduce community vulnerability and mitigate the impact of increasingly volatile natural hazards. Several strategies for adaptation can be used by governments to target the vulnerabilities of communities to changing natural hazards including: hazard assessment and monitoring; planning and building codes; prediction and warning systems and public education and research.
MOST RELEVANT FOR:	Local, Provincial and Federal governments in Canada
HOW TO ACCESS:	http://wsm.ezsitedesigner.com/share/scrapbook/42/425698/Climate_Change,_Natural_Hazards_and_Cities.pdf

TITLE:	**More Extreme Heat Waves: Global Warming's Wake Up Call**
AUTHOR(S):	National Wildlife Federation
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	This report shows the affects of how global warming comes into play; as it will bring more extreme heat waves. Urban areas will have exacerbated affects as asphalt, concrete and other infrastructures absorb reradiated heat. Heat waves are also critical for very old and young dwellers as well as those who already have health problems. However, it is more than just urban areas to be affected, as natural habitats and agricultural land stand to feel the impacts of heat waves.
KEY FINDINGS:	This report puts forth a set of recommendations in order to protect landscapes and people from extreme heat waves. The recommendations are as follows: • Make cities cooler and greener through design and the use of vegetation to absorb the heat; • Implement public health measures that not only reduce the impact but also takes a proactive approach to vulnerable populations; and • Safeguard wildlife, fish, and habitats from extreme heat.
MOST RELEVANT FOR:	National, provincial and local government, as well as associated stakeholders and members of the public.
HOW TO ACCESS:	http://www.docstoc.com/docs/10383286/More-Extreme-Heat-Waves--Global-Warmings-Wake-Up-Call

TITLE:	Municipal Resources for Adapting to Climate Change
AUTHOR(S):	Partners for Climate Protection: ICLEI – Local Governments for Sustainability and the Federation of Canadian Municipalities
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	This report provides information to Partners for Climate Protection members and other municipal officials about municipal adaptation initiatives, different types of climate change adaptation and mitigation programs, and to provide resources for municipal officials who wish to undertake adaptation planning, such as a list of organizations working with Canadian communities on adaptation planning. For communities that wish to initiate an adaptation and mitigation program, this is a helpful resource with points of reference for further information.
KEY FINDINGS:	This document provides a list of Canadian cities and a detailed account of climate change mitigation and adaptation focus areas.
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.sustainablecommunities.ca/files/Capacity_Building_-_PCP/PCP_Resources/Mun-Re-_Adapting-Climate-Change-e.pdf

TITLE:	**The Earthscan Reader on Adaptation to Climate Change**
AUTHOR(S):	Lisa F. Schipper and Ian Burton (eds.)
TYPE OF DOCUMENT:	Hard copy book
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	The book gathers some of the most significant writings on adaptation to climate change from the past two decades. Following an introduction tracing the evolution of adaptation from a biological concept into a policy objective the books is divided into five parts: 1) Adaptation Theory 2) Adaptation, Vulnerability and Resilience 3) Adaptation and Disaster Risk 4) Adaptation and Development 5) Adaptation and Climate Change Policy
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Students, policy makers, researchers, activists, local government staff and NGOs
HOW TO ACCESS:	Book can be ordered online from http://www.earthscan.co.uk/

TITLE:	The Mitigation-Adaptation Dichotomy and the Role of Spatial Planning
AUTHOR(S):	G. Robbert Biesbroek, Rob J. Swart, Wim G.M. Van Der Knaap
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	International
ABSTRACT:	There is a growing awareness that both adaptation and mitigation measures are needed to reduce the impacts of climate change. Historically, due to a wide variety of reasons, mitigation and adaptation have been framed by scientists and policy makers as two different approaches to deal with the same problem: climate change. As a result, there are large differences in the way knowledge is produced, the analytical approaches that are used, and the designed policy strategies. This paper discusses the origin of the adaptation–mitigation dichotomy. Second, the paper addresses the relationship between climate change responses and spatial planning since there is a growing awareness that spatial planning can function as a switchboard for mitigation, adaptation and sustainable development objectives. Furthermore, the paper explores the role that spatial planning can play in developing effective mitigation and adaptation options in an integrated manner, searching for synergies and trade-offs. This creates the necessity to take climate change responses into account in spatial planning practices. Climate change could also lead to changes in the traditional administrative structures that spatial planners are accustomed to. Since many of the main impacts of climate change have a water dimension, it discuss the river basin approach as the new administrative level at which spatial planning can increase the effectiveness of adaptation and mitigation measures and integrate these into other sustainable development policies.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local, Provincial and Federal Government
HOW TO ACCESS:	http://journals2.scholarsportal.info/details.xqy?uri=/01973975/v33i0003/230_tmdatrosp.xml

TITLE:	**The Skilled Facilitator Fieldbook: Tips, Tools, and Tested Methods for Consultants, Facilitators, Managers, Trainers, and Coaches**
AUTHOR(S):	Roger Schwarz, Anne Davidson, Peg Carlson, and Sue McKinney
TYPE OF DOCUMENT:	Fieldbook for facilitators
PUBLICATION DATE:	2005
GEOGRAPHIC SCOPE:	n/a
ABSTRACT:	The fieldbook introduces the Skilled Facilitator approach and seeks to share the principles and methods learned from applying this approach in the field. The book spans the full scope of the approach, from how to get started to how to integrate the approach with existing organizational structures and processes. It provides tips on introducing facilitation methods as well as guidelines for engaging audiences. It includes a variety of tips, exercises and sample agendas.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	The book is relevant for anyone who wants to work with others to develop more powerful results and more productive working relationships. This includes facilitators, consultants, leaders and managers, team members, coaches and teachers.
HOW TO ACCESS:	Available for purchase online via online bookstores (i.e. Amazon, Indigo etc)

MUNICIPAL ADAPTATION

Title:	**Ahead of the Storm: Preparing Toronto for Climate Change**
Author(s):	Toronto Environment Office
Type of document:	Guidebook
Publication date:	2008
Geographic scope:	City of Toronto
Abstract:	The purpose of this document is to propose a series of actions to improve Toronto's resilience to climate change. These include: • A series of short-term actions beginning in 2008 that will help prevent and/or minimize the potential impacts of climate change on Toronto; and • A series of actions that will guide the City's development of a comprehensive, long-term strategy to adapt to climate change.
Key findings:	In order to establish a strong adaptation process, progress should be monitored and evaluated on an ongoing basis. The report concludes with a list of actions for such an adaptation process. These include: 1. City operated groups that have identified and proposed short term adaptation actions should make the business case for implementing these actions and seek the appropriate approval(s) to ensure implementation. 2. Establish a mechanism to ensure that the City's leaders are regularly updated about climate change impacts and adaptation planning to ensure continual progress. 3. Make climate change a key mandate of the Executive Environment Team and commit to coordinating climate change planning across the City's Agencies, Boards Commissions, Corporations and Divisions to ensure efficient and effective implementation. 4. Ensure that divisions likely to be significantly affected by climate change have staff dedicated to impacts assessment and adaptation options review. 5. Establish a formal mandate, workplan and responsibilities for the City's Adaptation Steering Group. Ensure that all sectors likely to be affected by climate change, and/or are essential for adaptation, are represented and active. 6. Set up a mechanism for regular reporting on the work of the

	Adaptation Steering Group to Management. 7. Establish or enhance issue based adaptation working groups in areas that are already experiencing impacts from extreme weather or are at high risk of impacts, including: water, health, infrastructure, energy, urban ecosystems (e.g. forestry/green space) and emergency preparedness. 8. Develop a communications plan and implement inreach activities such as workshops, webinars and electronic communications to increase the awareness of management and front-line City staff about the local impacts of climate change and adaptation. 9. Establish a working group within the Adaptation Steering Group to identify training needs and opportunities for staff involved in climate change risk assessments and adaptation strategies. 10. Include climate change considerations and explicit goals for adaptation in plans, programs, strategies and assessment procedures, including: Toronto's Official Plan; Wet Weather Flow Master Plan; Transit City Plan; Parks, Forestry and Recreation Strategic Plan to name a few. 11. Incorporate explicit climate change considerations into existing programs that were designed to protect against current climate extremes, and adjust programs to provide additional protection where necessary. 12. All City agencies, boards, commissions and divisions should consider climate change in their emergency management and business continuity planning. 13. Establish a formal mechanism for periodic review or progress on climate change adaptation which is communicated to decision-makers and the public to help ensure continual progress.
Most relevant for:	Large urban local governments in Canada
How to access:	http://www.toronto.ca/teo/pdf/ahead_of_the_storm.pdf

TITLE:	Canadian Communities' Guidebook for Adaptation to Climate Change
AUTHOR(S):	Livia Bizikova, Tina Neale, and Ian Burton
TYPE OF DOCUMENT:	Guidebook
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	The purpose of this guidebook is to facilitate and promote the utilization of an integrated approach to climate risks centered on sustainability, and help avoid maladaptive and short-term responses to climate change; to ensure the adaptation strategies, policies and measures are compatible with and supportive of the need to mitigate by reducing GHG emissions; to help address both adaptation and mitigation in the context of sustainable development and help build low carbon and resilient communities; and finally, to provide support for decision-makers in identifying key capacities needed in order to carry out successful adaptation actions. The guide provides a description of a method that can be applied to existing planning processes, both at the individual project level and at a strategic level. It is structured around SAM actions which combines sustainability, adaptation and mitigation.
KEY FINDINGS:	The guidebook outlines a series of steps that lead to the development of locally-specific responses to climate change: Step 1 – Identify the focus and objectives of a SAM initiative Step 2 – Assess present status and trends. Where are we heading? Step 3 – Develop a vision of the future. Where do we want to be in the coming decades? Step 4 – Set trajectories to meet priorities. How can we get there? Step 5 – Monitor, reassess and adjust. Reexamining the identified actions in a project or addressing new challenges.
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.forestry.ubc.ca/LinkClick.aspx?fileticket=xsexCSatHjo%3D&tabid=2455&mid=5415&language=en-US

TITLE:	Climate Action Plan
AUTHOR(S):	Province of British Columbia
TYPE OF DOCUMENT:	Official Plan
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	British Columbia
ABSTRACT:	This plan shows the ways in which the Province of British Columbia is working to reduce its greenhouse gas emissions. The Plan outlines a set of recommendations, which are complemented by relevant targets for the different sectors, such as, agriculture, buildings, energy, forestry, etc. It also includes ways residents can improve their energy consumption and contribute to the overall goals of The Plan, through the use of incentive programs, and guidebooks. Adaptation is another key part of The Plan as it presents new ideas and solutions to major environmental problems, such as forest and water protection.
KEY FINDINGS:	The Climate Change Plan will be continuously developed as new initiatives and opportunities begin to present themselves. Currently, the following initiatives are underway: LiveSmart BC, additional greenhouse gas reduction strategies, and the western climate initiative.
MOST RELEVANT FOR:	Provincial and municipal governments and associated stakeholders in Canada.
HOW TO ACCESS:	http://www.livesmartbc.ca/attachments/climateaction_plan_web.pdf

TITLE:	Climate Change Adaptation: Planning for BC
AUTHOR(S):	Deborah Harford
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	British Columbia
ABSTRACT:	While adaptation has, by necessity, been built into certain climate-vulnerable sectors, countries around the world are acknowledging this new pressure and associated action is apparent on every continent. Smart adaptation policies cut across all major government functions—infrastructure, energy, water, economic development, resource management, agriculture—and therefore require an integrated response as part of a long term strategy. Best practices indicate that one lead agency must be identified to guide this approach, and that funding must derive from the combined public, private and non-profit sectors, as no one sector alone will have sufficient resources. Extensive resources exist to assist with these initiatives in BC's universities and the private and not-for-profit sectors, which together boast some of the nation's most dynamic innovators. This paper summarizes some key principles of smart adaptation; explores the climate challenge in the context of nine top-of-mind issues; and proposes a set of over-arching recommendations that would help to facilitate the development of smart adaptation in BC.
KEY FINDINGS:	Large-scale climate responses have almost entirely focused on mitigation and have created a disconnect between public awareness and smart adaptation. Given the threats and the uncertainty inherent with climate change data, we must begin a publicly visible shift to a more flexible way of managing and legislating that acknowledges the reality that ongoing change will be inherent in all sectoral and governance processes as climate impacts increase. The paper outlines a set of overarching recommendations, including: • Actively promoting smart adaptation through knowledge mobilization and outreach; • Developing new methodologies for the projection and assessment of climate change impacts; and • Building expertise.
MOST RELEVANT FOR:	Local and regional governments and organizations.
HOW TO ACCESS:	http://www.sfu.ca/act/documents/AdaptationPriorities.pdf

TITLE:	**HRM Climate SMART: Community Action Guide to Climate Change and Emergency Preparedness**
AUTHOR(S):	Halifax Regional Municipality
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	May 2008
GEOGRAPHIC SCOPE:	Eastern Canada
ABSTRACT:	Halifax Regional Municipality's Climate SMART guide provides: • Information on climate change and its risks; • Suggested actions to reduce greenhouse gas emissions that cause climate change; • Knowledge and tools to help organize neighbourhoods to prepare for extreme weather; and • Guidance on developing a Climate SMART Community Action Plan for Halifax Regional Municipality.
KEY FINDINGS:	Mainstreaming climate change related concerns should be initiated with capacity building of local disaster risk management personnel and policy makers such that they appreciate the linkage between climate change and disasters while inculcating the culture of strategic thinking. There are four primary factors to be considered while mainstreaming: 1) Uncertainty in climate change risk; 2) Capacity limitations; 3) Perception and awareness limitations; and 4) Economic limitations. Similarly, appropriate tools and techniques should be developed that help the local level players to identify and appreciate the role of climate change in their vicinity.
MOST RELEVANT FOR:	All levels of government (local, provincial and federal).
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/projdb/pdf/185b_e.pdf

POLICY

TITLE:	**Adaptation and Mitigation: An Integrated Climate Policy Approach (AMICA)**
AUTHOR(S):	Andreas Kress
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Europe
ABSTRACT:	Addressing climate change and its effects presents a twofold challenge: firstly, mitigation, that is limiting further climate change by reducing the production of greenhouse gases, and secondly adaptation, which means preparing for the impacts of inevitable climate change. It is essential that climate change be tackled in an integrated way. The objective of the AMICA project is to motivate local governments to include climate protection and adaptation in their planning practices. Synergies are created when measures that control greenhouse gas concentrations also reduce adverse impacts of climate change, or vice versa.
KEY FINDINGS:	Factors such as land-use patterns, coverage of urban trees and vegetation, integration of transport modes and systems, as well as the materials and heating systems used in building construction can be directly affected by decision makers. This is where integrated policies and programs to mitigate climate change and to alleviate adverse impacts of climate change can be most effective. AMICA identifies three fields with synergies for adaptation and mitigation: urban planning, construction and decentralized energy production. Municipalities and regions should take a leading role in adaptation to climate change and developing integrated mitigation and adaptation strategies.
MOST RELEVANT FOR:	European local governments
HOW TO ACCESS:	http://www.amica-climate.net/fileadmin/amica/inhalte/dokumente/CS_AMICA_Venice_II.pdf

TITLE:	**Advice to Government – Climate Change and Canadian Public Policy: Adaptation and action**
AUTHOR(S):	The Institute of Public Administration
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	Climate change experts see the urgent need for action on adaptation, and the important role of the public sector in framing issues, leading and coordinating action and helping other sectors move forward. The public sector has tools to help Canadians to adapt to the difficult changes ahead. Adaptation plans and actions must be multidisciplinary, flexible and innovative. They must be implemented on a local, provincial/territorial and national scale. Leadership at all levels will help Canadians prepare for the economic and social challenges that will certainly result from climate change. This report attempts to summarize the top 10 concerns and recommendations expressed by speakers, delegates and the network of distinguished experts who advised the Institute of Public Administration of Canada in the development of "Climate Change and Canadian Public Policy: Adaptation and Action," a conference where over 180 speakers and delegates came from across Canada and internationally to participate.
KEY FINDINGS:	The Institute of Public Administration of Canada developed this conference on Climate Change Adaptation because experts said the public administration policy response to this huge, urgent, societal challenge was inadequate. They said the public sector had not provided the leadership, coordination, funding and comprehensive approach necessary to address the rapidly emerging problems. Delegates said that IPAC program increased the understanding of policy staff of these complex and difficult issues, brought people together and helped strengthen the community of public administrators and climate change policy experts. The conference raised the profile of the issue among decision-makers in all orders of government in Canada, non-profits and the private sector.
MOST RELEVANT FOR:	Local governments in Canada
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/projdb/pdf/16_e.pdf

TITLE:	Climate Change and Extreme Weather: Designing Adaptation Policy
AUTHOR(S):	Dan Henstra and Gordon McBean
TYPE OF DOCUMENT:	Online resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	All regions of Canada experience extreme weather events of one type or another, and it is likely that these events will increase in frequency and intensity as a result of climate change. The risk these hazards pose demands a purposive course of action to reduce the vulnerability of communities and to strengthen their capacity to cope with weather-related impacts. This report seeks to contribute to the development of Canadian climate adaptation policies targeted at extreme weather events as they pose a significant risk to public health and safety, and thus demands a purposive and coordinated course of action to reduce the vulnerability of communities and to increase their capacity to cope with hazard impacts.
KEY FINDINGS:	This report identifies key principles associated with effective climate adaptation policy involving: • Intergovernmental collaboration; • Stakeholder engagement; • Addressing current vulnerability and risk; • A strategic and systematic approach; and • "Mainstreaming" Four broad instruments are also proposed for facilitating and supporting community-level adaptation: 1) Information 2) Planning 3) Insurance 4) Codes and Standards The goals, principles and instruments contained within the report offer guidance for the development of a community climate adaptation policy, and provide a blueprint for an intergovernmental framework to support local climate adaptation.
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.sfu.ca/act/documents/05_09-EWE_Background_Report_WEB.pdf

REVIEW

TITLE:	**Adapting to Climate Change in Atlantic Canada: What Organizations are Doing Today to Prepare for Tomorrow**
AUTHOR(S):	The Conference Board of Canada
TYPE OF DOCUMENT:	Executive Action Briefing
PUBLICATION DATE:	2010
GEOGRAPHIC SCOPE:	Atlantic Canada
ABSTRACT:	Adapting to Climate Change in Atlantic Canada provides the highlights of the observations, strategies and actions described by presenters during The Conference of the Board of Canada's Leaders' Roundtable on Climate Change Adaptation (LRCCA) meeting.
KEY FINDINGS:	While actions are being taken to address the impacts of climate change in Atlantic Canada, several important aspects need attention in order to advance the adaptation agenda across the region. These include: • strengthening the capacity of small communities (home to over 50% of the region's population) to come to grips with a changing climate; • achieving sustained levels of funding; • providing better information on impacts at the regional and local scales; • refreshing traditional knowledge; and • doing a better job of getting information and guidance out more broadly to communities.
MOST RELEVANT FOR:	Local governments in Atlantic Canada
HOW TO ACCESS:	http://www.conferenceboard.ca/documents.aspx?DID=3437

RISK BASED APPROACHES TO ADAPTATION

TITLE:	**An Overview of the Risk Management Approach to Adaptation to Climate Change in Canada**
AUTHOR(S):	David Noble, Jim Bruce and Mark Egener
TYPE OF DOCUMENT:	Online resource
PUBLICATION DATE:	2005
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	This report provides an introduction to risk-based approaches to climate change adaptation decision-making. It examines several risk management approaches that have been used in Canada and internationally for managing climate-related and other types of risk and recommends that risk management information and tools be further developed and disseminated in Canada to support adaptation decision-making. It also identifies functional areas where government departments, at all levels, could initiate risk management activities for the purpose of adapting to climate change.
KEY FINDINGS:	Many risk management frameworks have been developed internationally to support adaptation decision-making. The Canadian Standards Association's (CSA) *Risk Management: Guideline for Decision-Makers* offers a pragmatic, evolutionary and user-friendly approach developing strategies to avoid, reduce and control real and perceived risks. The CSA Guideline emphasizes stakeholder engagement, risk communications and thorough documentation throughout the risk management process. These foci have proven important in responding to climate change in a Canadian context. For adaptation to climate change, where the public's interests are at stake and where uncertainties are significant, these aspects will be important considerations for achieving sustained commitments to adapt. In order to have risk management methodologies used in climate change related decision-making, more widespread awareness of climate change risks and the importance of planning to address these risks is required. The development of decision-making tools, followed by training and experience in applying the procedures, is needed. This is required across relevant departments in all levels of government, and particularly for officials concerned with planning, design and construction, and disaster loss reduction.
MOST RELEVANT FOR:	Canadian local governments
HOW TO	http://adaptation.nrcan.gc.ca/pdf/NobleBruceEgener2005_e.pdf

ACCESS:	

TITLE:	Climate Change and Local Level Disaster Risk Reduction Planning: Need, Opportunities and Challenges
AUTHOR(S):	S.V.R.K. Prabhakar, Ancha Srinivasan and Rajib Shaw
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	International
ABSTRACT:	The field of climate change is full of uncertainties that are limiting strategic disaster risk reduction planning. There is lot to do before we get our hands on reliable estimates of future climate change impacts. This includes bringing together different stakeholders via the framework suggested in this paper, developing case studies that reflect long-term local impacts of climate change, and building capacity of local stakeholders that enables them to make decisions in the face of uncertainty. This paper proposed a scheme that brings together the climate, disaster and policy community to start a dialogue with a view to understanding wider aspects of long-term risk reduction at the local level. Strategic thinking, which has been restricted to national and regional planning to date, needs to be integrated in local level disaster risk reduction and policy. There is a need to move away from the perspective which sees local level players as merely 'implementers' to a more accurate perspective which sees them more as 'innovators.' To do this a network of self learning and evolving organizations is required at the local level.
KEY FINDINGS:	Mainstreaming climate change related concerns should be integrated with local disaster risk management and policy makers in order to appreciate the linkage between climate change and disasters while incorporating the culture of strategic thinking. There are four primary factors to be considered while mainstreaming: 1) Uncertainty in climate change risk; 2) Capacity limitations; 3) Perception and awareness limitations; and 4) Economic limitations. Similarly, appropriate tools and techniques should be developed that help the local level players to identify and appreciate the role of climate change in their vicinity.
MOST RELEVANT FOR:	All levels of government (local, provincial and federal).
HOW TO ACCESS:	http://www.springerlink.com/content/r22773k306274257/

TITLE:	**Climate Change Impacts & Risk Management (CCIRM): A Guide for Business and Government**
AUTHOR(S):	Broadleaf Capital International and Marsden Jacob Associates
TYPE OF DOCUMENT:	Guidebook
PUBLICATION DATE:	2006
GEOGRAPHIC SCOPE:	Australia
ABSTRACT:	This Guide is geared towards businesses and organizations and aims to help enumerate risks related to climate change impacts; prioritize risks that require further attention; and, establish a process for ensuring that these higher priority risks are managed effectively. It provides a risk management framework which follows a step-by-step process. Step 1: Establish the context Step 2: Identify the risks Step 3: Analyze the risks Step 4: Evaluate the risks Step 5: Treat the risks In addition to the step-by-step process, the guide is structured around a continual process of communication, consultation, monitoring and review. It recommends a two-stage approach to risk assessment - applying the 5 step process in both stages. The first stage involves an initial assessment to identify risks, followed by treatment planning and implementation for those high priority risks. The second stage requires a detailed analysis where additional information is needed to determine whether treatment is required or what form of treatment should be adopted.
KEY FINDINGS:	There are three components of the framework used to evaluate risks in the initial assessment: • scales to describe the level of consequence of a risk if it should happen; • a scale to describe the likelihood of suffering associated with that level of consequence; and • a means of assigning a priority rating, given this consequence and likelihood.
MOST RELEVANT FOR:	Local governments, businesses and organizations
HOW TO ACCESS:	http://www.preventionweb.net/files/7786_riskmanagement1.pdf

TITLE:	Climate Risk Information: New York City Panel on Climate Change
AUTHOR(S):	Radley Horton and Megan O'Grady
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	New York City
ABSTRACT:	Climate change poses a range of hazards to New York City and its infrastructure. These changes suggest a need for the City to rethink the way it operates and adapts to its evolving environment. To respond to these changes and accomplish the goals outlined in PlaNYC, the City's comprehensive sustainability plan, Mayor Michael Bloomberg, with funding from the Rockefeller Foundation, convened the New York City Panel on Climate Change (NPCC) in August 2008. The NPCC, which consists of leading climate change and impact scientists, academics, and private sector practitioners, was charged with advising the Mayor and the New York City Climate Change Adaptation Task Force (the "Task Force") on issues related to climate change and adaptation as it relates to infrastructure. This document, one of three in a series of workbooks to be produced for the Task Force, provides climate change projections for New York City and identifies some of the potential risks to the City's critical infrastructure posed by climate change.
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf

SCIENTIFIC ASSESSMENTS

TITLE:	**Arctic Climate Impact Assessment: Impacts of a Warming Arctic**
AUTHOR(S):	Henry Huntington and Gunter Weller
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Northern Canada
ABSTRACT:	The Arctic Climate Impact Assessment is the first comprehensive, integrated assessment of climate change and ultraviolet (UV) radiation across the entire Arctic region. The assessment has three main objectives: 1. To provide a comprehensive and authoritative scientific synthesis of available information about observed and projected changes in climate and UV radiation and the impacts of those changes on ecosystems and human activities in the Arctic. The synthesis also reviews gaps in knowledge and the research required to fill those gaps. 2. To provide an accessible summary of the scientific findings, written in plain language but conveying the key points of the scientific synthesis. 3. To provide policy guidance to the Arctic Council to help guide the individual and collective responses of the Arctic countries to the challenges posed by climate change and UV radiation.
KEY FINDINGS:	The assessment addresses the large climatic changes that are very likely to occur over the 21st century. It concludes that changes in climate and in ozone and UV radiation levels are likely to affect every aspect of life in the Arctic. An especially important task for future impact assessments will be to conduct comprehensive vulnerability studies of arctic communities, in which impacts modulated by adaptive capacity are examined in the context of both environmental and societal changes.
MOST RELEVANT FOR:	The intended audience is the international scientific community, including researchers and directors of research programs, policy makers and the general public.
HOW TO ACCESS:	http://www.acia.uaf.edu/pages/scientific.html

TITLE:	Atlantic Canada – From Impacts to Adaptation: Canada in a Changing Climate
AUTHOR(S):	Liette Vasseur and Norm R. Catto
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Atlantic Canada
ABSTRACT:	Adaptation is an anticipatory approach to climate change management and involves making adjustments in our decisions, activities and thinking because of observed or expected changes. In order to alleviate harm or risk, this framework is a necessary component in the reduction of greenhouse gas emissions. This report explains adaptation practices specific to the region of Atlantic Canada. It provides a detailed explanation of the problems and adaptive methods for various ecosystem sensitivities, such as marine ecosystem and the impact on fisheries. Key findings on climate change impacts such as rate of temperature change, precipitation rate, and sea-level rise are supported by research findings and observed trends. Different adaptation projects are also showcased to provide insight on adaptive strategies.
KEY FINDINGS:	Different regions within Atlantic Canada will experience different climate change impacts. There are some key sensitivities which are highlighted in this report including: coastal sea level rise and extreme weather events; marine ecosystems and shifting oceanic conditions; and, management of crucial sectors such as agriculture and forestry. Adaptive capacity in Canada is high, but there are areas and sectors in Atlantic Canada that do not have the resources to manage their adaptive capacity.
MOST RELEVANT FOR:	Canadian municipal governments who are, or plan to, implement adaptive practices into development and planning within Atlantic Canada.
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch4_e.pdf

TITLE:	**British Columbia – From Impacts to Adaptation: Canada in a Changing Climate**
AUTHOR(S):	Ian J. Walker and Robin Sydneysmith
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	British Columbia
ABSTRACT:	Adaptation is an anticipatory approach to climate change management and involves making adjustments in our decisions, activities and thinking because of observed or expected changes. In order to alleviate harm or risk, this framework is a necessary component in the reduction of greenhouse gas emissions. This report provides an overview of climate change impacts and adaptation concerns in British Columbia. The impacts and adaptation practices varies across this province and this difference is showcased through case studies and recent and ongoing research leading to adaption actions. The information within this chapter covers a breadth of issues such as historical and future trends in temperature and precipitation change; occurrence of extreme weather and weather-related events; sea-level impacts; and management of various economic sectors.
KEY FINDINGS:	Each industry and/or sector will experience a different change due to climate change: forestry related industries are becoming more vulnerable to forest fires; fisheries will experience increases stress due to changing freshwater temperatures and river flow; critical infrastructure will be impacted by increasing frequency and intensity of extreme weather events. The agricultural industry is a stand-out case because there is projected to be both positive and negative influences due to climate change. The conditions in some regions pose improved crop production and ability to expand agricultural surface area, while other regions will have sustained drought and increasing demand for water.
MOST RELEVANT FOR:	Canadian municipal governments and policy makers who are, or plan to, integrate adaptive practices into development and planning in British Columbia.
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch8_e.pdf

TITLE:	Climate Change Impacts and Adaptation: A Canadian Perspective
AUTHOR(S):	Donald S. Lemmen and Fiona J. Warren
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2004
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	The tremendous geographic, ecological and economic diversity of Canada means vulnerability varies significantly across the country. In many cases, adaptation will involve enhancing the resiliency and adaptive capacity of a system to increase its ability to deal with stress. Adaptation to climate change represents a challenge to all countries of the world, including Canada. To reduce the negative impacts of climate change and take advantage of new opportunities, Canadians will need to adapt. Although climate change may be unique in its scope and the potential magnitude of its impacts, humans have always adapted to changes in their environment, both climatic and non-climatic, and as such there is a foundation of knowledge upon which to build. The purpose of adaptation is not to preserve the status quo, since that will simply not be possible for most ecosystems and many human systems. Rather, the goal of adaptation is to reduce the negative impacts of climate change, while taking advantage of new opportunities that may be presented. As there will always be uncertainties associated with climate change, the issue is best addressed in the context of risk management.
KEY FINDINGS:	The seven sectoral chapters of this report outline the potential impacts of climate change on key sectors of Canada's economy, provides a review of recent research and identifies knowledge gaps and research needs. Through this review, it is evident that climate change impacts, and our ability to adapt to those impacts, will differ both among sectors and among the various regions of Canada. These differences will depend largely on the factors that determine vulnerability. Comprehensive assessment of this net balance has not been completed and, indeed, may not yet be possible given existing knowledge gaps. Nonetheless, there is general consensus in the literature that negative impacts are expected to dominate for all but the most modest warming scenarios. This is especially true for certain sectors, such as health and water resources, and less so for others, such as transportation.
MOST RELEVANT FOR:	Local, Provincial and Federal governments in Canada
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/perspective/index_e.php#toc

TITLE:	**Climate Variability and Change in Canada: Past, Present and Future**
AUTHOR(S):	E. Barrow, B. Maxwell, and P. Gachon (eds.)
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2004
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	This report presents a 'state of the science' regarding climate change and climate variability in Canada. As well as describing the changes in climate which have already been observed, it describes plausible climate futures for the country and outlines the major research challenges for the near future.
KEY FINDINGS:	Climate modeling work, at both global and regional scales, and the development of other downscaling methods must occur within a coherent strategy, since all are complementary. This more integrated approach will result in the development of useful and plausible scenarios at regional scales.
MOST RELEVANT FOR:	Local, Provincial or Federal government.
HOW TO ACCESS:	http://cccsn.ca/Reports_and_Publications/Climate_Variability_and_Change_en.pdf

TITLE:	From Impacts to Adaptation: Canada in a Changing Climate
AUTHOR(S):	Donald S. Lemmen, Fiona J. Warren and Jacinthe Lacroix
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	This report reflects the advances made in understanding Canada's vulnerability to climate change during the past decade. Through a primarily regional approach, this assessment discusses current and future risks and opportunities that climate change presents to Canada, with a focus on human and managed systems. It is based on a critical analysis of existing knowledge, drawn from the published scientific and technical literature and from expert knowledge. The current state of understanding is presented, and key knowledge gaps are identified. Advances in understanding adaptation, as well as examples of recent and ongoing adaptation initiatives, are highlighted throughout the report. The report also provides: detailed key findings for each region in Canada; impacts of climate change on physical and biological systems; vulnerability and adaptive capacity of communities and industries; adaptation initiatives across Canada through community and informal initiatives; policy adjustments; and, barriers to adaption action, such as access to knowledge, data, and tools.
KEY FINDINGS:	Examples of policies and adaptation initiatives from different sectors are provided. Each region in Canada (Atlantic, Northern, Ontario Quebec, Prairies, and British Columbia) has a detailed chapter dedicated to it with an exploration of climate change impacts, supplemented with scientific data of the projected impacts and ecological changes. This report provides ways to integrate adaptation into existing planning practices.
MOST RELEVANT FOR:	Canadian municipal governments who are, or plan to, implement adaptive practices into development and planning.
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/index_e.php

TITLE:	Impacts of Climate Change and Variation on the Natural Areas of Newfoundland and Labrador
AUTHOR(S):	Norm Catto
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2006
GEOGRAPHIC SCOPE:	Newfoundland and Labrador
ABSTRACT:	This report summarizes the impacts of climate change and variation on the Newfoundland and Labrador landscape as a whole, focusing on the Natural Areas administered by the Department of the Environment and Conservation. The report focuses primarily on the physical environment, including climate, terrain, weathering and erosion, and sedimentary processes. It also includes some discussion of potential impacts on terrestrial forest assemblages and fauna.
KEY FINDINGS:	The impacts of climate change and variation on the natural areas of Newfoundland and Labrador include enhanced coastal erosion; rising sea level in all areas except Lake Melville; enhanced frost wedging in coastal locations; decreases in summer precipitation in most interior areas; increased precipitation in westernmost Newfoundland; changes in forest fire frequency; and changed in severe weather events. These changes are compounded by increased human usage of landscapes, both by tourists and citizens of Newfoundland and Labrador. The impacts of climate change and variation will occur, regardless of the causes involved. Successful adaptive measures to ensure that the natural areas will continue to contribute to tourism, recreation, and heritage in Newfoundland and Labrador will require recognition of ongoing impacts.
MOST RELEVANT FOR:	Local governments in Newfoundland and Labrador
HOW TO ACCESS:	Contact Norm Catto *ncatto@mun.ca*

TITLE:	**Northern Canada – From Impacts to Adaptation: Canada in a Changing Climate**
AUTHOR(S):	Chris Furgal and Terry D. Prowse
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Northern Canada
ABSTRACT:	There is strong evidence from scientists and local residents that Canada's North is already experiencing changes in its climate. These changes are producing cascading effects on physical, biological, economic and social systems. The sensitivity of these systems to climate change is relatively high because of their dependence on the predictability and characteristic stability of the cryosphere (snow, glaciers, freshwater/sea ice and permafrost. The direct health impacts of climate extremes and natural disasters are also most significant for those communities and individuals living in more environmentally exposed location such as those in the North. The political, cultural and economic diversity of Northern Canada means that communities are affected by, and respond to, environmental change in different ways. It is evident that the Canadian Arctic is already undergoing significant changes in climate, and that these changes are affecting almost every aspect of the northern environment and population.
KEY FINDINGS:	Current levels of exposure to climate-related changes and sensitivities, as well as limitations in adaptive capacity, make some northern systems and populations particularly vulnerable to the effects of climate change. Key findings include: • Climate-induced changes in the cryosphere (permafrost, sea ice, lake ice, and snow) have important implications for infrastructure maintenance and design; • As the climate continues to change, there will be consequences for biodiversity shifts and the ranges and distribution of many species, with resulting impacts on availability, accessibility and quality of resources upon which human populations rely; and • Increased navigability of Arctic marine waters and expansion of land and fresh water based transportation networks will lead to a less 'remote' northern Canada, bringing both opportunities for growth in a range of economic sectors and challenges associated with culture, security and the environment.
MOST RELEVANT FOR:	Canadian local governments who are, or plan to, implement adaptive practices into development and planning in Northern Canada
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch3_e.pdf

TITLE:	**Ontario – From Impacts to Adaptation: Canada in a Changing Climate**
AUTHOR(S):	Q. Chiotti and B. Lavender
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Ontario
ABSTRACT:	**The social, economic and cultural health of Ontario is influenced by climate.** Vulnerability to climate variability and change is demonstrated by the impacts of recent severe weather events, such as drought, intense rainfall, ice and windstorms, and heat waves. Those impacts include water shortages, lower Great Lakes water levels, flooding, forest fires, reduced agricultural production, damages to infrastructure and property, power outages and outbreaks of water-borne diseases.
KEY FINDINGS:	**Since 1948, average annual temperatures in Ontario have increased by as much as 1.4 °C.** This trend is projected to continue, with the most pronounced temperature increases occurring in winter. Projections also indicate that intense rainfall events, heat waves and smog episodes are likely to become more frequent. **Physical infrastructure, water quality and supply, human health and well-being, remote and resource-based communities, and ecosystems are highly sensitive to climate.** The degree to which the associated systems are vulnerable depends on their ability to successfully adapt to changes in both climatic and non-climatic stresses. **Ontario has a strong capacity to adapt to climate change,** based on a variety of indicators, such as economic wealth, technology, information and skills, infrastructure, institutions, social capital and equity. However, this capacity is not uniform across sub regions and sectors.
MOST RELEVANT FOR:	Canadian municipal governments who are, or plan to, implement adaptive practices into development and planning in Ontario.
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch6_e.pdf

TITLE:	Prairies – From Impacts to Adaptation: Canada in a Changing Climate
AUTHOR(S):	Dave Sauchyn and Suren Kulshreshtha
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Canadian Prairies
ABSTRACT:	Adaptation is an anticipatory approach to climate change management and involves making adjustments in our decisions, activities and thinking because of observed or expected changes. In order to alleviate harm or risk, this framework is a necessary component in the reduction of greenhouse gas emissions. The Prairies are Canada's major dryland. The most significant threat due to climate change is the projected increase in climate variability and frequency of extreme events; with drought posing a major concern. Trends and scientific projections show lower summer stream flow, falling lake levels, and increasing soil and surface-water deficits. A change in water patterns is a certain impact as extra precipitation is expected in winter and spring, and summer will be drier. The demand for natural resources has led to policies and processes in all sectors that are focused on planned adaptation.
KEY FINDINGS:	Adaptive capacity is not evenly distributed within the Prairies. The level of vulnerability is subject to geographic disparity (for example, rural landscapes have less resources than urban landscapes) and demographic disparity (the elderly, Aboriginal communities and recent immigrants are most vulnerable). Climate change encourages migration into regions with the most resources, such as the urban centre's, and the population shift challenges adaptive capacity. This report provides a myriad of examples on how such implications are addressed and managed.
MOST RELEVANT FOR:	Canadian municipal governments who are, or plan to, implement adaptive practices into development and planning in the Prairies.
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch7_e.pdf

TITLE:	**Quebec – From Impacts to Adaptation: Canada in a Changing Climate**
AUTHOR(S):	A. Bourque and G. Simonet
TYPE OF DOCUMENT:	Report
PUBLICATION DATE:	2007
GEOGRAPHIC SCOPE:	Quebec
ABSTRACT:	Climate change will have many environmental, public health and socioeconomic impacts. In Quebec, these impacts will differ depending on the particular sensitivities of each region. The extent and costs of climate change impacts will likely increase over time. **The largest climate changes in absolute terms are anticipated to occur in the northern sub-region. Climate change will also result in alterations to the natural environment with potentially significant implications in areas where natural resource development is central to the economy.** Quebec has a high degree of adaptive capacity, due specifically to its increasingly diversified knowledge economy. As for the natural environment, it adapts spontaneously and autonomously, and human systems may be able to assist with its adaptation.
KEY FINDINGS:	Key findings include the following: • From 1960 to 2003, temperatures in southern Quebec increased by between 0.5°C and 1.2°C in the southwestern and south-central areas, and by less than 0.5°C in the southeastern part. In northern Quebec, a gradual cooling has been replaced by a sudden warming of about 2 °C since 1993. • Despite uncertainties, the use of increasingly high-performance climate models makes it possible to produce detailed climate scenarios for several parameters and several regions, all of which point to major changes in climate trends. • In Quebec, there is a slowing of population growth and an increasingly aging population, except among First Nations and Inuit communities. There has been a population shift from urban centres mainly to the outer edges of developed areas and suburban belts in southern Quebec, resulting in urban sprawl onto high-potential agricultural land. • Although the general state of public health is improving, the future trend is uncertain due to several factors, including the fact that high-risk populations are becoming increasingly vulnerable. • Quebec's growing economy is now based primarily on the tertiary (service) sector and is largely integrated into the North American and

	world economies. In contrast, infrastructure is aging and is largely exposed to the vagaries of the weather. In addition, many communities outside large urban centres are dependent on natural resources and are therefore also highly vulnerable to the vagaries of the weather.
MOST RELEVANT FOR:	Canadian local governments who are, or plan to, implement adaptive practices into development and planning in Quebec.
HOW TO ACCESS:	http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch5_e.pdf

TITLE:	**The Copenhagen Diagnosis**
AUTHOR(S):	I. Allison, N. L. Bindoff, R.A. Bindschadler, P.M. Cox, N. de Noblet, M.H. England, J.E. Francis, N. Gruber, A.M. Haywood, D.J. Karoly, G. Kaser, C. Le Quéré, T.M. Lenton, M.E. Mann, B.I. McNeil, A.J. Pitman, S. Rahmstorf, E. Rignot, H.J. Schellnhuber, S.H. Schneider, S.C. Sherwood, R.C.J. Somerville, K.Steffen, E.J. Steig, M. Visbeck, A.J. Weaver
TYPE OF DOCUMENT:	Scientific Update
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	International
ABSTRACT:	This report serves as an interim evaluation of the evolving science midway through an IPCC cycle (IPCC AR5 is not due for completion until 2013) and as a handbook of science updates that supplements the IPCC AR4. The report covers a wide range of topics, including: • An analysis of greenhouse gas emissions and their atmospheric concentrations, as well as the global carbon cycle; • Coverage of the atmosphere, the land-surface, the oceans and all of the major components of the crysophere (land-ice, glaciers, ice shelves, sea-ice and permafrost) • Paleoclimate, extreme events, sea level, future projects, abrupt change and tipping points; • Explanations of some of the common misconceptions surrounding climate change science.
KEY FINDINGS:	The most significant recent climate change findings are: **Greenhouse gas emissions are surging:** Even if global emission rates are stabilized at present day levels, just 20 more years of emissions would give a 25% probability that warming exceeds 2°C. **Recent global temperatures demonstrate human-based warming:** Over the past 25 years temperatures have increased at a rate of 0.190C per decade, in every good agreement with predictions based on greenhouse gas increases. **Acceleration of melting of ice-sheets, glaciers and ice-caps:** A wide array of satellite and ice measurements now demonstrate beyond doubt that both the Greenland and Antarctic ice-sheets are losing mass at an increasing rate. Melting of glaciers and ice-caps in other parts of the world has also accelerated since 1990. **Rapid Arctic sea-ice decline:** Summer-time melting of Arctic sea-ice has accelerated far beyond the expectations of climate models. The area of summertime sea-ice during 2007-2009 was about 40% less than the average prediction from IPCC AR4 climate models.

	Current sea-level rise underestimates: Satellites show great global average sea-level rise (3.4 mm/yr over the past 15 years) to be 80% above past IPCC predictions. **Sea-level prediction revised:** By 2100, global sea-level is likely to rise at least twice as much as projected by Working Group 1 of the IPCC AR4. Sea-level will continue to rise for centuries after global temperature have been stabilized and several meters of sea level rise must be expected over the next few centuries. **Delay in action risks irreversible damage:** Several vulnerable elements in the climate system (e.g. continental ice-sheets) could be pushed towards abrupt or irreversible change if warming continues in a business-as-usual way throughout this century. The risk of transgressing critical thresholds ("tipping points") increase strongly with ongoing climate change. Thus waiting for higher levels of scientific certainty could mean that some tipping points will be crossed before they are recognized. **The turning point must come soon:** If global warming is to be limited to a maximum of 2°C above pre-industrial values, global emissions need to peak between 2015 and 2020 and then decline rapidly.
MOST RELEVANT FOR:	Policy makers, stakeholders, the media and the general public.
HOW TO ACCESS:	http://www.copenhagendiagnosis.org/

SOCIAL IMPLICATIONS OF CLIMATE CHANGE

TITLE:	**Climate Change and Infectious Diseases in North America: The Road Ahead**
AUTHOR(S):	Amy Greer PhD, Victoria Ng, David Fisman MD MPH
TYPE OF DOCUMENT:	Academic Public Health Review
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	North America will experience a change in weather patterns, and though these changes may have direct consequences for health, they are also likely to cause important changes in the incidences and distribution of infectious diseases. The key points of the article are as follows: • Change in climate and associated changes in weather will have important consequences for human health; • Climate change will alter the relations between microorganisms, such as microbes, insect vectors and will alter the burden and distribution of infectious diseases of public health importance; • Warmer temperatures and altered rainfall patterns are likely to increase the range and burden of infectious diseases; • Strengthening public health infrastructure and allowing physicians to contribute to policies related to greenhouse gas emissions.
KEY FINDINGS:	Many important and harmful diseases, such as Lyme disease and blastomycosis, are not subject to national surveillance in Canada, and this will make reporting difficult. By monitoring public health patterns, it will decrease the level of unpredictable health effects. Therefore, it is important that there be a platform for interdisciplinary communication between health professions, geographers, economists, scientists.
MOST RELEVANT FOR:	All stakeholders and levels of government interested in public health
HOW TO ACCESS:	Can be requested through the Canadian Medical Journal.

TITLE:	**Climate Change, Adaptive Capacity and Development**
AUTHOR(S):	edited by **Joel B Smith, Richard J T Klein**, & **Saleemul Huq**
TYPE OF DOCUMENT:	Book
PUBLICATION DATE:	2003
GEOGRAPHIC SCOPE:	International
ABSTRACT:	The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has presented strong evidence that human-induced climate change is occurring and that all countries of the world will be affected and need to adapt to impacts. The IPCC points out that many developing countries are particularly vulnerable because of their relatively low adaptive capacity. Therefore it is seen as a development priority to help these countries enhance their adaptive capacity to climate change. The Potsdam Institute for Climate Impact Research and Stratus Consulting organized a workshop in the fall of 2001 to develop an agenda for research on how best to enhance the capacity of developing countries to adapt to climate change. This research agenda is relevant for governments and institutions that wish to support developing countries in adapting to climate change. The workshop brought together experts from developing and industrialized countries, non-governmental organizations, and multilateral and bilateral donor organizations to discuss a number of important topics related to adaptation, adaptive capacity and sustainable development. A dozen papers were commissioned to cover these topics, both from a theoretical perspective and in the form of national case studies. The papers form the basis for this book, which presents the latest interdisciplinary knowledge about the nature and components of adaptive capacity and how it may be strengthened. **Contents:** • From Adaptation to Adaptive Capacity and Vulnerability Reduction *(B Smit & O Pilifosova)* • Social Aspects of Adaptive Capacity *(W N Adger)* • Adaptive Capacity: What Does It Mean in the Context of Natural Hazards? *(J Handmer)* • Lessons from Famine Early Warning and Food Security for Understanding Adaptation to Climate Change: Toward a Vulnerability/Adaptation Science? *(T E Downing)* • Assessing Vulnerability in the Context of Changing Socioeconomic Conditions: A Study of Egypt *(G Yohe et al.)*

	• Do We Have the Adaptive Capacity to Develop and Use the Adaptive Capacity to Adapt? *(I Burton)* • and other papers
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Natural resource managers; experts on development issues in developing countries, and on climate change issues.
HOW TO ACCESS:	Available for purchase from http://www.icpress.co.uk/environsci/p298.html

TITLE:	Climate Resilient Cities: A Primer on Reducing Vulnerability to Disasters
AUTHOR(S):	Neeraj Prasad, Federica Ranghieri, Fatima Shah, Zoe Trohanis, Earl Kessler, and Ravi Sinha.
TYPE OF DOCUMENT:	Book
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	International
ABSTRACT:	This book provides information about the complex and compelling challenges of climate change. The book helps local governments create training, capacity building, and capital investment programs for building sustainable and resilient communities. This primer is unique from other resources in its treatment of climate change using a dual-track approach that integrates both mitigation (lowering contributions to greenhouse gases) and adaptation (preparing for impacts of climate change) with disaster risk management. The book is relevant both to local governments that are just beginning to think about climate change as well as those that already have well established policies, institutions, and strategies in place. By providing a range of city-level examples of sound practices around the world, this book demonstrates that there are many practical actions that cities can take to build resilience to climate change and natural disasters. TABLE OF CONTENTS *Section 01: Understanding the Impacts of Climate Change and Disaster Risk Management* A. Primer Objectives B. The Imperatives of Action C. Developing a Resilient City of the Future D. Mainstreaming Policy and Practice for Local Impact E. The Risks of Doing Nothing *Section 02: Explaining Climate Change Impacts and Disaster Risk Management* A. What Is Mitigation (Climate Change Management)? B. What Is Mitigation (Disaster Risk Management)? C. What Is Adaptation? D. What about Sea-Level Rise? *1. What Are the Effects and Impacts?* *2. What Are Some Mitigation and Adaptation Sound Practices?* E. What about Temperature? *1. What Are the Effects and Impacts?*

2. What Are Some Mitigation and Adaptation Sound Practices?
F. What about Precipitation?
1. What Are the Effects and Impacts?
2. What Are Some Mitigation and Adaptation Sound Practices?
G. What about Resilience?
1. How Is Resilience Enhanced?
2. Are There Sound Practices?
H. What about Extreme Events?
1. What Are the Effects and Impacts?
2. What Are Some Sound Practices?

Section 03: Assessment Exercise: Discovery of a "Hot Spot"
A. Completing the City Typology and Risk Characterization Matrix
1. Select Climate Change Team
2. Hold Series of Workshops
3. Complete the Matrix
B. Additional Testing for a "Hot Spot"
C. Is Your City a "Hot Spot"?

Section 04: Information Exercise: Creating a City Information Base
A. The Workbook
B. The Participatory Process
C. The Annotated Maps
1. City/Community Base Map
2. City/Community Socio-Economic Profile Map
3. City Hazard Profile Map
4. The Future Growth Map
5. City Institutional Map
D. The Framework

Section 05: Sound Practice Examples of Adaptation and Mitigation
1: Organizational Structure and Information Base
2: Institutional Mechanism
3: Ownership by Line Departments
4: Preparing a Climate Change Strategy
5: Generating Public Awareness
6: Accounting and Reporting for Mitigation: The GHG Inventory
7: Catastrophic Risk Financing and Transfer Mechanisms
8: Developing a Disaster Risk Management System Considering Climate Change Impacts
9: Climate Change Mitigation—Energy Sector
10: Climate Change Mitigation—Transport Sector
11: Climate Change Mitigation—Built Environment and Densification
12: Climate Change Mitigation—Forestry and Urban Greenery
13: Climate Change Mitigation—Finance and Financial Mechanisms

	14: Adaptation—Infrastructure Sector 15: Adaptation—Water Conservation and Flooding 16: Adaptation—Public Health *Section 06: Conclusions*
KEY FINDINGS:	n/a
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	https://extop-workflow.worldbank.org/extop/ecommerce/catalog/product?item_id=8786494

TITLE:	Combining Climate Change Adaptation and Mitigation Measures at the Local Level
AUTHOR(S):	Julia Laukkonen, Paola Kim Blanco, Jennifer Lenhart, Marco Keiner, Branko Cavric, Cecilia Kinuthia-Njenga
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	International
ABSTRACT:	The vulnerability of individuals and communities to climate change impacts is not simply determined by the location of their settlements, but also by how those settlements are serviced, how effective and capable their local governments are and to what extent communities are able to cope with climate change impacts. It is widely accepted that the poorest communities are the most vulnerable, because they lack access even to the most basic urban services placing them at a comparative disadvantage and challenging their capabilities to take on additional stresses caused by climate change. Such complex vulnerabilities require comprehensive responses that link climate change adaptation and mitigation efforts to the sustainable development of these communities enhancing their adaptive capacity. It is not sufficient to concentrate on either mitigation or adaptation, but a combination of these results in the most sustainable outcomes. Yet, these two strategies do not always complement each other, and can instead be counterproductive. A similar argument can be made for linking climate change adaptation with sustainable development. In order to avoid these conflicts, priorities need to be set. This calls for a methodology and comparison tool to assess the most cost-effective and appropriate strategies for each community. Strategies need to be evaluated in terms of their negative consequences and priority given to those that minimize these. This article includes case studies of successful adaptation and mitigation strategies suggesting that these successes be translated into local contexts and communalized with the involvement of local authorities using participatory approaches. Successful outcomes integrate different adaptation and mitigation strategies with the overall development goals of the community through local government leadership, comprehensive planning and prioritization.
KEY FINDINGS:	n/a
MOST	Local governments

RELEVANT FOR:	
HOW TO ACCESS:	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V9H-4TYPJ0N-1&_user=10&_coverDate=07/31/2009&_rdoc=10&_fmt=high&_orig=browse&_srch=doc-info(%23toc%235899%232009%23999669996%231052049%23FLA%23display%23Volume)&_cdi=5899&_sort=d&_docanchor=&_ct=11&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=6ceb326434c673eed5cb7f2c02206411

TITLE:	Communities Adapting to Climate Change: Emerging Public Health Strategies
AUTHOR(S):	Hannah Moffat
TYPE OF DOCUMENT:	Online Resource
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	North America
ABSTRACT:	Local governments throughout North American are mitigating greenhouse gases (GHGs) and adapting to the impacts of climate change. This project utilizes a case-based approach to address the question, "How does health promotion and public health practice influence municipal climate change adaptation?" The project reviewed resource materials and interviewed staff members from ten selected Canadian and American local government leaders in adaptation. To provide a public health perspective, staff members from Toronto Public Health and Vancouver Coastal Health were also interviewed. Results demonstrate that there is a disconnect between many local health authorities and their respective municipality. The case studies illustrate the need to employ community-based strategies, recognize leaders in local governments and utilize strategic partnerships while adapting to climate change. Further research is required to understand how local governments can be proactive in preventing and mitigating the negative health and wellbeing consequences of climate change.
KEY FINDINGS:	Results demonstrate that there is a disconnect between many local health authorities and their respective municipality. The case studies illustrate the need to employ community-based strategies, recognize leaders in local governments and utilize strategic partnerships while adapting to climate change. Further research is required to understand how local governments can be proactive in preventing and mitigating the negative health and wellbeing consequences of climate change.
MOST RELEVANT FOR:	Local governments
HOW TO ACCESS:	http://www.cleanairpartnership.org/files/Moffatt%20Capstone.pdf

TITLE:	Health Effects of Exposure to Extreme Heat
AUTHOR(S):	George Luber
TYPE OF DOCUMENT:	Power-point presentation
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	North America and Europe
ABSTRACT:	This document includes an overview of the health effects of heat exposure, the epidemiology of heat waves, the impact of climate change on extreme heat exposure and current CDC activities. The presentation looks at previous heat wave studies (including Chicago in 1995 and France in 2003) and the lessons learned from these incidents, the urban heat island effect and vulnerability mapping using remote sensing. The presentation recommends the EPA-produced Excessive Heat Events (EHE) Guidebook which includes city-specific heat response plans for cities (includes Toronto as a Case Study).
KEY FINDINGS:	As a result of Climate Change, heat waves will pose a significant challenge for urban populations. Morbidity and mortality related to extreme heat exposure can be prevented. Adaptation measures such as city-specific Heat Response Plans are essential for prevention.
MOST RELEVANT FOR:	Local governments of any sized municipality or town, but with particular interest to the governments of large cities or urban centers, as they would be most affected by the urban heat island effect.
HOW TO ACCESS:	www.bt.cdc.gov/coca/ppt/extreme_heat_071007.pps

TITLE:	**Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity**
AUTHOR(S):	Jacinthe Seguin and Peter Berry
TYPE OF DOCUMENT:	General resource
PUBLICATION DATE:	2008
GEOGRAPHIC SCOPE:	Canada wide
ABSTRACT:	The report provides a synthesis of knowledge on how the health of Canadians is affected by the climate today, and what lies ahead under future climate change. Through an examination of key health issues of concern, along with two regional assessments (the province of Quebec and Canada's North), it develops a baseline of evidence concerning the relationship between a changing climate and direct as well as indirect impacts on health. A framework for analyzing adaptive capacity is presented, along with an exploration of how governments, communities and individuals are drawing on current capacity to address and mitigate the effect of climate on health. Each chapter makes recommendations for future action and identifies key knowledge gaps to direct future research in support of adaptation to protect the health of Canadians. This study is meant to compliment *From Impacts to Adaptation: Canada in a Changing Climate 2007* by providing decision makers with an integrated perspective on existing vulnerability to the potential health impacts of climate change, and insights on how risks can be reduced by increase adaptive capacity.
KEY FINDINGS:	The following are key conclusions from this assessment of risks to health from climate change. • Climate change scenarios project an increased risk of extreme weather and other climate-related events in Canada such as floods, drought, forest fires and heat waves—all of which increase health risks to Canadians. • The air Canadians breathe is affected by climate. Air quality in many Canadian communities is likely to be affected by climate change through increased smog formation, wildfires, pollen production and greater emissions of air contaminants due to changed personal behaviours—all increasing risks to health. • Climate change is likely to increase risks associated with some infectious diseases across the country, and may result in the emergence of diseases that are currently thought to be rare in or exotic to Canada.

	• Overall, Canadians enjoy very good health status and a high level of health and social services, providing a strong foundation for coping with the diverse stresses that climate change will place on health and well-being. However, the combined effects of projected health, demographic and climate trends in Canada, as well as changes related to social conditions and infrastructure could increase the vulnerability of Canadians to future climate-related health risks in the absence of effective adaptations. • Concerns exist about the effectiveness of current adaptations to health risks from climate variability. Existing gaps in public health and emergency management activities that are not addressed have the potential to significantly affect the ability of Canadians to effectively plan for and respond to climate change in Canada. • Adaptation can reduce health risks posed by climate change by providing citizens with the knowledge, tools and confidence needed to take protective actions. Measures to protect health should be tailored to meet the needs of the most vulnerable Canadians—seniors, children and infants, the socially disadvantaged, and the chronically ill. • Barriers to adaptation exist in Canada and include an incomplete knowledge of health risks, uneven access to protective measures, limited awareness of best adaptation practices to protect health, and constraints on the ability of decision makers to strengthen existing health protection programs or implement new ones. • Adaptive capacity is not evenly distributed among communities in Canada. Small communities often have less capacity to plan for or cope with the effects of extreme events or health emergencies. • The health sector needs to maintain current efforts to protect health from climate-related risks, and incorporate climate change information and engage other sectors in their plans for future programs. • Regional and community-level assessments of health vulnerabilities are needed to support adaptation through preventative risk reduction. • Multi-disciplinary research and collaborations across all levels of government can build the knowledge base on vulnerabilities to climate change to address existing adaptation gaps.
MOST RELEVANT FOR:	Canadian local governments
HOW TO ACCESS:	Synthesis Report is available at http://ptaff.ca/blogue/wp-content/uploads/human_healt_in_a_changing_climate-synthesis_report.pdf and the full report is available by request to publications@hc-sc.gc.ca

TITLE:	**True North: Adapting Infrastructure to Climate Change in Northern Canada**
AUTHOR(S):	National Round Table on the Environment and the Economy
TYPE OF DOCUMENT:	Policy Report
PUBLICATION DATE:	2009
GEOGRAPHIC SCOPE:	Canada wide with a specific focus on Northern Canada
ABSTRACT:	This report brings recognition to the unique vulnerability of Northern Canada and the potential for climate change to compromise sustainable regional development. Key recommendations found in this report: • Funding for infrastructure development and rehabilitation should be adjusted so that they become incentives to integrate risk management. • National codes and standards for engineering and construction should be reviewed and modified to accommodate the risk of climate change. • Government agencies and the insurance industry need to work together so Canadians have access to affordable insurance. • The Government of Canada should invest in updating and providing more comprehensive climate data, climate change projections, and information for infrastructure design. Their main findings address the gaps within policies, limited interaction among key stakeholders, lack of interest in Northern Canada, uneven distribution of resources, and the important synergies which exist among different management options.
KEY FINDINGS:	Comprehensive organization of the following charts: predicted temperature and precipitation changes, physical effects of climate change, regional biodiversity, cost of services, socio-economic indicators, oil and gas resources, role of mining, analysis of risk and opportunities of climate change, role of the government.
MOST RELEVANT FOR:	All levels of government
HOW TO ACCESS:	http://www.nrtee-trnee.com/eng/publications/true-north/true-north-eng.pdf

INFORMATION ANNEX TWO – REGIONAL CLIMATIC CHANGES

This Annex serves to inform the research conducted as part of Milestone Two. For ease of use, the information is separated by each region of Canada as distinguished by Natural Resources Canada: Northern Canada, British Columbia, Prairies, Ontario, Quebec, and Atlantic Canada. The tables include projection data on temperature, precipitation, changes in water levels (lakes, rivers and ocean) and the occurrence of extreme events.

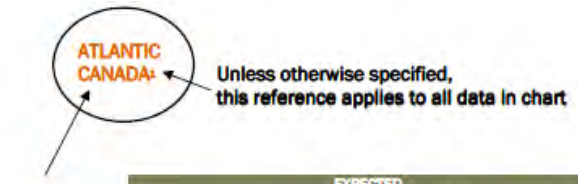
National government sources have been used to inform the content of the tables below where possible. In the case where national data was unavailable, data has been extracted from other accredited supplementary sources (details on the sources used are specified in each table - see Exhibit 1 for referencing format details).

Where "N/A" has been used, the data for this field was either not applicable to the region or was not available in national government or accredited sources, such as the 2007 Natural Resources Canada National Assessments.

To compliment all resources in this annex, a list of organizations with current research on climate data is included in Exhibit 2. These sources should be referred to for further information at the discretion of the user.

EXHIBIT 1

Referencing Format Details



ATLANTIC CANADA[1]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Annual temperature increase of 0.3°C from 1948-2005	Projected increase of ~3°C by 2050	N/A	N/A	N/A
Annual Average Precipitation	Precipitation increased ~10% between 1948-1995	Projected increase of ~5% by 2050 and ~ 8% by 2080	N/A	N/A	N/A
CHANGES IN WATER LEVELS					
Sea Level	Since 1900 sea level in the Atlantic region has risen ~ 30, cm. Areas such as the coast of southeastern New Brunswick could experience sea-level rise in the order of 50 to 70 cm during the current century (years 2000 –2100).	N/A	N/A	N/A	N/A
Extreme Weather	The Atlantic region experiences a wide range of seasonal and interannual events, including winter cyclonic storms, tropical cyclones; summer heat and drought; and other severe weather events. Recent evidence shows a trend toward greater extremes and higher frequencies of such events.	N/A	N/A	N/A	N/A

NATIONAL[1]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Annual temperature increase of 1.1°C from 1950-2000	Projected increase of 2°C by 2050 and 4°C by 2080	Projected increase of 1°C by 2050 and 2°C by 2080	Projected increase of 5°C by 2050 and 8°C by 2080	The values used for medium, low and high emissions scenarios reflect the average median projected change in temperature across six Canadian cities.
Annual Average Precipitation	Average precipitation increase of 29 mm from 1950-2000	Projected increase of 138 mm by 2050 and 171 mm by 2080	Projected increase of 46 mm by 2050 and 29 mm by 2080	Projected increase of 271 mm by 2050 and 333 mm by 2080	The values that are used for medium, low and high emissions scenarios reflect the average median projected change in precipitation across six Canadian cities.
CHANGES IN WATER LEVELS – Rivers and Lakes					
Prairies	N/A	Projected decrease of ~9% in winter and spring stream flows by 2050	N/A	N/A	N/A
Great Lakes	1°C increase in mean annual temperature is associated with a 7-8% increase in the evapotranspiration rates (AET) resulting in decrease water availability in the Great Lakes.	Water levels in the Great Lakes are generally projected to drop in the future.	N/A	N/A	N/A
CHANGES IN WATER LEVELS – Sea					
Atlantic Canada	Between 1911-2000 sea level has risen ~30cm	2000-2100 sea level is projected to increase 50-70cm	N/A	N/A	N/A
Pacific Canada	Average sea levels have risen 4-12 cm along pacific coast (E.g. high water sea levels in Vancouver increased by 16-34 cm)[2]	N/A	N/A	N/A	N/A
Extreme Weather	There is evidence to suggest that extreme weather events, such as winter cyclonic storms, summer heat and drought, and flooding are increasing in intensity and frequency. These rapid rates of change may exceed certain coping thresholds.	N/A	N/A	N/A	Note: Not all extreme events can be linked to climate change however extreme weather events, such as flooding, wind storms, drought, ice storms, tornados and wild fires, highlight the vulnerability of Canadian communities and critical infrastructure to climate change.

Note: The six Canadian cities in the study were: Yarmouth, NS; Drummondville, QC; Ottawa, ON; Regina, SK; Victoria, BC; and Yellowknife, NT.

ATLANTIC CANADA[3]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Annual temperature increase of 0.3°C from 1948-2005	Projected increase of ~3°C by 2050	N/A	N/A	N/A
Annual Average Precipitation	Precipitation increased ~10% between 1948-1995	Projected increase of ~5% by 2050 and ~ 8% by 2080	N/A	N/A	N/A
CHANGES IN WATER LEVELS					
Sea Level	Since 1900 sea level in the Atlantic region has risen ~ 30, cm. Areas such as the coast of southeastern New Brunswick could experience sea-level rise in the order of 50 to 70 cm during the current century (years 2000 –2100).	N/A	N/A	N/A	N/A
Extreme Weather	The Atlantic region experiences a wide range of seasonal and interannual events, including winter cyclonic storms, tropical cyclones; summer heat and drought; and other severe weather events. Recent evidence shows a trend toward greater extremes and higher frequencies of such events.	N/A	N/A	N/A	N/A

BRITISH COLUMBIA[4]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Average annual temperature increase of ~1.3°C from 1950-1998[5]	Projected increase of ~2.°C by 2050 and ~3.6°C by 2080	Projected increase of ~1.2°C by 2050 and ~1°C by 2080	Projected increase of ~3°C by 2050 and ~6°C by 2080	The values used for medium, low and high emissions scenarios reflect the average median projected change in temperature across Coastal, South and North British Columbia and have been retrieved from Natural Resources Canada's National Assessment.
Annual Average Precipitation					
Coastal	Annual precipitation increase of +10 to + 15% from 1950-1998[6]	Projected increase of ~5% by 2050 and ~8% by 2080	Projected decrease of ~4% by 2050 and ~0% by 2080	Projected increase of ~11% by 2050 and ~18% by 2080	The values used for medium, low and high emissions scenarios have been retrieved from Natural Resources Canada's National Assessment.
South	Annual precipitation increase of +25% from 1950-1998[7]	Projected increase of ~1% by 2050 and ~5% by 2080	Projected decreased of ~1% by 2050 and increase ~1% by 2080	Projected increase of ~10% by 2050 and ~16% by 2080	The values used for medium, low and high emissions scenarios have been retrieved from Natural Resources Canada's National Assessment.
North	Annual precipitation increased of +10 to +20 from 1950-1998[8]	Projected increase of ~9% by 2050 and ~12% by 2080	Projected increased of ~1% by 2050 and ~2% by 2080	Projected increase of ~15% by 2050 and ~22% by 2080	The values used for medium, low and high emissions scenarios have been retrieved from Natural Resources Canada's National Assessment.
Changes in Water Levels					
Annual Sea Level	Due to vertical land movements in British Columbia, relative sea-level changes differ from global trends. During the 20th century, sea level rose 4cm in Vancouver, 8cm in Victoria, and 12cm in Prince Rupert and dropped 13cm in Tofino.	Based on medium estimates of global sea level rise, British Columbia could have a rise of 0.3m by 2100	Based on low estimates of global sea level rise, British Columbia could have a rise of 0.13m by 2100	Based on high estimates of global sea level rise, British Columbia could have a rise of 1.11m by 2100	The values used for medium, low and high emissions scenarios reflect the average relative sea level rise across five locations in British Columbia and have been retrieved from *Projected Sea Level Changes for British Columbia in the 21st Century*.[9]
Extreme Weather	Frequency of extreme weather events have increased from 2 to 3 (1990-2002) to 3 to 5 (2003-2005).	Significant wave heights and storm surges expected to increase on the coast by approximately 1cm/decade since 1950, due to more intense storms.[10]	N/A	N/A	N/A

NORTHERN CANADA[11]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Average annual temperature increase of ~2°C from 1950-1988	Projected increase of ~4% by 2050 and ~6% by 2080	Projected increase of ~2% by 2050 and ~4% by 2080	Projected increase of ~8% by 2050 and ~12% by 2080	The values used for medium, low and high emissions scenarios reflect the average mean projected change in temperature across Northern Canada and have been retrieved from Natural Resources Canada's National Assessment.
Annual Average Precipitation	Average annual precipitation increase of ~20% from 1948-2005	Projected increase of ~15% by 2050 and 20% by 2080	Projected increase of ~5% by 2050 and ~5% by 2080	Projected increase of ~30% by 2050 and ~40% by 2080	The values used for medium, low and high emissions scenarios reflect the average mean projected change in precipitation across Northern Canada and have been retrieved from Natural Resources Canada's National Assessment.
CHANGES IN WATER LEVELS					
Sea Ice	The annual average area of sea ice in the Northern Hemisphere has decreased by 7.4% (3% per decade) between 1978 and 2003.[12]	Duration of sea ice cover is expected to be 15-20 days shorter by 2050 and 20-30 days shorter by 2050.[13]	N/A	N/A	N/A
Extreme Weather	Increased frequency and intensity of extreme weather events, such as storms, floods, icing of snow layers, drought.[14]	N/A	N/A	N/A	N/A

ONTARIO[15]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Annual average temperature increase of 0.7°C from 1948-2006		Projected increase of ~3°C by 2050[16]	Projected increase of ~3.5°C by 2050[17]	N/A
Annual Average Precipitation	Annual precipitation increase has ranged from 5-35% since 1900	Projected increase of ~15% by 2050	Projected increase of 5-15% by 2050, in northern Ontario[18]	Projected increase of 35% by 2050, in northern Ontario[19]	N/A
CHANGES IN WATER LEVELS					
Rivers and Lakes	Annual average water levels in the Great Lakes have varied in the past 150 years, with the range between minimum and maximum levels being around 180cm. Water levels were 50-80cm higher than average in 1973-1975, 1985-1986, 1997 and 50-80cm lower than average in 1934-1935, 1964-1965 and 1999-2002.	N/A	N/A	N/A	N/A
Extreme Weather	Projected changes in average temperature and precipitation imply more frequent and intense weather events. However, observations have not clearly shown an increase in extreme weather events in Ontario.[20]	N/A	N/A	N/A	N/A

PRAIRIES[21]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Annual temperature increase of 1.6°C from 1895-2000.	Projected increase of ~3°C by 2050 and ~5°C by 2080	Projected increase of ~1°C by 2050 and ~3°C by 2080	Projected increase of ~4°C by 2050 and ~9°C by 2080	The values used for medium, low and high emissions scenarios reflect the average mean projected change in temperature across the prairies and have been retrieved from Natural Resources Canada's National Assessment.
Annual Average Precipitation	Annual precipitation ranges considerably from year to year. The average ranges from: less than 300mm to over 1000mm from 1971-1990	Projected increase of ~10% by 2050 and ~20% by 2080	Projected increase of ~2.5% by 2050 and decrease of ~2.5% by 2080	Projected increase of ~35% by 2050 and ~40% by 2080	The values used for medium, low and high emissions scenarios reflect the average mean projected change in precipitation across the prairies and have been retrieved from Natural Resources Canada's National Assessment.
CHANGES IN WATER LEVELS					
Rivers and Lakes	Downward trends in annual river flows have been observed from 1967-1996. Mean annual discharges are projected to continue to decline in southern and central regions.[22]	Projected decrease of ~9% in winter and spring stream flows by 2050	N/A	N/A	N/A
Extreme Weather	Studies suggest an increased probability of extreme conditions, including a greater frequency of flooding and severe drought.	N/A	N/A	N/A	N/A

QUEBEC[23]	PAST CLIMATE	EXPECTED CLIMATE (MEDIUM EMISSIONS SCENARIO)	LOW EMISSIONS SCENARIO	HIGH EMISSIONS SCENARIO	DEGREE OF CERTAINTY (DATA RETRIEVAL)
Annual Average Temperature	Average annual temperature increase of 2.9°C from 1922-2004	Projected increase of ~3°C by 2050 and ~5°C by 2080	N/A	N/A	The values used for medium emissions scenario reflects the average mean projected change in temperature across the subregions of Quebec and have been retrieved from Natural Resources Canada's National Assessment.
Annual Average Precipitation	Average annual precipitation ranges from 60-400mm	Projected increase of ~10% by 2050 and ~14% by 2080	N/A	N/A	The values used for medium emissions scenario reflects the average mean projected change in precipitation across the subregions of Quebec and have been retrieved from Natural Resources Canada's National Assessment.
CHANGES IN WATER LEVELS					
Sea Level	The mean sea level in the Gulf of St. Lawrence rose by ~ 2-3.2mm/year between 1911 and 2000.	Estimated sea level rise in Quebec City and Rimouski is ~14cm by 2050.	N/A	N/A	N/A
Extreme Weather	Extreme weather for this region includes: drought, ice storms and violent winds.	A change in climate will impact the severity, frequency and extent of extreme weather disturbances.	N/A	N/A	N/A

EXHIBIT 2

Sample Organizations with Climate Data by Region

REGION	ORGANIZATION	WEBSITE
International	• International • Intergovernmental Panel on Climate Change (IPCC) • Pew Center of Global Climate Change • Red Cross/Red Crescent Climate Centre • UK Climate Impacts Programme	http://www.ipcc.ch/index.htm http://www.pewclimate.org http://www.climatecentre.org/ http://www.ukcip.org.uk
National	• Canadian Climate Change Scenario Network • Canadian Institute of Planners • Centre for Indigenous Environmental Resources • Engineers Canada • Environment Canada • Environmental Systems Research Institute Canada • The Federation of Canadian Municipalities • International Association of Emergency Managers Canada • Natural Resources Canada's National and Regional Assessments • Ouranos • Policy Research Initiative	http://www.cccsn.ca http://www.cip-icu.ca http://www.cier.ca http://www.engineerscanada.ca http://www.ec.gc.ca http://www.esricanada.com/english/955.asp http://www.fcm.ca http://www.iaem-canada.ca/html/home/html/ http://www.nrcan.ca http://www.ouranos.ca http://www.policyresesarch.gc.ca
Atlantic Canada	• Atlantic Climate Adaptation Solutions • ClimAdapt	http://adaptation.nrcan.gc.ca/collab/index_e.php http://www.climadapt.com/aboutus.html
British Columbia	• British Columbia Regional Adaptation Collaborative • Pacific Climate Impacts Consortium • Pacific Institute for Climate Solutions • Professional Engineers and Geoscientists of BC (APEGBC) • Provincial Emergency Program	http://adaptation.nrcan.gc.ca/collab/index_e.php http://pacificclimate.org/ http://www.pics.uvic.ca/research/details.php?id=13899 http://www.apeg.bc.ca http://www.pep.bc.ca/index.html
Northern Canada	• Arctic Change • Canadian Polar Information Network • Northern Climate Exchange • Taiga Net	http://www.arctic.noaa.gov/detect/ http://www.polarcom.gc.ca http://www.taiga.net/nce/index.html http://www.taiga.net
Ontario	• Emergency Management Ontario • Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) • Professional Engineers Ontario	http://www.emergencymanagementontario.ca/english/home.html http://www.climateontario.ca http://www.peo.on.ca
Prairies	• Alberta Emergency Management Agency • Prairie Adaptation Research Collaborative (PARC)	http://www.aema.alberta.ca/ http://www.parc.ca
Quebec	• Climat Municipalités • Ouranos	http://www.mddep.gouv.qc.ca/programmes/climatmunicipalites/ http://www.ouranos.ca

[1] Warren, F.J. and Egginton, P.A. (2008). *Chapter 2: Background Information - From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 27-56

[2] Government of British Columbia. (2004). *Weather, Climate and the Future: B.C.'s Plan*. Available for download at http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs/373154/actions.pdf

[3] Vasseur, L. and Catto, N. (2008). *Chapter 4: Atlantic Canada- From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 119-170.

[4] Ibid

[5] Black, R. A., Bruce, J. P., and Egener, M. (2009). Adapting to Climate Change: A Risk-Based Guide for Local Governments in British Columbia Municipalities

[6] Ibid

[7] Ibid

[8] Ibid

[9] Bornhold, B. (2008). Projected Sea Level Changes for British Columbia in the 21st Century. Government of Canada and Government of British Columbia. Pp. 8: mean measurements within the report are based on 5 locations (Prince Rupert, Nanaimo, Victoria, Vancouver, Fraser River Delta) http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs/452793/sea_level_changes_08.pdf

[10] Black, R. A., Bruce, J. P., and Egener, M. (2009). Adapting to Climate Change: A Risk-Based Guide for Local Governments in British Columbia.

[11] Furgal, C. and Prowse, T.D. (2008). *Chapter 3: Northern Canada - From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 57-118

[12] Ibid

[13] Ibid

[14] Ibid

[15] Chiotti, Q. and Lavender, B. (2008).*Chapter 6: Ontario- From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 227-274

[16] Expert Panel on Climate Change Adaptation. (2009). *Adapting to Climate Change in Ontario*. Available for download at http://www.ene.gov.on.ca/publications/7300e.pdf

[17] Ibid

[18] Ibid

[19] Ibid

[20] Expert Panel on Climate Change Adaptation. (2009). *Adapting to Climate Change in Ontario*. Available for download at http://www.ene.gov.on.ca/publications/7300e.pdf

[21] Sauchyn, D. and Kulshreshtha, S. (2008). *Chapters 7: Prairies - From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 275-328

[22] Black, R. A., Bruce, J. P., and Egener, M. (2009). Adapting to Climate Change: A Risk-Based Guide for Local Governments in Alberta Municipalities

[23] Bourque, A. and Simone, G. (2008) *Chapte r5: Quebec - From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 171-226

INFORMATION ANNEX THREE - DRIVERS AND CONSTRAINTS

Below is a list of common constraints that can come up while proceeding with Milestone Three and some possible ways to overcome them. Often these solutions will be the drivers for an action. This list is not comprehensive, rather, it is meant to provide some guidance on how to work through some of the more frequently encountered constraints.

Constraint: Too little information on regionally based climate change impacts hindering the development of adaptation actions.

One way to combat limited information is to look at a wide variety of sources including:

- Anecdotal evidence (e.g. memories of aboriginal elders or long-term residents)
- Departments heads and municipal staff
- Government records
- Media archives
- Biological or ecosystem studies
- Environmental research departments within universities
- Information on how your community has responded to previous and present climate/weather events
- Organizations that assign value to climate/weather events (e.g. insurance agencies; reinsurers; investment/lending firms)
- Professional associations for planners and organizations that train planners
- Environmental law practitioners and associations
- Practices of cities with similar adaptation actions.

You may also have to extrapolate relevant data from more general or nationally based sources.
Determining how much information is needed will depend on your resources and the availability and accessibility of information. It will be up to the adaptation team to determine how much information is sufficient to base adaptation actions on.

Driver: Partnership opportunity with local universities, colleges, or other educational institutions. This relationship can be mutual as both parties benefit from the use and/or distribution of information.

Constraint: Limited information – technical (i.e. infrastructure, energy generation), procedural (e.g. emergency response systems, communication systems) and human (e.g. community education, social structures) – at various points in the future (e.g. 2020, 2050, and 2080).

As climate change impacts are expressed in terms of ranges (i.e. sea-level rise between *x* and *y* centimeters), it is difficult to know the exact figures to use for making decisions and implementing actions. The projections for climate change impacts are constantly evolving. Because of this, there will never be perfect information on what the local impacts will be in 20, 30, or 50 years. Therefore, your community must be able to act without perfect information. One means for ensuring decision-making is still as accurate as possible is to use information that is up to date, and has been taken from a source that your adaptation team

deems as reliable. Also, instances where your team had to make assumptions, in response to limited information, be sure to state those assumptions throughout the planning process.

See *Information Annex One* for examples of appropriate resources.

Driver: The release of new guidelines, studies, and/or codes of practice i.e. from CSA, and Engineers Canada. Although this information is meant to inform interested parties and decision makers, it has the backing of professional associations and with that comes support and accreditation.

Constraint: Limited understanding of the costs associated with particular adaptation actions.

It is difficult to calculate the costs of adaptation actions in your community, or to determine the business-case for particular actions. Given that adaptation actions are designed to avoid future costs of potential events, it is important to keep foresight in mind when determining values. Assumptions regarding potential actions and the most likely impact scenarios, the team could develop calculations to use in decision-making to present to council. There are reports that have been developed that outline estimated costs of climate change, as well as the processes used to develop those estimates.

See *Information Annex One* for more detail on resources.

Driver: Many of the adaptation actions identified are already carried out in the municipality but have not been labelled as 'adaptation'. Creating a separate list of actions that are underway within other spheres of municipal operations and, investigating the costs identified for them, will help to alleviate some of the uncertainties. Likewise, meetings with senior staff, both on your adaptation team and beyond, will help to paint a picture of the costs for each action.

Constraint: Limited staff capacity

For smaller communities with limited staff capacity, your team may comprise both municipal staff and non-municipal staff members. Being a smaller community provides you with an opportunity to solicit help from expertise outside of your organization.

Driver: Look to municipal associations, neighboring communities, non-profit organizations, NGOs, and universities for possible team members and sources of information. Internships, Masters and PhD students can be excellent sources for specific research pieces likewise staff secondments from other organizations (municipalities) can be an opportunity for acquiring dedicated climate change adaptation staff.

Constraint: Having a number of departments involved may increase the complexity of action efforts and may diminish effectiveness.

A good team leader to coordinate work across departments can help alleviate some of the difficulties involved in working with large groups. Assigning tasks and subtasks to individuals or departments will help to create sub-groups that involve fewer departments.

Constraint: Silo thinking in local governments.

One way to address silo thinking is through systems thinking. Systems thinking looks at all the interdepartmental components that make a whole functioning system. Departments within a local government often behave as independent from each other. Acknowledging the interconnections between departments and recognizing the overlapping goals, priorities, and responsibilities helps to combat this compartmentalized form of thinking.

Constraint: Lack of agreement that climate change impacts are real and will be experienced in the short term.

Although there is already much information to support climate change as a reality, (See *Information Annex One* for a list of relevant resources), this information might not be compelling for all parties that need to be involved. In such occurrences, it will be important to find other motivations to change individual practice or behaviours. One such example would be to make the link that people are not being asked to undertake work outside of their responsibility, rather, they are being given an opportunity to manage the same responsibility with more appropriate processes.

Driver: When an event takes place which causes damage to the community – i.e. flash flooding. The realization that such damage could have been avoided by adaptation planning may expedite the implementation of identified actions.

Constraint: Resources used for adaptation actions leading to a defeatist perception for mitigation efforts and lead to funding cuts.

Although in some cases adaptation actions can contribute to local greenhouse gas emissions, it is possible to integrate adaptation and mitigation actions. For example, improvements to existing infrastructure intended to reduce energy consumption would also prepare those buildings for an instances where peak energy demands may stress the electricity system.

Where appropriate, offer assurances that your adaptation efforts will not adversely impact your community's mitigation efforts.

Constraint: Lack of staff capacity or expertise to implement the highest priority actions.

One way to combat this constraint is to first address the quick and easy actions.

When developing adaptation actions and options, the adaptation team should also identify what actions could be considered "low-hanging fruit" or simple actions requiring little staff or funding requirements. This builds momentum for the more complex adaptation actions.

As responding to climate change impacts will often require some degree of organizational change (e.g. moving from short-term, simpler decision-making to long-term, complex decision-making), several short-term adaptation actions are likely to focus on reviewing and revising policies, procedures and decision-matrices.

The following drivers can be used to help build momentum for these organizational changes

- Utilizing existing resources where possible, such as cross-departmental teams, partnerships with external groups, political commitments, etc.
- Drawing links between current staff responsibilities and adaptation actions, such as policies and procedures which are already within their responsibilities.
- Linking the practices that already require staff to manage the impacts of weather events (drought, fires, hail, storms, etc.) and noting where adaptation efforts are just an extension of that responsibility.

These drivers generally require a moderate level of staff resource, but minimal financial resources.

Driver: Consequences of doing nothing may be extremely detrimental, or even devastating to your community. As such, the anticipation of severe consequences, and the hope f avoiding the harm and loss associated, may drive action. For more details on the costs of inaction, consult with either the local insurance providers or nationally with the Insurance Bureau of Canada (IBC). The Institute for Catastrophic Loss reduction also provides guidance on the costs of inaction on climate change adaptation.

Constraint: Managing significant expenditures.

There will be some actions that will require significant financial resources, such as improvements to infrastructure. Be sure to consider:

- Wherever possible, the adaptation planning process should be scheduled so action planning is completed before the city's budget allocation process.
- Funding already earmarked for the upkeep and maintenance of infrastructure should be identified, and plan for where those existing funds can be leveraged for adaptation actions.
- Other internal mechanisms, such as revolving energy funds could be established to create a fund for priority actions.

Driver: Consider the availability of external resources. Partnerships with relevant businesses, community organizations, regional alliances, neighbouring community's or provincial/federal governments might yield funding opportunities or the ability to leverage resources for adaptation efforts.

INFORMATION ANNEX FOUR - TIPS FOR FACILITATORS [1]

A *facilitator* is a substantively neutral third party, accepted by all members of the group, who has little to no decision-making authority. *Group Facilitation is* a process in which a neutral person intervenes to help a group improve on how it identifies and solves problems and makes decisions to increase the group's overall effectiveness.

There are three core assumptions that should guide any facilitated group session that will help a group to become more effective:

1) *I have some relevant information; and other people also have relevant information;*
2) *Each of us may see things others do not; and*
3) *Differences are opportunities for learning.*

It is important that a facilitator is mindful of these three factors as they will help create a productive and communicative environment.

Facilitators should:

- Carry a workbook to make note of key comments, discussions, areas of contention, areas to be revisited later, and/or where conversations of the day started/finished;
- Get to know the participants backgrounds beforehand;
- Follow the speed of the conversations and make sure there are no one-sided discussions;
- Make sure each day has a resolution so participants feel as though progress is being made; and
- Always address participants by name so others will learn everyone's name.

Tips for Facilitators:

- *Start with introductions* – Introductions are a good way for people to begin to get their voices in the room. This is the time to check and clarify expectations of the session so that the content can be adapted if necessary. Ask each participant to include:
    - Their name
    - Their job title
    - What they are expecting to get from the session
- *Establishing ground rules* – Depending on the nature of the discussion subject(s), ground rules are an important aspect to establish and it is the facilitator's role to impede any false actions. These can be descriptions of specific behaviours that improve the groups effectiveness and can include:
    - "start on time, end on time"
    - "turn off cell phones and pagers"
    - "treat everyone with respect"
    - "be constructive"
- *Test assumptions and inferences* – If people are making assumptions or inferences that are causing tension in the group, try to test these assumptions by asking others whether the

[1] This information has been taken and modified from: Schwarz, R. et, al. (2005) *The Skilled Facilitator Fieldbook: Tips, Tools, and Tested Methods for Consultants, Facilitators, Managers, Trainers, and Coaches.* Jossey-Bass: San Francisco.

meaning you are making of their behaviour, or of the situation, is the meaning they make of it. You can also ask them to reiterate the statement in order to eliminate misinterpretations or misunderstanding.

- *Encourage participants to use specific examples when explaining concepts* – Specific examples enable other people to determine their opinion on the information being shared.
- *Agree on what important words mean* – By agreeing on what key terms are referring to, you can develop a common understanding in the group whereby words mean the same thing to everyone.
- *Ask people to explain their reasoning and intent* – It is important for the facilitator to get others to explain their thought process that leads to a comment or question, reflecting on the logical process that is uses to draw conclusions from data, values and assumptions. This can be a helpful tool as it allows others to see how conclusions are reached and areas where people might reason differently.
- *Focus on interests, not positions* – Interests are the needs, desires and concerns that people have in regard to a given situation; positions are how people meet their interests. Often people's interests lead them to advocate a particular solution. If the group shares their interests from the start, it will be easier down the road to generate solutions that take all sets of interests into account.
- *Be direct, but without judgment* - Being direct without judgment allows everyone to have all the relevant information so that each can make free and informed choices about how to proceed. By withholding this information, even for the sake of being kind prevents others from having the option to challenge opinions or to accept them.
- *Jointly decide on next steps* – This means deciding with others what topics to discuss, when to discuss them, how to discuss them, and when to switch topics. Depending on the dynamic of the group, this step might be simple or it may get complicated. If complications do arise, don't focus on achieving a consensus, but try to ensure there are compromises on each end.

HAVING DIFFICULT CONVERSATIONS

Avoiding a conversation now, due to its potential risk, prevents the group from moving forward and remaining productively engaged, which is likely to create a bigger problem or threat later.

How to have a risk conversation:

1) *Clarify your own purpose and intent* – When a participant enters a conversation or discussion with the intention of changing someone's belief this will likely lead to defensiveness and might fail to accomplish what you desire. It is best to approach a risky conversation with curiosity, to explore the situation and discover whether your view is accurate and how you can productively change your own behaviour. In doing this you will have a basis for moving forward.
2) *Build a foundation for the conversation* – Agree on the purpose of the conversation before it begins. Share the reasoning for the difficulty of the conversation. To clear the air, do not be afraid to acknowledge the 'elephant in the room.'
3) *Stay focused* – In difficult conversations it can be easy to get off track. Try to avoid delving into history, rehashing specific problems, or repeating old discussions. It is not productive to spend a lot of time trying to agree on old issues. Rather, try and stay focused on the current situation and work toward future changes.

When preparing for risky conversations consider:

a. Why do you want to have this conversation? And,
b. What are the potential consequences of not having this conversation?

RESPONDING TO SILENCE

Although it may feel uncomfortable when the group goes silent, it is often better to be patient and remain quite. This gives people a chance to think about whether they want to say something. If you intervene because of your discomfort, you reduce the chance that others will respond. Remember, your role is to encourage others to speak, and mediate when necessary.

After a reasonable about of time (approximately half a minute), it can be helpful to acknowledge the silence and ask what leads people to be silent. If a question was asked which lead to the silence, it may be valuable to ask the question again but follow with *"And no one said anything. What does this mean?"* If it is a difficult topic, it may be helpful to discuss the difficulty or it may just be that people need more prompting to answer the initial question. If the group identifies what makes this topic difficult to discuss, you can then ask *"What needs to happen for you to be willing to discuss this topic?"* By asking this question, you are allowing the group to identify what interests need to be met to discuss the topic and can see how they can address the issue(s). Be sure to balance your interest in identifying the cause of the silence while preserving people's free and informed choice to stop participating in the conversation if they desire. You can acknowledge this internally or verbally.

DEALING WITH INTERRUPTIONS

If it appears that someone has interrupted another person, you can ask the person that was still speaking whether they were finished their thought and if they say they are finished, you can move on to the next comments. If they say there were not finished, ask the person who interrupted whether they would be willing to let the person finish. This intervention is based on jointly designing next steps, because by interrupting one individual has unilaterally controlled the conversation in a way that reduces others ability to share their relevant information.

If someone continues to interrupt, you can address that person directly by naming the pattering of their behaviour (i.e. the interruptions) and asking them about it. By inquiring about the interruption, the group learns what is causing it and can address it. If, for example, the person interrupting has to leave in ten minutes and felt that the meeting was moving too slowly, this can be addressed by the group.

Discussions may go back and forth. It is important to follow the conversation trail and allow those that were interrupted to have to chance to speak. Be aware of who is leading the conversation and steer attention towards those who may not feel they can participate in the discussion. If someone abruptly interrupts another, you can ask them to hold on to their comment until the other person is finished speaking.